



# GLIMPSES OF SUGARCANE CULTIVATION

DIRECTORATE OF SUGARCANE DEVELOPMENT

Government of India

Ministry of Agriculture and Farmer's Welfare  
(Department of Agriculture, Cooperation & Farmer's Welfare)

Lucknow (U.P.)

2020

# **GLIMPSES OF SUGARCANE CULTIVATION**

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**2020**

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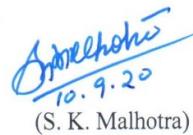


भारत सरकार  
कृषि एवं किसान कल्याण मंत्रालय  
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## FOREWORD

India occupies 2<sup>nd</sup> position in world sugarcane production after Brazil. Sugarcane derived sugar is an essential item of mass consumption and the cheapest source of energy for the people. A record sugarcane production of 405.42 million tonnes with productivity of 80.11 tonnes/ha and sugar production of 331.30 lakh tonnes during 2018-19 have been achieved. The favourable Government policies have played crucial role in the enhancement of production of sugarcane and sugar. Rising yields and enhanced sugar level have contributed significantly in the growth of sugarcane and sugarcane products. The productivity led growth in sugarcane boosted through NFSM-Commercial Crops is greatly appreciated.

The compilation “Glimpses of Sugarcane Cultivation” contains details on sugarcane related statistics and technologies, which will prove useful in research and development, policy planning for the betterment of sugarcane sector. My compliments to the team at Directorate of Sugarcane Development for this useful compilation. I am sure that this publication will prove as reference book to the policy makers, researchers, farming community and industry.



10.9.20  
(S. K. Malhotra)

**Shubha Thakur**  
**Joint Secretary**



भारत सरकार  
कृषि एवं किसान कल्याण मंत्रालय  
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Government of India  
Ministry of Agriculture & Farmers Welfare  
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& Farmers Welfare

### Foreword

Sugarcane is an important commercial crop of India and playing key role in the national economy. India is the 2<sup>nd</sup> largest sugarcane producing country next to Brazil. In India, sugarcane is cultivated in around 50 lakh ha area with production of about 405.42 million tonnes (highest ever) and productivity of 80.11 tonnes/ha during 2018-19. The year 2018-19 also witnessed highest ever sugar production of 331.30 lakh tonnes. The concentric efforts of developmental organizations, research institutes, farming communities, sugar factories in gaining the ever highest sugarcane production is appreciable.

The Directorate of Sugarcane Development is bringing the publication “Glimpses of Sugarcane Cultivation” covering various aspects of Sugarcane scenario, its production technologies, post harvest management, mechanization, varietal scenario, various developmental programmes implemented by Government of India, statistical data etc. which will be helpful in policy planning for research and development activities for stabilization of Sugarcane production in India.

I hope that this document will be useful to all concerned officers, scientists, policy makers, farmers and other stakeholders. I express my appreciation to Dr. Man Singh, Director, Directorate of Sugarcane Development and his entire Team efforts in bringing out this valuable publication.

(Shubha Thakur)

डॉ मान सिंह  
निदेशक  
Dr. Man Singh  
Director



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### Preface

The Directorate of Sugarcane Development a subordinate of the Ministry of Agriculture & Farmers Welfare is entrusted with the responsibility of monitoring of Sugarcane Development Programme of National level and have to maintain liaison with Indian Council of Agriculture Research Institutes like Indian Institute of Sugarcane Research Institute (IISR), Lucknow, Sugarcane Breeding Institute (SBI), Coimbatore, State Agriculture Universities, State Department of Agriculture/Cane etc. The present scenario of Sugarcane revealed that the production and productivity has been increased in recent past year mainly due to development of improved varieties by research institutes and its dissemination to the farmer field by extension/ development departments/ organizations.

The “Glimpses of Sugarcane Cultivation” compiled by this Directorate covering various aspects viz. Introduction, Sugarcane Scenario, Sugarcane Varieties, Production Technologies, Mechanization, Post Harvest Management, Seed production, Developmental Programmes, Cost of production, Sugar Statistics etc.

I am grateful to Dr. S.K. Malhotra, Agriculture Commissioner, Govt. of India for continuous encouragement and guidance in framing this document. I am grateful to Smt. Shubha Thakur, Joint Secretary (Crops & Oilseeds) for her initiative, guidance and encouragement in bringing out this publication. I am also grateful to Dr. A.P. Singh, Additional Commissioner (Commercial Crops), Dr. S.S. Tomar, Additional Commissioner (Crops), Crop Unit IV of DAC&FW for their valuable suggestions in bringing out this publication.

I am gratefully acknowledged the Research Institutes, State Agriculture Universities, State Cane Departments, Statistical Institutes for valuable information/inputs. The publication will be immensely helpful for the people engaged in Extension & Development, Research, Education and Policy making of Sugarcane sector.

I appreciate the efforts made by Dr. A. L. Waghmare, Joint Director, Dr. Mahesh Kumar, Joint Director, Dr. A.K.Singh, Asstt. Director, Shri Ankit Kumar Verma, Senior Technical Assistant and Shri Sanjeev Kumar Singh & Shri Triloki Nath, Technical Assistants for bringing out this valuable publication.

(Dr. Man Singh)  
Director

## **ABBREVIATIONS**

|       |   |  |
|-------|---|--|
| AICRP | : | All India Coordinated Research Project |
| CSS   | : | Central Sector Scheme                  |
| DES   | : | Department of Economics & Statistics   |
| EBP   | : | Ethanol Blended Petrol                 |
| FRP   | : | Fair and Remunerative Price            |
| FIRB  | : | Furrow Irrigated Raised Bed            |
| FYM   | : | Farm Yard Manure                       |
| IISR  | : | Indian Institute of Sugarcane Research |
| INM   | : | Integrated Nutrient Management         |
| IPM   | : | Integrated Pest Management             |
| IDM   | : | Integrated Disease Management          |
| ICAR  | : | Indian Council of Agriculture Research |
| ISMA  | : | Indian Sugar Mills Association         |
| KVKs  | : | Krishi Vigyan Kendra                   |
| MHAT  | : | Moist Hot Air Treatment                |
| MMMA  | : | Macro Management Mode on Agriculture   |
| NFSM  | : | National Food Security Mission         |
| NSI   | : | National Sugar Institute               |
| RMD   | : | Ratoon Management Device               |
| RBS   | : | Raised Bed Seeder                      |
| SAUs  | : | State Agriculture Universities         |
| STP   | : | Spaced Transplanting Method            |
| SBI   | : | Sugarcane Breeding Institute           |
| UPCSR | : | U.P. Council of Sugarcane Research     |
| VSI   | : | Vasantdada Sugar Institute             |

# INDEX

## ***Forewords***

|                                  |  |
|----------------------------------|--|
| Agriculture Commissioner         | Dr. S.K.Malhotra, Govt. of India, Min. of Agri & FW (DAC&FW)   |
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| <b>S. NO.</b> | <b>PARTICULARS</b>   | <b>PAGE NO.</b> |
|---------------|--|-----------------|
| <b>1</b>      | <b>Introduction</b>  | <b>14-23</b>    |
| 1.1           | Classification   | 15              |
| 1.2           | Morphology of Sugarcane  | 16              |
| 1.2.1         | Root system  | 16              |
| 1.2.2         | The Stalk  | 17              |
| 1.2.3         | The leaf   | 18              |
| 1.2.4         | Inflorescence Scenario of Sugarcane                                  | 19              |
| 1.2.5         | Growth phases  | 20              |
| 1.3           | Nutritive value  | 20              |
| 1.4           | Important regions for sugarcane cultivation in India                 | 21              |
| 1.5           | Constraints in Various Agro climate Zone of Sugarcane in India       | 22-23           |
| <b>2</b>      | <b>Scenario of Sugarcane</b>   | <b>25-36</b>    |
| 2.1           | Global Scenario  | 25-27           |
| 2.2           | National Scenario: Plan Period                                       | 28-29           |
| 2.3           | National Scenario: All India   | 29-30           |
| 2.4           | State Scenario   | 30-33           |
| 2.5           | District Scenario: Major Districts                                   | 34-35           |
| 2.6           | Varietal Scenario  | 35-36           |
| <b>3</b>      | <b>Production Technology</b>   | <b>38-45</b>    |
| 3.1           | Climate  | 38              |
| 3.2           | Soil   | 38              |
| 3.3           | Field preparation  | 38-39           |
| 3.4           | Planting Season  | 39              |
| 3.5           | Planting methods   | 39-43           |
| 3.5.1         | Flat Method  | 39              |
| 3.5.2         | Ridge and Furrow planting  | 40              |
| 3.5.3         | Trench Method  | 40              |
| 3.5.4         | Furrow Irrigated Raised Bed (FIRB) technique                         | 41              |
| 3.5.5         | Spaced transplanting (STP) method                                    | 41              |
| 3.5.6         | Ring Pit method  | 42-43           |
| 3.5.7         | Bud Chip Method  | 43              |
| 3.6           | Seed rate & treatment  | 43-44           |
| 3.6.1         | Distance   | 45              |
| 3.6.2         | Depth  | 45              |
| 3.7           | Varieties  | 45              |
| <b>4</b>      | <b>Sugarcane based Cropping Systems</b>                              | <b>47-48</b>    |
| 4.1           | Intercropping  | 48              |
| <b>5</b>      | <b>Water Management</b>  | <b>50-55</b>    |
| 5.1           | Water requirement (WR) in various sugarcane- growing states of India | 50              |
| 5.2           | Method of irrigation   | 51              |
| 5.2.1         | Surface irrigation   | 51              |

|           |   |                |
|-----------|---|----------------|
| 5.2.2     | Flood irrigation  | 51-52          |
| 5.2.3     | Furrow irrigation   | 52             |
| 5.2.4     | Skip furrow irrigation  | 52             |
| 5.2.5     | Alternate furrow irrigation   | 52-53          |
| 5.2.6     | Overhead/Sprinkler irrigation                                       | 53             |
| 5.2.7     | Micro-irrigation  | 53-54          |
| 5.2.8     | Drip/Trickle irrigation   | 54-55          |
| <b>6</b>  | <b>Plant Nutrient Management</b>                                    | <b>57-62</b>   |
| 6.1       | Fertilizer  | 57             |
| 6.2       | Micronutrients  | 57-58          |
| 6.3       | Organic manures   | 58             |
| 6.3.1     | Legumes   | 58             |
| 6.3.2     | Sugarcane trash   | 58-59          |
| 6.3.3     | Pressmud  | 59             |
| 6.4       | Bio-fertilizers   | 60             |
| 6.5       | Nutritional disorders of Sugarcane                                  | 60-62          |
| <b>7</b>  | <b>Weed Management, Earthing-Up and Propping</b>                    | <b>64-67</b>   |
| 7.1       | Weed Management   | 64-65          |
| 7.2       | Earthing-up   | 66             |
| 7.3       | Propping  | 66-67          |
| <b>8</b>  | <b>Plant Protection</b>   | <b>69-76</b>   |
| 8.1       | Important sugarcane diseases & their prevalence in India            | 71-75          |
| 8.2       | Insect Pest   | 75-80          |
| <b>9</b>  | <b>Sugarcane Ripening, Harvesting and Post Harvest Management</b>   | <b>82-84</b>   |
| 9.1       | Ripening  | 82             |
| 9.2.      | Harvesting  | 82             |
| 9.3       | Post Harvest Management   | 83             |
| 9.3.1     | Ratoon Management in Sugarcane                                      | 83-85          |
| <b>10</b> | <b>Mechanization in Sugarcane</b>                                   | <b>87-96</b>   |
| <b>11</b> | <b>Product &amp; By-Product of Sugarcane &amp; Sugar Industries</b> | <b>98-101</b>  |
| 11.2      | Bagasse based industries  | 98             |
| 11.3      | Molasses based industries   | 99             |
| 11.4      | Ethanol production  | 99-100         |
| 11.5      | Press mud based industries  | 100            |
| 11.6      | Sugar Industry  | 100-101        |
| <b>12</b> | <b>Sugarcane economics</b>  | <b>103-106</b> |
| <b>13</b> | <b>Seed Production</b>  | <b>108-111</b> |
| <b>14</b> | <b>Production Constraints</b>                                       | <b>113-118</b> |
| 14.1      | Constraints in Important Sugarcane Growing State                    | 113-118        |
| <b>15</b> | <b>Policy Intervention</b>  | <b>120-133</b> |
| 15.1      | Price Policy: Minimum support price (MSP)                           | 120            |
| 15.2.     | Developmental Programmes  | 121-133        |
| <b>16</b> | <b>Future Strategy</b>  | <b>135-136</b> |
|           | <b>Annexures I-XX</b>   | <b>138-183</b> |
|           | <b>Contact details of related to Sugarcane crop</b>                 | <b>185-192</b> |

## LIST OF TABLES

| S. No. | PARTICULARS  | PAGE NO. |
|--------|--|----------|
| 1      | Different species of Sugarcane, their Sugar content, Chromosome number & Origin              | 15       |
| 2      | Nutritional Value of Sugarcane Juice   | 20       |
| 3      | Major Sugarcane growing Regions/ States & their characteristics                              | 21-22    |
| 4      | Zone- wise common constraints of Sugarcane cultivation                                       | 22-23    |
| 5 (a)  | Major Sugarcane Countries: Area  | 25       |
| 5 (b)  | Major Sugarcane Countries: Production  | 26       |
| 5 (c)  | Major Sugarcane Countries: Yield   | 27       |
| 6      | Plan-wise area, production and yield of Sugarcane in India                                   | 28       |
| 7      | All India: Area, Production and Yield of Sugarcane   | 30       |
| 8 (a)  | State-wise Area of sugarcane   | 31       |
| 8 (b)  | State-wise production of sugarcane   | 32       |
| 8 (c)  | State-wise productivity of Sugarcane   | 33       |
| 9      | Fifteen leading districts under sugarcane of India   | 34       |
| 10     | Temperature and Humidity requirement for sugarcane cultivation                               | 38       |
| 11     | Optimum seed rate and row spacing for sugarcane in different states in India                 | 45       |
| 12     | Cropping system for Sub tropical & Tropical region.  | 47       |
| 13     | Water requirement (WR) in various sugarcane- growing states of India                         | 48       |
| 14     | State-wise irrigation requirement in sugarcane cultivation                                   | 50       |
| 15     | Fertilizer recommendations for sugarcane in major sugarcane growing states                   | 57       |
| 16     | Critical limits of available micronutrients in soil  | 58       |
| 17     | Nutrient deficiency symptoms and their ameliorative measures                                 | 60-62    |
| 18     | Herbicides approved for use in sugarcane   | 65       |
| 19     | Insect-pests and Diseases  | 69-71    |
| 20     | Important Diseases of Sugarcane, their symptoms & Management                                 | 72-75    |
| 21     | Important Insect pests of Sugarcane, their nature of damage & Management                     | 75-80    |
| 22     | Harvesting schedule for high sugar- recovery from sugarcane                                  | 82       |
| 23     | Projected cost of production of sugarcane, sugar season 2019-20                              | 103      |
| 24     | Average Gross Returns of Sugarcane   | 104      |
| 25     | Sugarcane: Break-up of cost of cultivation   | 104-105  |
| 26     | Sugarcane: Break-up of cost of cultivation   | 105-106  |
| 27     | Specific requirement   | 110-111  |
| 28     | State-wise constraints of Sugarcane Cultivation  | 114-118  |
| 29     | Sugarcane prices in different years  | 120      |
| 30     | Pattern of Assistance in Sustainable Development of Sugarcane Based Cropping System (SUBACS) | 121-122  |
| 31     | Pattern of Assistance in Sugarcane Development Programme under Macro Management Mode         | 123-124  |
| 32     | Pattern of Assistance- NFSM-Commercial Crops - Sugarcane:                                    | 124-125  |
| 33     | Pattern of Assistance- NFMS- Intercropping of Pulses with sugarcane                          | 125      |

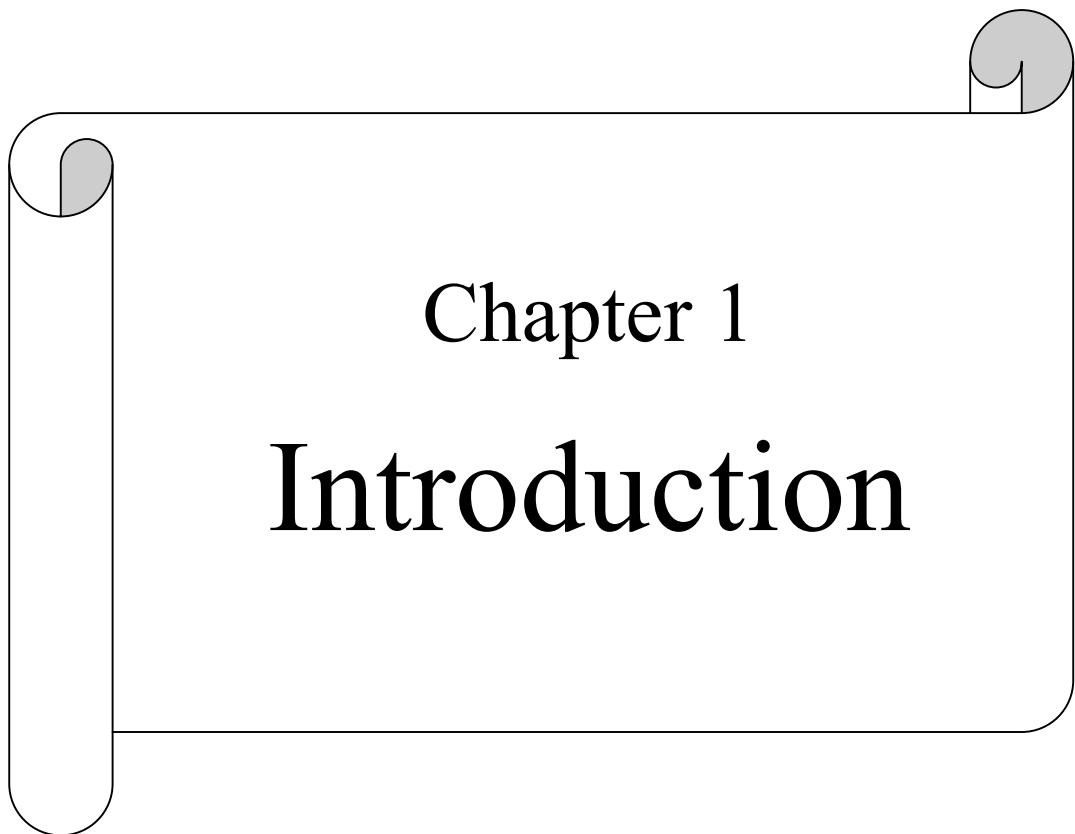
|    |  |     |
|----|--|-----|
| 34 | Financial summary of Implementation-NFSM- Commercial crop- Sugarcane- during: 2019-20                                | 126 |
| 35 | Component-wise Physical & Financial progress of NFSM-Commercial crop- Sugarcane scheme during 2019-20                | 127 |
| 36 | Financial summary of Implementation-NFSM- Commercial crop- Sugarcane- during: 2018-19                                | 128 |
| 37 | Component-wise Physical & Financial progress of NFSM- Commercial crop- Sugarcane scheme during 2018-19               | 129 |
| 38 | Financial Progress under Implementation of NFSM- Intercropping of Pulses with Sugarcane-during: 2019-20              | 130 |
| 39 | Component-wise Physical & Financial progress of “NFSM- Intercropping of Pulses with Sugarcane” scheme during 2019-20 | 131 |
| 40 | Financial Progress under Implementation of NFSM- Intercropping of Pulses with Sugarcane- during: 2018-19             | 132 |
| 41 | Component-wise Physical & Financial progress of NFSM- Intercropping of Pulses with Sugarcane scheme during 2018-19   | 133 |

## LIST OF PICTURES

| S. No.  | PARTICULARS  | PAGE NO. |
|---------|--|----------|
| 1       | Root system  | 16       |
| 2       | The stalk  | 17       |
| 3       | Internode Pattern  | 17       |
| 4       | Different form of Bud pattern                                    | 18       |
| 5       | Leaf of Sugarcane  | 19       |
| 6       | Inflorescence  | 19       |
| 7       | Deep furrow sugarcane cutter planter                             | 88       |
| 8       | Sugarcane trench planter   | 88       |
| 9       | Pit digger for mechanizing ring-pit method of sugarcane planting | 89       |
| 10      | Raised bed seeder  | 90       |
| 11      | IISR Raised Bed Seeder-cum- Sugarcane Planter                    | 90       |
| 12      | IISR Sugarcane-cum-potato planter                                | 90       |
| 13      | Inter-culturing operations in Sugarcane                          | 91       |
| 14      | Ratoon management device (RMD)                                   | 92       |
| 15      | Disc type ratoon management device (Disc RMD)                    | 93       |
| 16      | Self propelled- Hansen   | 94       |
| 17 to19 | Self propelled- Hansen Self propelled billet harvesters          | 94-95    |
| 20      | Trash Shredder   | 96       |

## LIST OF ANNEXURE

| S. NO.          | PARTICULARS  | PAGE NO. |
|-----------------|--|----------|
| Annexure- I     | State wise Area, Production and Yield of Sugarcane from 2008-09 to 2017-18   | 138-141  |
| Annexure- II    | State-wise - District wise area, production and yield of sugarcane   | 142-155  |
| Annexure-III    | Varieties of sugarcane released and notified from 2000 to 2019 and their salient characteristics.                                    | 156-162  |
| Annexure- IV    | Variety-wise Area under sugarcane  | 163-170  |
| Annexure-V      | Important growing / Planting and harvesting time of sugarcane in different States of India   | 171      |
| Annexure- VI    | Sugarcane, sugar and molasses production at a glance   | 172      |
| Annexure- VII   | Statement showing factories in operation, opening stocks, production, imports, consumption and exports of sugar during last 10 years | 173      |
| Annexure- VIII  | Utilization of sugarcane for different purposes  | 173      |
| Annexure- IX    | State wise utilization (%) of sugarcane for sugar production in major states.  | 174      |
| Annexure- X     | State wise cane crushed by sugar factories in India  | 174      |
| Annexure- XI    | Per capita consumption of sugar, gur & khandsari   | 175      |
| Annexure- XII   | State wise number of sugar factories in operation in India   | 176      |
| Annexure- XIII  | State wise duration (in days) of crushing season for sugarcane in India  | 177      |
| Annexure- XIV   | State wise average sugar recovery percent cane in India  | 177      |
| Annexure- XV    | State wise & sector wise installed annual sugar production capacity and utilization of capacity during last five years               | 178      |
| Annexure- XVI   | State wise sugar production ('000 ton) during last 10 years  | 179      |
| Annexure- XVII  | Export- import of sugar on financial year basis from 2000-01 onwards   | 180      |
| Annexure- XVIII | Country wise export of sugar from India during 2012 to 2017  | 181-182  |
| Annexure- XIX   | Cane growers cooperative societies/cane development commissions in various states  | 183      |
| Annexure- XX    | State wise rate of cess/ purchase tax on sugarcane paid by sugar factories   | 183      |



# Chapter 1

# Introduction

## INTRODUCTION

Sugarcane (*Saccharum spp.*) is an important industrial crop accounts for approximately 6% of the total agriculture output of the country grown in almost all states except some north eastern states. India is known to be the origin of the crop. It provides raw material for the second largest agro-based industries after textile. Sugar industry contributes significantly to the rural economy as the sugar mills are located in the rural areas and provide large scale employment to rural population. About 0.5 million people in sugar mills and 7.5 million sugarcane farmers, their dependents and a large mass of agricultural labour are involved in sugarcane cultivation, harvesting and ancillary activities, constituting 7.5% of the rural population.

The sugar industry in India has been a focal point for socio-economic development in the rural areas by mobilizing rural resources, generating employment and enhancing farm income. Some of the sugar factories have also diversified into by-products basis industries and have invested and put up distilleries, organic chemical plants, paper, ice board factories and cogeneration plant. The industry generates its own replenishable biomass uses as fuel without depending on fossil fuel. The sugar industry's contribution to the India economy is therefore, enormous.

- Sugarcane and sugar beet are the main sources of sugar in the world.
- Out of total sugar produced in the world, about 80 % of sugar is produced from sugarcane only.
- Sugarcane is used for the production of white sugar, Jaggery (Gur), Khandsari.
- In addition, sugarcane also used for chewing and extraction of juice for beverage purpose.

In world, Sugarcane is grown between the latitude  $36.7^{\circ}$  N and  $31.0^{\circ}$  S of the equator extending from tropical & subtropical zones. On an average a person consumes about 24 kg of Sugar every year.

## 1.1. CLASSIFICATION

Kingdom- Plantae  
 Order- Poales  
 Family- Poaceae  
 Sub-family- Panicoideae  
 Tribe- Andropogoneae  
 Sub-tribe- Saccharininae  
 Genus- *Saccharum*  
     |  
     *Erianthus*  
     *Misscanthus* | - *Saccharum* complex  
 Species- *Saccharum officinarum*  
 Binomial Name - *Saccharum officinarum* L.

**Table No.1: Different species of Sugarcane, their Sugar content, Chromosome number & Origin**

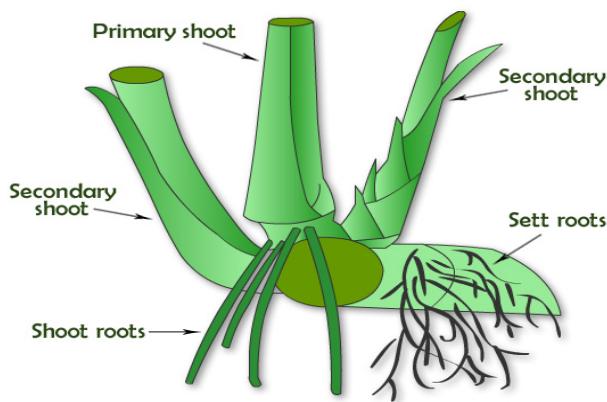
| Species               | Classification | Sugar content                            | Chromosome number             | Origin   |
|-----------------------|----------------|--|-------------------------------|--|
| <i>S. spontaneum</i>  | Wild species   | Nil                                      | 2n =40-128                    | Southern Asia  |
| <i>S. robustum</i>    | Wild species   | Nil                                      | 2n =60-80                     | New Guinea   |
| <i>S. officinarum</i> | Noble canes    | High                                     | 2n =80                        | New Guinea, derived from <i>S. robustum</i>                                |
| <i>S. barberi</i>     | Ancient hybrid | Low                                      | 2n =111-120                   | North India, derived from <i>S. spontaneum</i> x <i>S. officinarum</i>     |
| <i>S. sinense</i>     | Ancient hybrid | Low                                      | 2n =81-124                    | India and China, derived from <i>S. spontaneum</i> x <i>S. officinarum</i> |
| <i>S. edule</i>       | Wild species   | Compact inflorescence eaten as vegetable | 2n =60-80 with Aneuploid form | Malanesia and Indonesia, derived from <i>S. officinarum</i>                |

From 100 tonnes of cane crushed, on an average produces about 10.00 tonnes of raw sugar, 30 tonnes bagasse, 4.5. tones molasses, 3.5-3.9 tonnes of filter/press mud, 0.3 tonnes of bagasse ash, 1200 litres of alcohol by molasses route and 10,000 kwhr surplus electricity.

## 1.2. Morphology of Sugarcane:

Sugarcane is a tall perennial plant growing erect even up to 5 or 6 metres and produces multiple stems or culms each of which consist of a series of nodes separated by internodes. The plant is composed of four principal parts, root system, stalk, leaves and inflorescence. Following germination, the terminal vegetative bud of each shoot lays down a series of node.

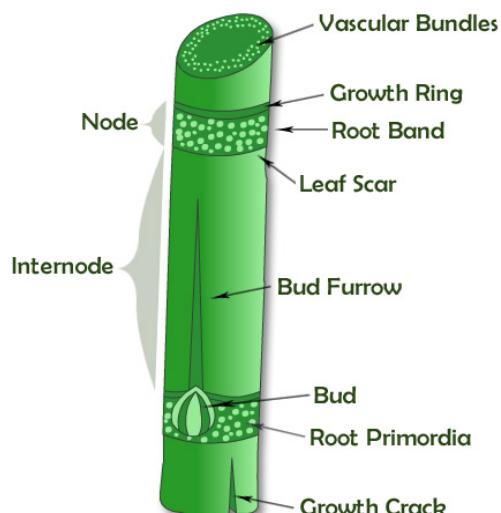
**1.2.1. Root system-** The function of the root system is twofold: first, it enables the intake of water and nutrients from the soil; and second, it serves to anchor the plant. The root system is fibrous and consists of two types of roots, namely 'sett roots' and 'shoot roots'. When sugarcane sett is planted in the soil and covered with moist soil, the root primordia (translucent dots) situated at the base of every cane joint is activated and produces roots. These roots are known as 'sett roots' and are mostly temporary. After the emergence of the primary shoot from the bud, other roots are produced from lower rings of the lower nodes of the shoot. Later, this process occurs progressively in upper rings of the nodes near the soil surface. Those formed first go downwards, whereas those formed near the soil surface. Surface roots grow in upper layer of soil for providing anchorage for the plant. These roots produced from shoot are known as 'shoot roots'. These are permanent roots and are thick, fleshy and white in colour. New roots are continually produced from tillers.



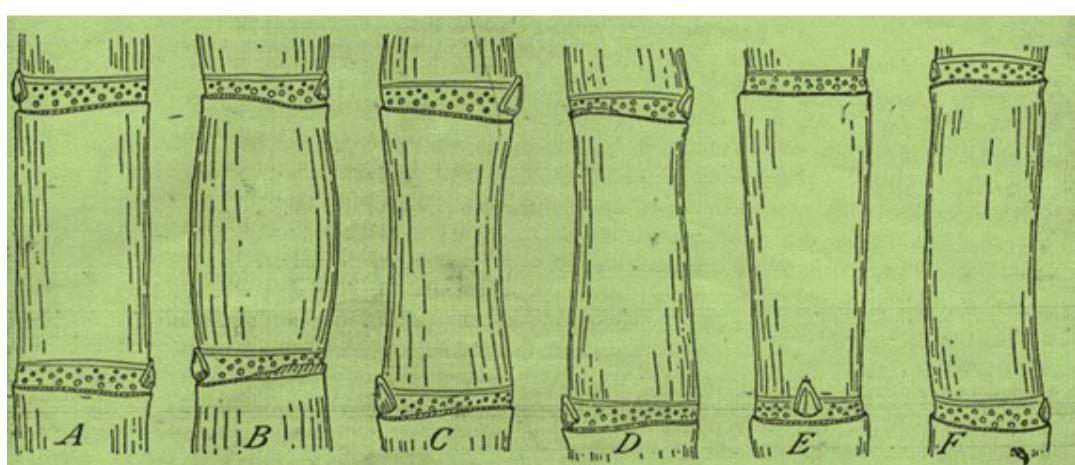
Picture: 1

### 1.2.2. The Stalk

The stalk consists of segment called joint. Each joint is made up of node and inter node. The node is where the leaf attaches to the stalk and where the buds and root primordial are found. A leaf scar can be found at the node where the leaf drops off the plant. The buds, located in the root band of the node are embryonic shoots consisting of a miniature stalk with small leaves. The outer small leaves are in the form of scales. The colour of the stalk derived from two basic pigments, the red colour of anthocyanin and the green of chlorophyll. The ratio of the concentration of these two pigments produced colours from green to purple red to almost black. Yellow stalks indicate a relative lack of these pigments.

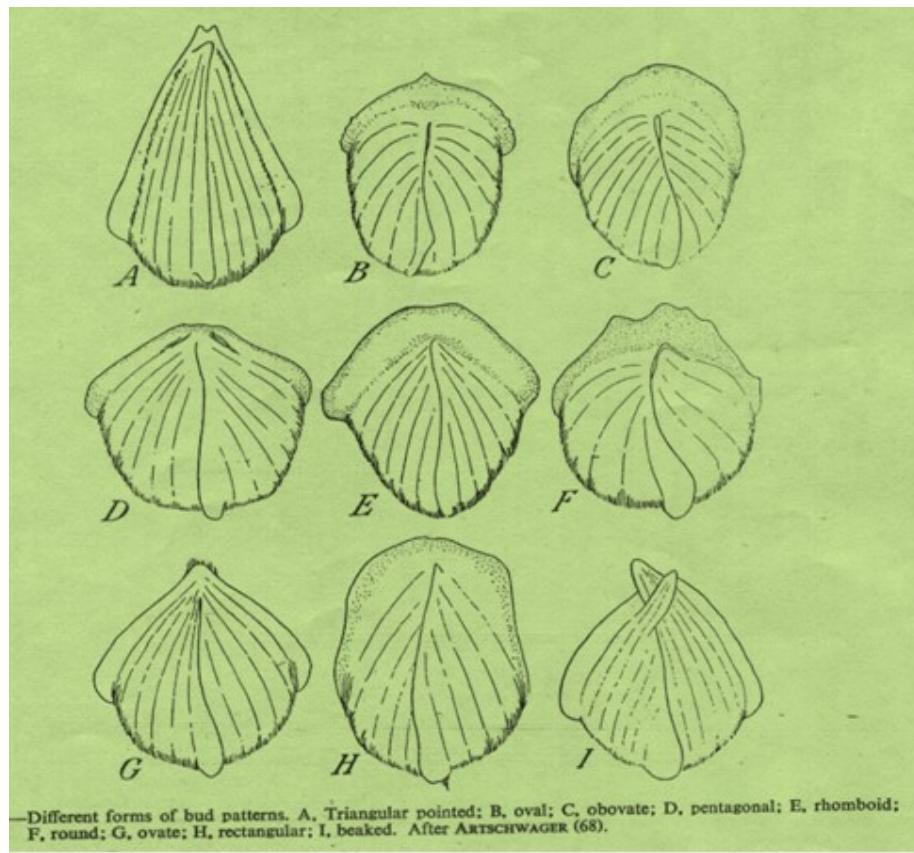


Picture: 2



Internode patterns: A, Cylindrical; B, tumescent; C, bobbin-shaped; D, conoidal; E, obconoidal; F, curved.  
After ARTSCHWAGER (68).

Picture: 3



**Picture: 4**

### 1.2.3. The leaf

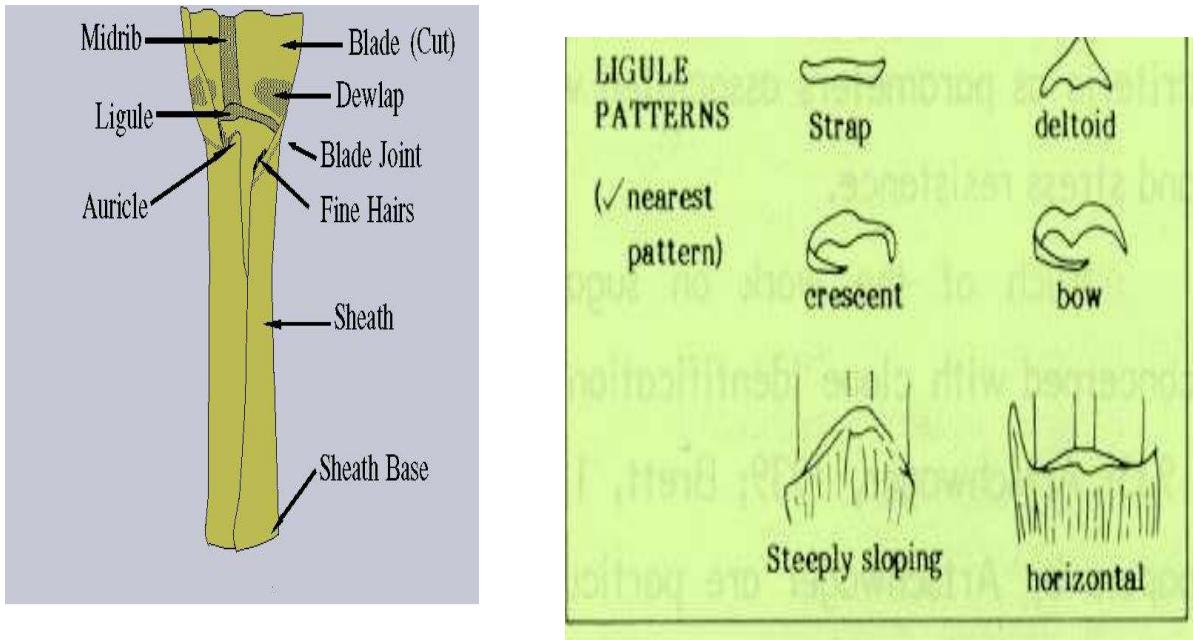
The leaf of the sugarcane plant is divided into two parts sheath and blade. The leaves are usually attached alternately to the nodes, thus forming two ranks on opposite sides. The mature sugarcane plant has an average upper leaf surface of about 0.5 square meters and the number of green leaves per stalk is around ten, depending on variety and growing condition.

#### **Sheath & blade**

Green with red blotches; moderate to heavy bloom; scarious border prominent; sheath splitting occasional Clasping; Spines present on the middle of the sheath; deciduous.

**Blade Joint:** The blade joint is where two wedge-shaped areas called dewlaps area found.

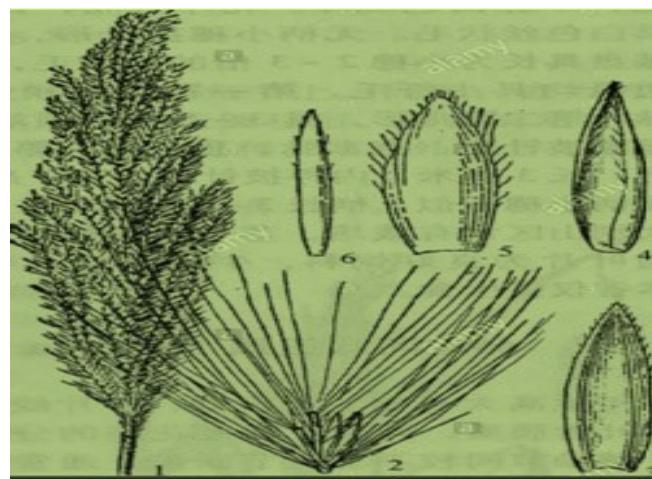
**Ligule:** The ligule is a membranous appendage inside of the sheath that separates the sheath from the leaf blade. It is a slightly asymmetric organ whose colour, size and shape are age and variety dependent.



**Picture: 5**

#### 1.2.4. Inflorescence

The inflorescence of sugarcane generally called the 'arrow' is an open panicle. It is long (30 centimeter or more) and tapering. The arrangement of the spikelets is racemose, i.e. the oldest flowers are at the bottom and the youngest at the top. The flowers open in succession over a number of days. Flowers have both male and female organs, but not all produce fertile pollen. Some of the varieties have fertile pollens but they are usually small and low vitality. Sugarcane usually flowers at the age of ten to twelve months, but some varieties in north India do not flower at all. Due to this fact cane has so long been propagated vegetatively by cuttings of sugarcane. Cane produced from seed is not so vigorous, but it is important for breeders.



**Picture: 6**

### **1.2.5. Growth phases:**

Sugarcane is a C<sub>4</sub> plant having high efficiency in storing solar energy and most efficient converter of solar energy, thus having potential to produce huge amounts of biomass. Sugarcane has essentially four growth phases, though it is difficult to recognize distinct duration of each. The growth phases are:

1. Germination phase,
2. Tillering phase,
3. Grand growth phase,
4. Maturity and ripening phase.

### **1.3. Nutritive value**

Nutritive value & Calories in cane Juice

Amount: 1 oz, Weight 28.35 g

**Table No. 2: Nutritional Value of Sugarcane Juice**

| <b>Nutrients</b>            | <b>Amount</b> |
|-----------------------------|---------------|
| Basic Components            |               |
| Proteins                    | 0.20 g        |
| Water                       | 0.19 g        |
| Ash                         | 0.66 g        |
| Fat                         | 0.09 g        |
| Calories                    |               |
| Total Calories              | 111.43        |
| Calories From Carbohydrates |               |
| Calories From Fats          | 0.03          |
| Calories From Proteins      |               |
| Carbohydrates               |               |
| Total Carbohydrates         | 27.40 g       |
| Sugar                       | 25.71 g       |
| Vitamins                    |               |
| Riboflavin                  | 0.16 mg       |
| Niacin                      | 0.20 mg       |
| Pantothenic Acid            | 0.09 mg       |
| Minerals                    |               |
| Calcium                     | 32.57 mg      |
| Iron                        | 0.57 mg       |
| Magnesium                   | 2.49 mg       |
| Phosphorus                  | 0.01 mg       |
| Potassium                   | 162.86 mg     |
| Copper                      | 0.09 mg       |
| Manganese                   | 0.09 mg       |

<http://nutrition.indobase.com/articles/sugarcane-juice-nutrition.php>

#### 1.4. Important regions for sugarcane cultivation in India

**Table No. 3: Major Sugarcane growing Regions/ States & their characteristics**

| Region       | States  | Remark   |
|--------------|---|--|
| Tropical     | Maharashtra, Andhra Pradesh, Tamil Nadu, Karnataka, Gujarat, Madhya Pradesh, Telangana, Goa, Pondicherry and Kerala | <ul style="list-style-type: none"> <li>Contributes about 55 per cent to the total cane production and 45 % area in the country.</li> <li>Annual rainfall of 602 to 3640 mm having moist to dry sub-humid and semi-arid to dry semi-arid climates.</li> <li>Floods, water logging diseases such as red rot are the main problems.</li> <li>Moisture stress during the early part of the cane growths mostly during March to June, is an important problem.</li> <li>Maharashtra and the adjoining area of Karnataka, Gujarat and A.P. record higher sugar recoveries. Long hours of sunshine, cool nights with clear skies and the latitudinal position of this area are highly favourable for sugar accumulation.</li> </ul> |
| Sub-Tropical | Uttar Pradesh, Uttarakhand, Haryana, Punjab, Bihar, Rajasthan, Assam, West Bengal                                   | <ul style="list-style-type: none"> <li>Contributes about 55 per cent to the total cane area and 45 % production in the country.</li> <li>Climate ranges from humid, moist sub-humid and dry sub-humid to cold arid, semiarid and arid.</li> <li>Extreme of climate is the characteristic feature of this region. During April to June, the weather is very hot and dry. July to October is rainy season accounting for most of the rainfall from S-W monsoon rains. December and January are the very cold months temperature touching sub-zero levels in many places. November to March is cool months with clear</li> </ul>  |

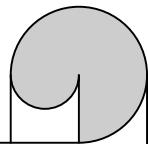
|  |  |  |
|--|--|--|
|  |  | <p>sky.</p> <ul style="list-style-type: none"> <li>The cane yields are lower in the subtropics due to short growing season, moisture stress, more pest and disease problem, floods and water logging and very poor ratoons.</li> </ul> |
|--|--|--|

## 1.5. Constraints in Various Agro climate Zone of Sugarcane in India

**Table No. 4: Zone- wise common constraints of Sugarcane cultivation**

| S. N. | Zone          | Area included   | Constraint  |
|-------|---------------|---|---|
| 1     | North-West    | States of Punjab, Haryana, Western and Central U.P. & Rajasthan | <ul style="list-style-type: none"> <li>i. Non availability of labour for intercultural operation</li> <li>ii. Transportation problem of sugarcane setts</li> <li>iii. Delay in transportation of harvested cane by factory</li> <li>iv. High cost of sugarcane setts at sugarcane seed set plot</li> <li>v. Occurrence of insect-pests and diseases</li> <li>vi. Extreme climate, especially temperature; short growth period, occasional to severe frost.</li> </ul> |
| 2     | North-Central | Eastern U.P., Bihar and West Bengal                             | <ul style="list-style-type: none"> <li>i. Non availability of labour for intercultural operation.</li> <li>ii. Transportation problem of sugarcane setts.</li> <li>iii. Delay in transportation of harvested cane by factory.</li> <li>iv. High cost of sugarcane setts at sugarcane seed set plot.</li> <li>v. Regional politics at cane factories.</li> <li>vi. Less pre-monsoon and high post-monsoon rainfall.</li> </ul>   |
| 3     | North-East    | Assam and Nagaland  | <ul style="list-style-type: none"> <li>i. Lack of knowledge of scientific crop production</li> <li>ii. Lack of regular visit by extn. personnel to villages</li> <li>iii. Occurrence of insect-pests and diseases</li> <li>iv. Crop damage due to flood</li> <li>v. Late planting</li> <li>vi. Drought during crop cane formation period.</li> </ul>  |

|   |            |   |   |
|---|------------|---|---|
| 4 | East-Coast | Orissa, Coastal Andhra Pradesh and Coastal Tamil Nadu.  | <ul style="list-style-type: none"> <li>I. Non availability of labour for intercultural operation</li> <li>II. Transportation problem of sugarcane sets</li> <li>III. Heavy winds in Oct/Nov lodges sugarcane.</li> <li>IV. Two monsoons, summer and winter monsoon (preceded by cyclonic winds); temperatures favourable for vegetative growth even during maturity (and associated winter monsoon cause low recovery)</li> </ul>   |
| 5 | Peninsular | Maharashtra, Karnataka, Gujarat, Madhya Pradesh, Kerala, interior Andhra Pradesh and Tamil Nadu (plateau region). | <ul style="list-style-type: none"> <li>I. Non availability of labour for intercultural operation.</li> <li>II. Inadequacy of irrigation water at proper time</li> <li>III. Non availability of equipment at village Level</li> <li>IV. Irregular supply of electricity</li> <li>V. Heavy winds in Oct/Nov lodges sugarcane</li> <li>VI. Occurrence of insect-pests and diseases</li> <li>VII. Lack of finance to purchase sugarcane sets, fertilizers and other inputs</li> <li>VIII. Lack of knowledge about use of water and its critical stages of application</li> <li>IX. Lack of knowledge about spraying of insecticides</li> <li>X. Lack of technical guidance.</li> <li>XI. Lack of training at village level</li> </ul> |



## Chapter 2

# Scenario of Sugarcane

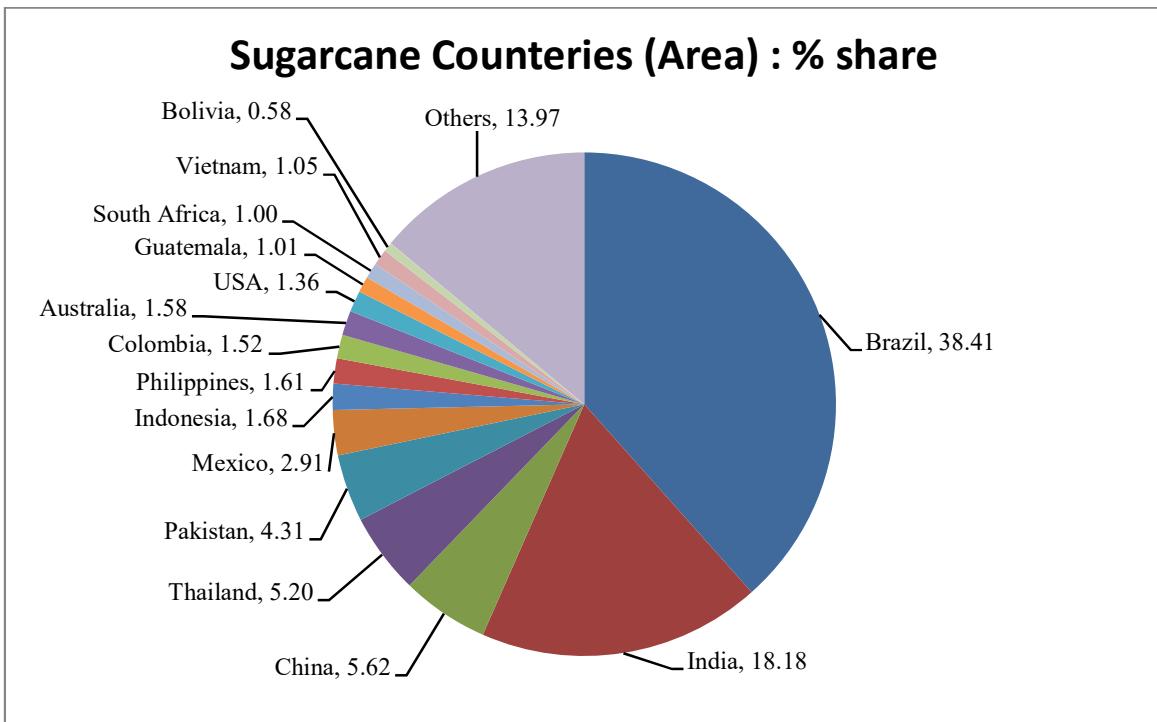
## SCENARIO OF SUGARCANE

### 2.1. GLOBAL SCENARIO

Sugarcane is grown in more than 115 countries with an Ave. area of 26.54 million ha with a total cane production of 1878.79 million tonnes and productivity of 71 tonnes/ ha. (FAO, 2019). Brazil, India, China, Thailand, Pakistan, Mexico, Colombia and Australia are the major white sugar producing countries. Brazil is the largest sugarcane growing country followed by India & China. These three countries contributed about 62% area and 64% production of sugarcane in the world. As regard to the productivity is concerned, the highest average productivity was recorded in Guatemala (120 tonnes/ha) followed by Colombia (89.20 tonnes /ha) and USA with 81.58 tonnes per ha. The area, production and yield during 2014-2018 of ten major countries are given in the **table 5 (a, b, c)**.

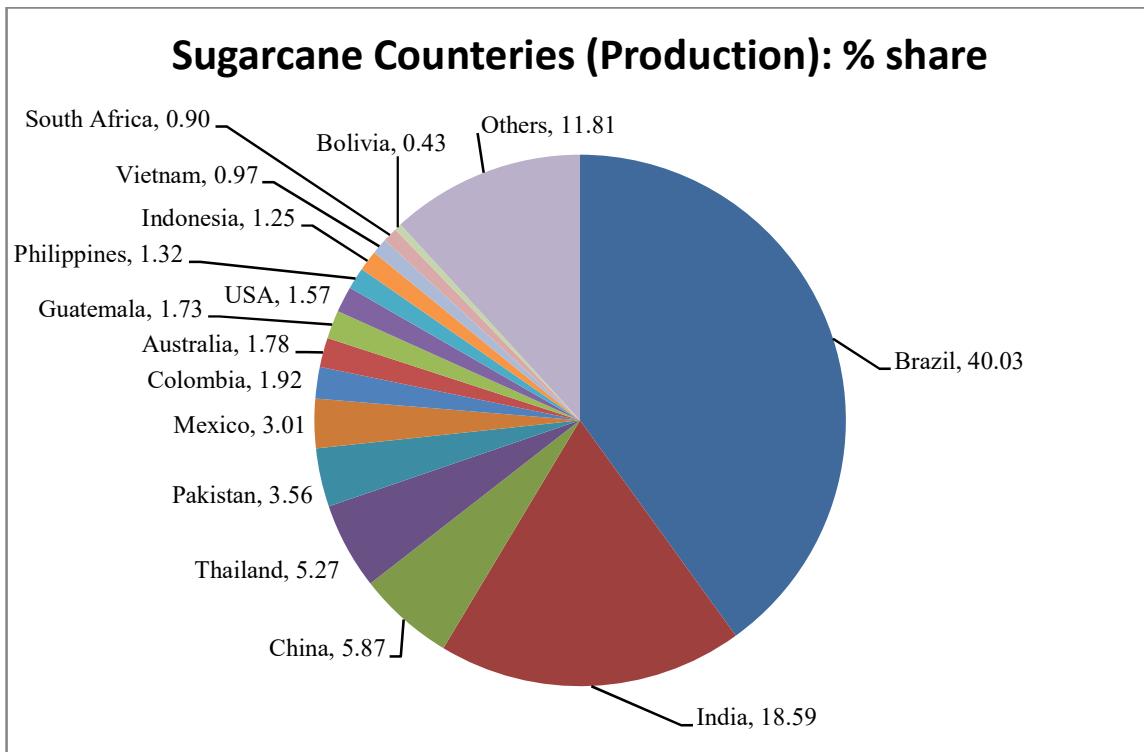
**Table 5 (a): Major Sugarcane Countries: Area (Lakh ha)**

| Country      | 2014          | 2015          | 2016          | 2017          | 2018          | Average       | % share |
|--------------|---------------|---------------|---------------|---------------|---------------|---------------|---------|
| Brazil       | 104.20        | 101.11        | 102.23        | 101.84        | 100.42        | 101.96        | 38.41   |
| India        | 49.90         | 50.70         | 49.50         | 43.89         | 47.30         | 48.26         | 18.18   |
| China        | 17.68         | 14.86         | 14.12         | 13.77         | 14.15         | 14.92         | 5.62    |
| Thailand     | 13.53         | 14.01         | 14.09         | 13.68         | 13.72         | 13.81         | 5.20    |
| Pakistan     | 11.41         | 11.32         | 11.31         | 12.17         | 11.02         | 11.45         | 4.31    |
| Mexico       | 7.62          | 7.59          | 7.81          | 7.72          | 7.86          | 7.72          | 2.91    |
| Indonesia    | 4.73          | 4.56          | 4.58          | 4.30          | 4.17          | 4.47          | 1.68    |
| Philippines  | 4.32          | 4.21          | 4.10          | 4.38          | 4.38          | 4.28          | 1.61    |
| Colombia     | 4.01          | 4.09          | 4.02          | 3.97          | 4.09          | 4.04          | 1.52    |
| Australia    | 3.75          | 3.77          | 4.47          | 4.54          | 4.43          | 4.19          | 1.58    |
| USA          | 3.51          | 3.59          | 3.65          | 3.66          | 3.64          | 3.61          | 1.36    |
| Vietnam      | 3.05          | 2.84          | 2.56          | 2.81          | 2.69          | 2.79          | 1.05    |
| Guatemala    | 2.66          | 2.68          | 2.60          | 2.52          | 3.00          | 2.69          | 1.01    |
| South Africa | 2.73          | 2.58          | 2.50          | 2.54          | 2.86          | 2.64          | 1.00    |
| Bolivia      | 1.48          | 1.45          | 1.46          | 1.57          | 1.68          | 1.53          | 0.58    |
| Others       | 36.39         | 36.81         | 36.98         | 37.93         | 37.29         | 37.08         | 13.97   |
| <b>World</b> | <b>270.97</b> | <b>266.17</b> | <b>265.98</b> | <b>261.29</b> | <b>262.70</b> | <b>265.42</b> |         |



**Table 5 (b): Major Sugarcane Countries: Production (Lakh tonnes)**

| Country      | 2014           | 2015           | 2016           | 2017           | 2018           | Average         | % share |
|--------------|----------------|----------------|----------------|----------------|----------------|-----------------|---------|
| Brazil       | 7361.09        | 7502.9         | 7685.64        | 7585.48        | 7468.28        | 7520.68         | 40.03   |
| India        | 3521.42        | 3623.33        | 3484.48        | 3060.69        | 3769.00        | 3491.78         | 18.59   |
| China        | 1261.54        | 1077.29        | 1037.89        | 1047.93        | 1087.19        | 1102.37         | 5.87    |
| Thailand     | 1036.97        | 941.39         | 900.9          | 1029.46        | 1043.61        | 990.47          | 5.27    |
| Pakistan     | 628.27         | 654.82         | 654.51         | 734.01         | 671.74         | 668.67          | 3.56    |
| Mexico       | 566.73         | 553.96         | 564.47         | 569.55         | 568.42         | 564.63          | 3.01    |
| Colombia     | 381.57         | 361.39         | 347.6          | 346.38         | 362.77         | 359.94          | 1.92    |
| Australia    | 305.18         | 323.79         | 344.03         | 365.62         | 335.07         | 334.74          | 1.78    |
| Guatemala    | 332.39         | 338.69         | 335.33         | 259.51         | 355.68         | 324.32          | 1.73    |
| USA          | 276.00         | 291.41         | 291.37         | 301.53         | 313.36         | 294.73          | 1.57    |
| Philippines  | 250.30         | 229.26         | 223.71         | 292.87         | 247.31         | 248.69          | 1.32    |
| Indonesia    | 257.54         | 253.49         | 233.25         | 212.13         | 217.44         | 234.77          | 1.25    |
| Vietnam      | 198.23         | 188.37         | 163.13         | 183.56         | 179.45         | 182.55          | 0.97    |
| South Africa | 177.56         | 148.61         | 150.75         | 173.88         | 193.02         | 168.76          | 0.90    |
| Bolivia      | 75.99          | 71.93          | 73.75          | 87.32          | 96.16          | 81.03           | 0.43    |
| Others       | 2228.77        | 2189.43        | 2255.3         | 2263.41        | 2161.75        | 2219.73         | 11.81   |
| <b>World</b> | <b>18859.6</b> | <b>18750.1</b> | <b>18746.1</b> | <b>18513.3</b> | <b>19070.3</b> | <b>18787.86</b> |         |



**Table 5 (c): Major Sugarcane Countries: Yield (tonnes/ha)**

| Country      | 2014         | 2015         | 2016         | 2017         | 2018         | Average      | YI     |
|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------|
| Guatemala    | 125.16       | 126.43       | 129.05       | 102.98       | 118.46       | 120.42       | 170.10 |
| Colombia     | 95.15        | 88.36        | 86.47        | 87.25        | 88.76        | 89.20        | 126.00 |
| USA          | 78.53        | 81.16        | 79.72        | 82.41        | 86.07        | 81.58        | 115.24 |
| Australia    | 81.38        | 85.89        | 76.96        | 80.53        | 75.64        | 80.08        | 113.12 |
| China        | 71.35        | 72.5         | 73.5         | 76.1         | 76.83        | 74.06        | 104.61 |
| Brazil       | 70.64        | 74.21        | 75.18        | 74.48        | 74.37        | 73.78        | 104.22 |
| Mexico       | 74.37        | 72.99        | 72.28        | 73.78        | 72.33        | 73.15        | 103.33 |
| India        | 70.57        | 71.47        | 70.39        | 69.74        | 79.68        | 72.37        | 102.23 |
| Thailand     | 76.64        | 67.19        | 63.94        | 75.25        | 76.06        | 71.82        | 101.45 |
| Vietnam      | 65.00        | 64.51        | 63.64        | 65.29        | 66.6         | 65.01        | 91.83  |
| South Africa | 65.06        | 57.49        | 60.32        | 68.48        | 67.55        | 63.78        | 90.10  |
| Pakistan     | 55.06        | 57.85        | 57.87        | 60.31        | 60.96        | 58.41        | 82.51  |
| Philippines  | 57.94        | 54.46        | 54.56        | 66.87        | 56.53        | 58.07        | 82.03  |
| Bolivia      | 51.09        | 49.45        | 51.51        | 55.59        | 57.18        | 52.96        | 74.82  |
| Indonesia    | 54.45        | 55.59        | 50.93        | 49.33        | 51.19        | 52.30        | 73.88  |
| Others       | 61.25        | 59.48        | 60.99        | 59.67        | 57.97        | 59.87        | 84.58  |
| <b>World</b> | <b>69.60</b> | <b>70.44</b> | <b>70.48</b> | <b>70.85</b> | <b>72.59</b> | <b>70.79</b> |        |

Source- FAOSTAT 2019, YI- Yield index

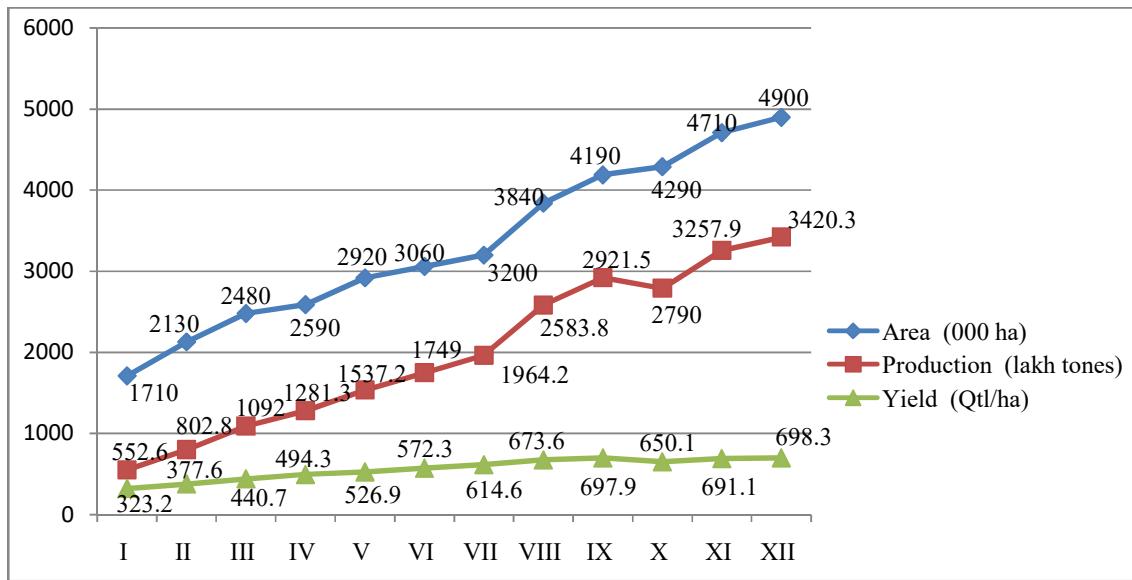
## 2.2. NATIONAL SCENARIO: PLAN-PERIOD

The average area under sugarcane during first plan (1951-56) was 1.71 million ha with production of 55.36 million tonnes and yield of 32.32 tonnes/ha. During XII plan (2012-17), the area coverage was 4.90 million ha with production of 342.03 million tonnes and productivity was 69.83 tonnes/ha. This showed that there was rise in area about 3 times, production 6 times and productivity 2 times over first plan. The plan-wise area, production and yield is given in **Table 6**:

**Table 6: Plan-wise area, production and yield of Sugarcane in India**

| Plan period       | Area (Million ha) | Production (Million tonnes) | Yield (Ton/ha) | % increase over previous plan |         |       |
|-------------------|-------------------|-----------------------------|----------------|-------------------------------|---------|-------|
|                   |                   |                             |                | Area                          | Produ'n | Yield |
| I<br>(1951-56)    | 1.71              | 55.26                       | 32.32          | -                             | -       | -     |
| II<br>(1956-61)   | 2.13              | 80.28                       | 37.76          | 24.33                         | 45.26   | 16.84 |
| III<br>(1961-66)  | 2.48              | 109.20                      | 44.07          | 16.56                         | 36.03   | 16.71 |
| IV<br>(1969-74)   | 2.59              | 128.13                      | 49.43          | 4.60                          | 17.33   | 12.17 |
| V<br>(1974-78)    | 2.92              | 153.72                      | 52.69          | 12.56                         | 19.97   | 6.59  |
| VI<br>(1980-85)   | 3.06              | 174.90                      | 57.23          | 4.75                          | 13.78   | 8.63  |
| VII<br>(1995-90)  | 3.20              | 196.42                      | 61.46          | 4.58                          | 12.30   | 7.38  |
| VIII<br>(1992-97) | 3.84              | 258.38                      | 67.36          | 20.03                         | 31.54   | 9.60  |
| IX<br>(1997-2002) | 4.19              | 292.15                      | 69.79          | 9.12                          | 13.07   | 3.62  |
| X<br>(2002-07)    | 4.29              | 279.00                      | 65.01          | 2.53                          | -4.50   | -6.86 |
| XI<br>(2007-12)   | 4.71              | 325.79                      | 69.11          | 9.83                          | 16.77   | 6.32  |
| XII<br>(2012-17)  | 4.90              | 342.03                      | 69.83          | 3.90                          | 4.99    | 1.04  |
| 2017-18           | 4.74              | 379.91                      | 80.20          | 6.79                          | 24.12   | 16.23 |
| 2018-19           | 5.06              | 405.42                      | 80.11          | 6.84                          | 6.72    | -0.11 |
| 2019-20*          | 4.54              | 358.14                      | 78.84          | -10.25                        | -11.66  | -1.59 |

\*IV Adv. Estimates of DES, New Delhi.



From the figure, it has been shown that the area showing increasing trend during all the plan periods, whereas, the production and productivity has been declined during Xth Plan due to drought/moisture stress particularly in Central and Southern states.

### 2.3. NATIONAL SCENARIO: ALL INDIA

The present Sugarcane scenario has been changed, if we compare the present status with 1930-31, it showed that area has been increased 5 folds, production 9 folds and productivity 2.5 folds. The main reason attributed to development of improved varieties, production & protection technologies and increase area in irrigation. The area, production and yield from 1930-31 is given in **Table 7**. The maximum area was recorded during 2014-15 at 5.07 million ha, where as production & yield was recorded during 2018-19 at 405.42 million tonnes and 80.11 tonnes/ ha respectively.

**Table 7: All India: Area, Production and Yield of Sugarcane**

| Year     | Area<br>(000 ha.) | Production<br>(000 tonnes) | Yield<br>(tonnes/ha) | Area under<br>irrigation (%) |
|----------|-------------------|----------------------------|----------------------|------------------------------|
| 1930-31  | 1176              | 36354                      | 30.90                | -                            |
| 1940-41  | 1617              | 51978                      | 32.10                | -                            |
| 1950-51  | 1710              | 57050                      | 33.42                | 67.33                        |
| 1960-61  | 2420              | 110000                     | 45.55                | 69.26                        |
| 1970-71  | 2620              | 126370                     | 48.32                | 72.38                        |
| 1980-81  | 2670              | 154250                     | 57.84                | 81.26                        |
| 1990-91  | 3690              | 241050                     | 65.40                | 86.97                        |
| 2000-01  | 4320              | 295960                     | 68.58                | 92.17                        |
| 2010-11  | 4880              | 342380                     | 70.09                | 92.67                        |
| 2011-12  | 5040              | 361040                     | 71.67                | 94.81                        |
| 2012-13  | 5000              | 341200                     | 68.25                | 95.16                        |
| 2013-14  | 4990              | 352140                     | 70.52                | 95.31                        |
| 2014-15  | 5070              | 362330                     | 71.51                | 95.61                        |
| 2015-16  | 4930              | 348450                     | 70.72                | 95.80                        |
| 2016-17  | 4440              | 306070                     | 69.00                | -                            |
| 2017-18  | 4774              | 379900                     | 80.20                | -                            |
| 2018-19  | 5061              | 405420                     | 80.11                | -                            |
| 2019-20* | 4542              | 358140                     | 78.84                |                              |

\*Source - E&S, DAC 3<sup>rd</sup> Adv. Est -2019-20\*

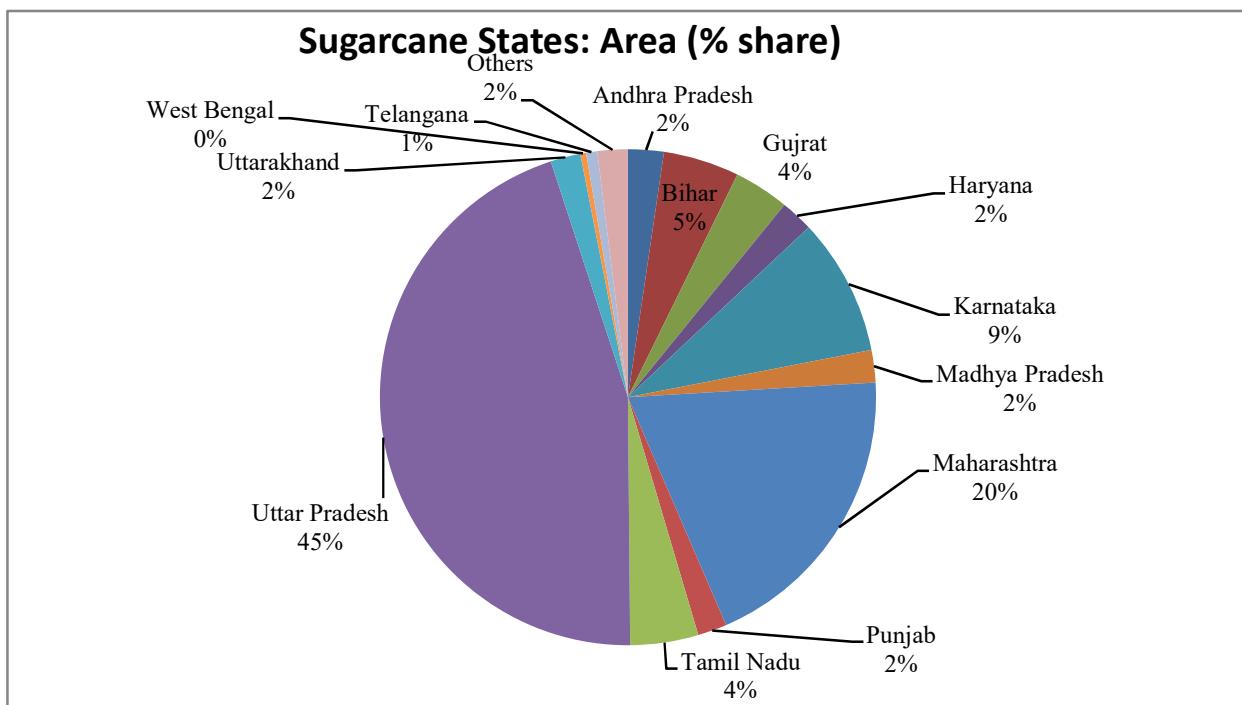
#### 2.4. STATES' SCENARIO:

The sugarcane is cultivated in area of 48.46 lakh ha with production of 360.43 million ha and yield of 78.84 tonnes per ha (Ave. 2014-15 to 2018-19). The maximum area and production is recorded in Uttar Pradesh (45% area and 43 % production) followed by Maharashtra (19 % area and 21 % production) and Karnataka (9% area and 10% production). These three states contributed about 73% area and 74% production of the country. During 2016-17, the area under sugarcane has been declined and estimated at 44.40 lakh ha which was 10% less as compared to 2015-16 due to moisture stress prevailed in most parts of Maharashtra and Karnataka states. The area was recouped during 2017-18 to some extent but not reached up to level of 2015-16. The highest production was recorded in Uttar Pradesh during 2018-19 (179.71 million tonnes) followed by Maharashtra (89.77 million tonnes) and Karnataka (42.41 million tonnes). As the average productivity is concerned, Tamil Nadu recorded maximum (99.53 tonnes/ ha) followed by West Bengal (94.26 tonnes/ ha) and Karnataka (83.66 tonne/ha). Area, production and yield of major states during 2014-15 to 2019-20 are given in **Table 8 (a, b, c)**. State- wise Area, Production and yield during 2008-09 to 2017-18 are given in **Annexure I**.

**Table 8 (a): State wise Area of sugarcane** (Lakh ha)

| S. No. | States           | 2014-15      | 2015-16      | 2016-17      | 2017-18      | 2018-19      | 2019-20*     | Average (2014-15 to 2018-19) | % Share       |
|--------|------------------|--------------|--------------|--------------|--------------|--------------|--------------|------------------------------|---------------|
| 1      | Andhra Pradesh   | 1.39         | 1.22         | 1.03         | 0.99         | 1.02         | 0.86         | 1.13                         | 2.33          |
| 2      | Bihar            | 2.54         | 2.44         | 2.40         | 2.34         | 2.26         | 2.24         | 2.40                         | 4.95          |
| 3      | Gujarat          | 2.08         | 1.57         | 1.69         | 1.82         | 1.55         | 1.08         | 1.74                         | 3.59          |
| 4      | Haryana          | 0.97         | 0.93         | 1.02         | 1.14         | 1.09         | 0.96         | 1.03                         | 2.12          |
| 5      | Karnataka        | 4.80         | 4.50         | 3.97         | 3.70         | 4.71         | 4.18         | 4.34                         | 8.95          |
| 6      | Madhya Pradesh   | 1.11         | 1.03         | 0.92         | 0.98         | 1.08         | 1.25         | 1.02                         | 2.11          |
| 7      | Maharashtra      | 10.30        | 9.87         | 6.33         | 9.02         | 11.63        | 8.22         | 9.43                         | 19.46         |
| 8      | Punjab           | 0.94         | 0.90         | 0.88         | 0.96         | 0.95         | 0.96         | 0.93                         | 1.91          |
| 9      | Tamil Nadu       | 2.63         | 2.52         | 2.18         | 1.72         | 1.66         | 1.26         | 2.14                         | 4.42          |
| 10     | Uttar Pradesh    | 21.41        | 21.69        | 21.60        | 22.34        | 22.24        | 22.08        | 21.86                        | 45.10         |
| 11     | Uttarakhand      | 1.02         | 0.97         | 0.93         | 0.90         | 0.91         | 0.92         | 0.95                         | 1.95          |
| 12     | West Bengal      | 0.18         | 0.17         | 0.21         | 0.19         | 0.16         | 0.19         | 0.18                         | 0.38          |
| 13     | Telangana        | 0.38         | 0.35         | 0.29         | 0.35         | 0.40         | 0.26         | 0.35                         | 0.73          |
| 14     | Others           | 0.92         | 1.11         | 0.91         | 0.92         | 0.95         | 0.96         | 0.96                         | 1.98          |
|        | <b>All India</b> | <b>50.67</b> | <b>49.27</b> | <b>44.36</b> | <b>47.37</b> | <b>50.61</b> | <b>45.42</b> | <b>48.46</b>                 | <b>100.00</b> |

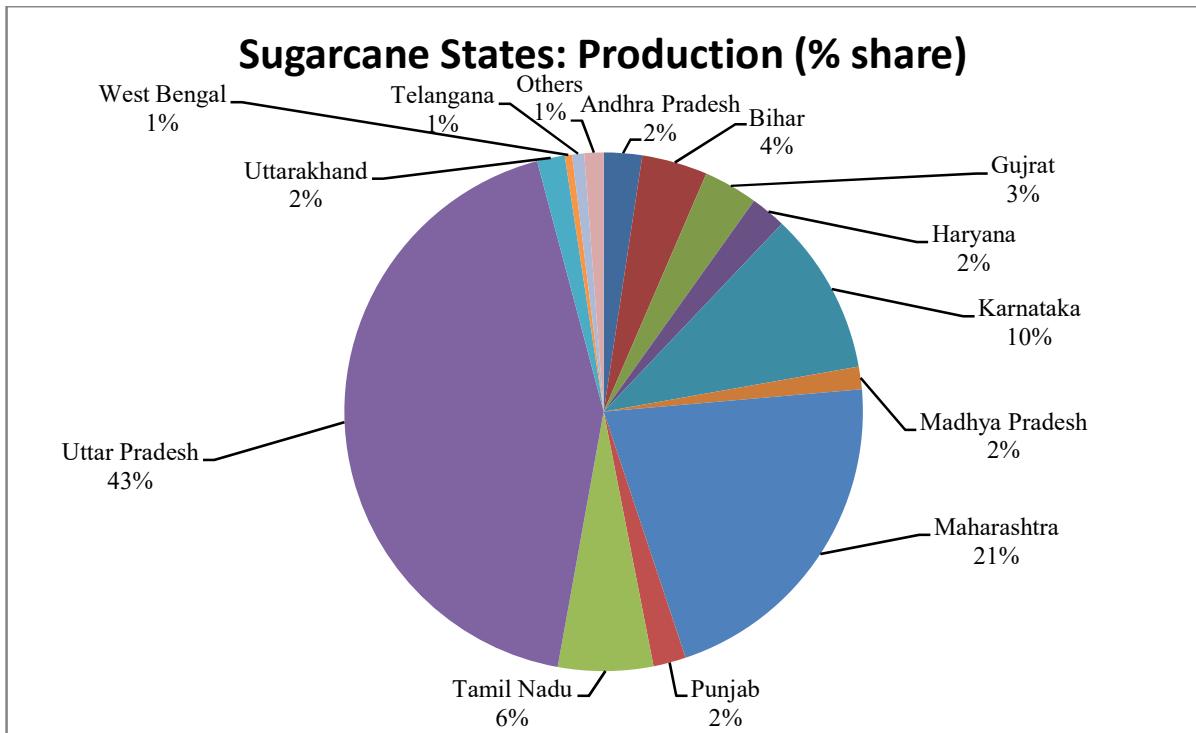
\*Source - E&S, DAC, 3<sup>rd</sup> Adv. Est -2019-20\*



**Table 8 (b): State wise production of sugarcane** (Million tonnes)

| S.No | States / UT    | 2014-15 | 2015-16 | 2016-17 | 2017-18 | 2018-19 | 2019-20* | Average (2014-15 to 2018-19) | % Share |
|------|----------------|---------|---------|---------|---------|---------|----------|------------------------------|---------|
| 1    | Andhra Pradesh | 9.99    | 9.35    | 7.83    | 7.80    | 8.09    | 6.55     | 8.61                         | 2.39    |
| 2    | Bihar          | 14.03   | 12.65   | 13.04   | 13.83   | 20.12   | 15.97    | 14.73                        | 4.09    |
| 3    | Gujarat        | 14.33   | 11.12   | 11.95   | 12.07   | 11.33   | 7.68     | 12.16                        | 3.37    |
| 4    | Haryana        | 7.17    | 6.69    | 8.22    | 9.63    | 8.51    | 7.80     | 8.04                         | 2.23    |
| 5    | Karnataka      | 43.78   | 37.83   | 27.38   | 31.14   | 42.41   | 37.62    | 36.51                        | 10.13   |
| 6    | Madhya Pradesh | 4.57    | 5.28    | 4.73    | 5.43    | 5.28    | 3.17     | 5.06                         | 1.40    |
| 7    | Maharashtra    | 84.70   | 73.68   | 52.26   | 82.98   | 89.77   | 65.24    | 76.68                        | 21.27   |
| 8    | Punjab         | 7.04    | 6.61    | 7.15    | 8.02    | 7.77    | 7.94     | 7.32                         | 2.03    |
| 9    | Tamil Nadu     | 28.09   | 25.49   | 18.99   | 17.15   | 17.14   | 12.60    | 21.37                        | 5.93    |
| 10   | Uttar Pradesh  | 133.06  | 145.39  | 140.17  | 177.03  | 179.71  | 178.42   | 155.07                       | 43.02   |
| 11   | Uttarakhand    | 6.17    | 5.89    | 6.48    | 6.27    | 6.33    | 6.94     | 6.23                         | 1.73    |
| 12   | West Bengal    | 2.11    | 2.08    | 1.55    | 1.13    | 1.34    | 1.73     | 1.64                         | 0.45    |
| 13   | Telangana      | 3.34    | 2.41    | 2.06    | 2.60    | 3.18    | 1.95     | 2.72                         | 0.75    |
| 14   | Others         | 3.96    | 3.99    | 4.26    | 4.82    | 4.45    | 4.53     | 4.29                         | 1.19    |
|      | All India      | 362.33  | 348.45  | 306.07  | 379.90  | 405.42  | 358.14   | 360.43                       | 100.00  |

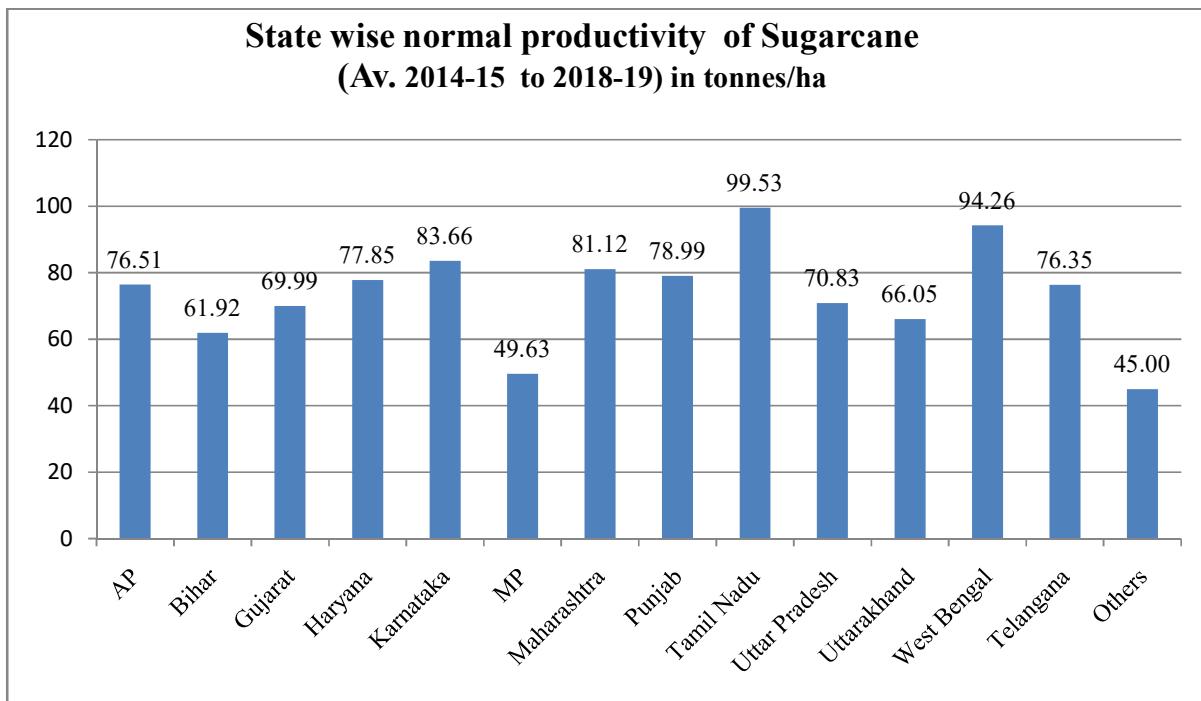
\*Source - E&S, DAC, 3rd Adv. Est -2019-20\*



**Table 8 (c): State wise productivity of Sugarcane** **(tonnes/ha)**

| S.No | States / UT      | 2014-15      | 2015-16      | 2016-17      | 2017-18      | 2018-19      | 2019-20*     | Average<br>(2014-15 to<br>2018-19) |
|------|------------------|--------------|--------------|--------------|--------------|--------------|--------------|------------------------------------|
| 1    | Andhra Pradesh   | 71.85        | 76.66        | 76.02        | 78.68        | 79.36        | 76.14        | 76.51                              |
| 2    | Bihar            | 55.18        | 51.84        | 54.42        | 59.14        | 89.01        | 71.42        | 61.92                              |
| 3    | Gujarat          | 68.89        | 70.83        | 70.71        | 66.33        | 73.17        | 71.30        | 69.99                              |
| 4    | Haryana          | 73.91        | 71.96        | 80.62        | 84.50        | 78.24        | 80.98        | 77.85                              |
| 5    | Karnataka        | 91.20        | 84.08        | 68.96        | 84.08        | 90.00        | 90.00        | 83.66                              |
| 6    | Madhya Pradesh   | 41.14        | 51.27        | 51.41        | 55.41        | 48.90        | 25.33        | 49.63                              |
| 7    | Maharashtra      | 82.23        | 71.65        | 82.52        | 92.00        | 77.20        | 79.35        | 81.12                              |
| 8    | Punjab           | 74.88        | 73.41        | 81.27        | 83.58        | 81.82        | 82.68        | 78.99                              |
| 9    | Tamil Nadu       | 106.79       | 101.06       | 87.00        | 99.81        | 103.00       | 100.00       | 99.53                              |
| 10   | Uttar Pradesh    | 62.16        | 67.03        | 64.89        | 79.25        | 80.81        | 80.81        | 70.83                              |
| 11   | Uttarakhand      | 60.61        | 60.77        | 69.65        | 69.68        | 69.55        | 75.41        | 66.05                              |
| 12   | West Bengal      | 118.75       | 119.23       | 73.82        | 75.00        | 84.49        | 90.00        | 94.26                              |
| 13   | Telangana        | 87.97        | 68.71        | 71.07        | 74.41        | 79.58        | 75.05        | 76.35                              |
| 14   | Others           | 43.04        | 36.08        | 46.80        | 52.35        | 46.75        | 47.19        | 45.00                              |
|      | <b>All India</b> | <b>71.51</b> | <b>70.72</b> | <b>69.00</b> | <b>79.66</b> | <b>80.11</b> | <b>78.84</b> | <b>74.20</b>                       |

\*Source - E&S, DAC, 3<sup>rd</sup> Adv. Est -2019-20\*

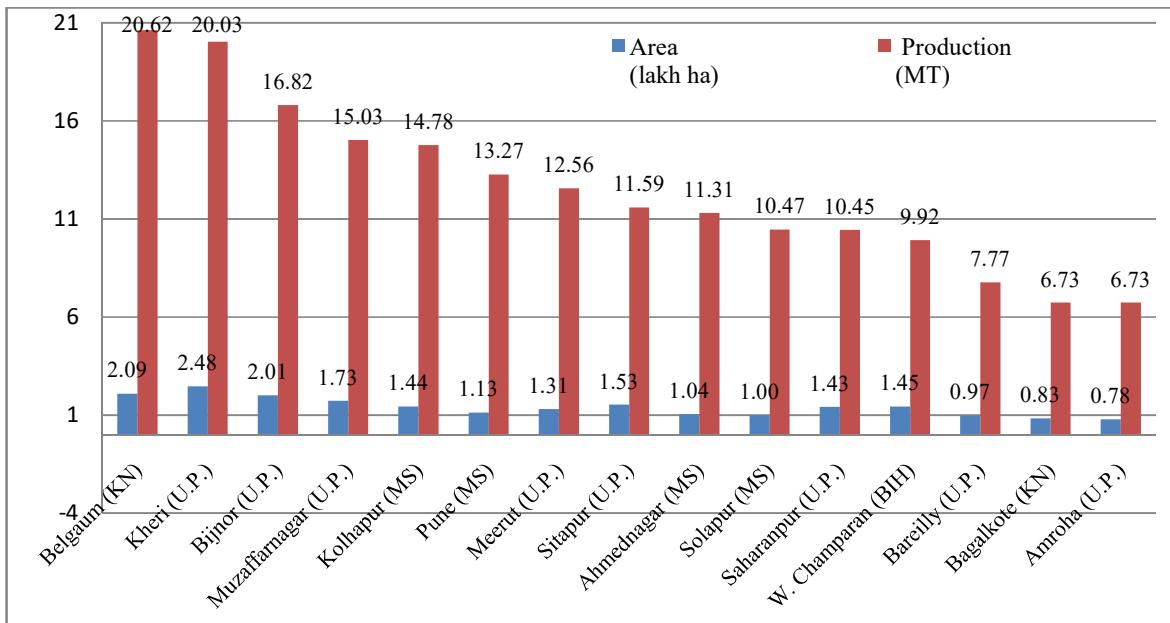


## 2. 5. DISTRICT SCENARIO: MAJOR DISTRICTS (2017-18)

About 50% of production and 45 % of area confined to 15 districts in India. 08 districts of U.P., four districts of Maharashtra, two districts of Karnataka and one district of Bihar comes under top 15 districts in the national scenario of sugarcane. The area, production and yield of 15 leading districts of India during 2017-18 are given in **Table No 9**.

**Table 9: Fifteen leading districts under sugarcane of India**

| S.<br>N. | State | District      | Area<br>(Lakh<br>/ha) | % share<br>to<br>India | Production<br>(Lakh<br>/Tonnes) | % share<br>to India | Yield<br>(Tonnes/<br>ha) | YI  |
|----------|-------|---------------|-----------------------|------------------------|---------------------------------|---------------------|--------------------------|-----|
| 1        | KN    | Belgaum       | 2.09                  | 4.41                   | 206.20                          | 5.43                | 99                       | 124 |
| 2        | U.P.  | Kheri         | 2.48                  | 5.24                   | 200.26                          | 5.27                | 81                       | 101 |
| 3        | U.P.  | Bijnor        | 2.01                  | 4.24                   | 168.15                          | 4.43                | 83                       | 104 |
| 4        | U.P.  | Muzaffarnagar | 1.73                  | 3.65                   | 150.28                          | 3.96                | 87                       | 109 |
| 5        | MS    | Kolhapur      | 1.44                  | 3.04                   | 147.79                          | 3.89                | 103                      | 129 |
| 6        | MS    | Pune          | 1.13                  | 2.39                   | 132.70                          | 3.49                | 117                      | 146 |
| 7        | U.P.  | Meerut        | 1.31                  | 2.77                   | 125.56                          | 3.31                | 95                       | 119 |
| 8        | U.P.  | Sitapur       | 1.53                  | 3.23                   | 115.89                          | 3.05                | 75                       | 94  |
| 9        | MS    | Ahmednagar    | 1.04                  | 2.20                   | 113.09                          | 2.98                | 108                      | 135 |
| 10       | MS    | Solapur       | 1.00                  | 2.11                   | 104.68                          | 2.76                | 104                      | 130 |
| 11       | U.P.  | Saharanpur    | 1.43                  | 3.02                   | 104.50                          | 2.75                | 73                       | 91  |
| 12       | Bihar | W. Champaran  | 1.45                  | 3.06                   | 99.21                           | 2.61                | 68                       | 85  |
| 13       | U.P.  | Bareilly      | 0.97                  | 2.05                   | 77.66                           | 2.04                | 80                       | 100 |
| 14       | KN    | Bagalkote     | 0.83                  | 1.75                   | 67.30                           | 1.77                | 81                       | 101 |
| 15       | U.P   | Amroha        | 0.78                  | 1.65                   | 67.29                           | 1.77                | 85                       | 106 |
|          |       | All India     | 47.37                 |                        | 3799.00                         |                     | 80                       |     |



**Fifteen leading districts under sugarcane of India (2017-18)**

State-wise district wise area, production and yield is given in **Annexure II**.

## 2.6. VARIETAL SCENARIO

About 30 research stations in India are engaged in sugarcane research and varietal improvement. The varietal development work was started in India since the establishment of Cane Breeding Station at Coimbatore in Tamil Nadu during 1912. The first commercial successful variety Co 205 was released in 1918. Since then lot of varieties were released for cultivation. Breeding varieties for tropical India started in 1926, first wonder variety Co 419 was released in 1933, which has saturated the entire tropical belt occupying 96.2% of the sugarcane area by 1952-53. The major varieties developed for tropical India were Co 7219, Co 7527, Co 7704, CoC 671, Co 8013, Co 8014, Co 7508, Co 6907, CoA 7601. In Uttar Pradesh the breeding work started with the establishment of Sugarcane Research Station in Shahjahanpur during 1912. Since then UPCSR has released more than 212 varieties. The popular varieties are CoS 510, CoS 687, CoS 8436, CoS 88230, CoS 95255, CoS 96268, CoS 767, CoS 802, CoS 7918, CoS 8432, CoS 91269, CoSe 92423, CoSe 95422.

The All India Coordinated Research Project on Sugarcane was started in the year 1970, coordinating research work through network of sugarcane research stations of ICAR, SAUs, State Govt. Departments and Non Government Organizations. At present 22 regular and 14 voluntary centers conducting research and multi location testing of technology for wider adoption. After inclusion of sugarcane in Seed Act, More than 75 varieties have been released and notified during 2000 to 2019. The details are given in **Annexure III**.

Few varieties have been widely adopted and occupied larger share in sugarcane area viz. Co 86072 (70%) in Pennisular zone, Co 0238 (60 %) in North Western and Central Zone and CoLk 94184, BO 91, Co 6907 and Co Bln 9104 in eastern one of the country. The State-wise/ variety-wise area under sugarcane is at **Annexure IV**.

## Chapter 3

# Production Technology

## PRODUCTION TECHNOLOGY

**3.1. Climate:** Sugarcane is being grown in India from latitude 8° North to 32° North. The wide variations brings with a large variation in climatic conditions apex its growth, yield and quality. Sugarcane is long duration crop encounters in all three seasons during its life cycle. The optimum temperature for germination range from 22-23°C. Temperature below 20 °C reduces rate of germination and at below 10°C cane setts failed to sprout. The optimum temperature range for tillering between 18-35°C whereas for grand growth/ elongation phase it range from 20-30 °C. Bright days with temperature of 23-30 °C and cool nights temperature 7-14 °C require for normal ripening of Sugarcane. Temperature & humidity requirement for Sugarcane cultivation is given in **Table No 10.**

**Table 10: Temperature and Humidity requirement for sugarcane cultivation**

| S. No. | Sugarcane crop stages           | Growth stages duration (days) | Temperature requirement (oC) |      | Humidity requirement (%) |      | Sunshine (hrs) |
|--------|---------------------------------|-------------------------------|------------------------------|------|--------------------------|------|----------------|
|        |                                 |                               | Max.                         | Min. | Max.                     | Min. |                |
| 1      | Germination and emergence phase | 15 to 30 days after planting  | 30                           | 15   | 70                       | 50   | 10             |
| 2      | Tillering and stem elongation   | 31 to 120                     | 30                           | 15   | 70                       | 50   | 10             |
| 3      | Grand growth phase              | 121 to 210                    | 30                           | 20   | 85                       | 80   | 11             |
| 4      | Ripening phase                  | 211 to 365                    | 15                           | 12   | 65                       | 45   | 10             |

**3.2. Soil:** In India, sugarcane is grown in varied types of soil like Alluvial soils in the states of Uttar Pradesh, Haryana, Punjab, Bihar & West Bengal; black soils in states like Maharashtra, Gujarat, Madhya Pradesh, Andhra Pradesh, Karnataka & Tamil Nadu and red soils in the state of Andhra Pradesh, Karnataka & Tamil Nadu, Kerala, parts of West Bengal and Southern parts of Bihar. Deep well drained medium texture soil with sufficient water holding capacity with 6.5-7.5 pH are most suitable for sugarcane cultivation.

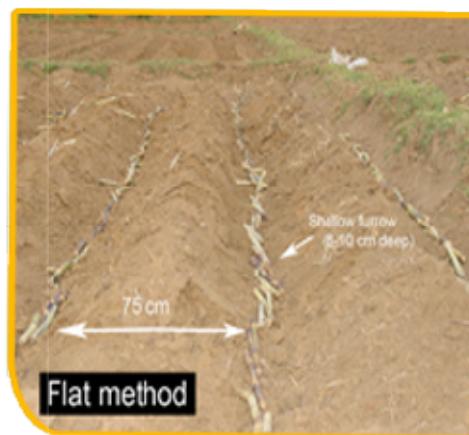
**3.3. Field preparation:** After harvest of previous crop the field is deep ploughed followed by subsequent light ploughing to produce fine tilth in north India one pre-planting irrigation is given for seed bed preparation followed by planking to conserve

soil moisture. In tropical India planting is done in relatively dry moisture condition in the lighter soil followed by irrigation whereas in heavy soils normally water is applied in furrow to loosen the soil and setts pushed.

**3.4. Planting Season:** The crop duration in India ranges from 12-18 months. 18-20 months crop called adsali is planted in Maharashtra, Andhra Pradesh & Karnataka. In sub tropical India spring planting in February to March and late planting after harvest of Wheat in the month of April is most common where as in southern region sugarcane is mostly planted in February and March. In North India Autumn planting in month of October is also done. Important planting and harvesting time of sugarcane in different states is enclosed in **Annexure V**.

### 3.5. Planting methods

**3.5.1. Flat Method:** Flat planting suited to un-irrigated or partial irrigated culture in alluvial soils with good soil moisture. It is mostly adopted in Uttar Pradesh, Bihar, Punjab, Haryana & Rajasthan. In this method shallow furrow (8-10) cm deep) are opened with country plough or tractor operated furrow opener at a distance of 75-90 cm. The setts are planted end to end taking care that on 3 budded sett falls in each running 30 cm length of furrow. After planting, the furrows are covered with 5-7 cm soil and the field is leveled by heavy planking.



**3.5.2. Ridge and Furrow planting:** This method is usually adopted in areas of moderate rainfall having drainage problems. It is used in tropical states like Tamil Nadu, Gujarat, Andhra Pradesh & Kerala. A furrow of 20 cm deep and 20-40 cm wide at an inter row spacing of 80-100 cm are opened with ridger or an iron plough drawn by tractor. Cane setts are placed in furrow keeping buds on sides in dry or wet condition depending upon soil type.



**3.5.3. Trench Method:** Trench method is practiced in heavy soils, where clod formation is frequent. In this system 25-30 cm deep trenches are made with row 90 cm apart and ridge each occupies 45 cm wide space. Bottom of the trenches are then tilled to pulverize the soil. Planting of setts is done about 5-7.5 cm deep in centre of the trench followed by irrigation. Planting in deep trenches provides better capacity of root development. It also produces better ratoons. This system is labour intensive.



**3.5.4. Furrow Irrigated Raised Bed (FIRB) technique:** Furrow Irrigated Raised Bed (FIRB) technique with wheat sowing on raised beds and sugarcane planting in furrows has been developed at IISR, Lucknow. In this system, three rows of wheat in the month of November are sown on raised beds and sugarcane is planted at 80-85 cm apart furrows in February in furrows. Sugarcane planting coincides with irrigation at boot leaf stage in wheat. Irrigation is given in furrows preferably in the evening and sugarcane setts are planted next day and pressed into the soil manually when the soil is muddy condition (wet planting). After the harvest of wheat the furrows are used for irrigating sugarcane till earthing-up operation.



**3.5.5. Spaced transplanting (STP) method:** The technique as described by Srivastava et al. in 1981 based on transplanting of nursery raised settling. A month old settling are used to transplanting in the main field. The settling are raised by planting single bud sett in nursery. Approximately  $50\text{ m}^2$  land area and about 2 tonnes seed cane are needed to obtain settling sufficient for transplanting in one hectare of field.



**3.5.6. Ring Pit method:** In this method, the seedlings are planted in circular pits dug out with specific diameters and distances. The circular pits of 3 ft or 5 ft diameter are dug out to a depth of 1.5 to 2 ft. Row to row spacing is maintained at 7 ft and pit to pit spacing is maintained at 6 ft. At these spacing's, about 1050 to 1150 (with 3 ft diameter) or 500 to 550 (with 5 ft diameter) pits can be made per acre. The pits are then filled with loose dug out soil, FYM or press mud leaving about 1 ft space at the top. Two to four seedlings per pit with 3 ft diameter and 6 to 8 seedlings per pit with 5 ft diameter can be planted close to the edge and covered with soil to a thickness of 5 cm. About 2000 to 4000 seedlings are sufficient per acre, saving the seed cost further for a farmer. All other crop management practices can be followed as practiced in normal method.



#### **Benefits of Pit Method:**

- This method has given high yields in the subtropics and in the tropical part of India, about 25-50 % higher yields were obtained.
- Growth of the crop will be vigorous and the maturity will also be earlier compared to the normal method sufficient and equal spacing between the clumps and rows allows sufficient light and air circulation improving the growth.
- In case of drip irrigation, nutrition supplied through drip fertigation will help in faster crop growth
- This method allows a farmer to pay individual attention to the crops or crop pits.

- It gives better ratoon crops and has also been found useful under saline soils and saline water irrigated conditions.
- All the shoots will be of the same age, so there is uniformity in growth and sugar accumulation in the canes.
- The most important factor is that the seedlings are placed at a depth, which will be always moist, hence, in case of drought, or non-availability of water, the yields will not get affected.

**3.5.7. Bud Chip Method:** The technique is quiet similar to STP but only difference is that instead of using single bud setts as a planting material only the bud along with a portion of nodal region is chipped off using a machine. Due to this method only 0.8 tonnes seed material is needed for planting one hectare land.



**3.6. Seed rate & treatment:** Seed rate depend on row spacing, size of setts and method of planting. It varies from region to region. Generally higher seed rate are used in north western India (Punjab, Haryana and Rajasthan) because of the lower germination percent and also adverse climatic condition (very hot weather with desiccating winds) during tillering phase. A northern region seed rate generally varies from 40,000 to 60,000 three budded setts per hectares while in southern region it range between 25,000 to 40,000 three budded setts.

### **Seed Treatment:**

Since sugarcane is vegetative propagated crop, it is more prone to attack by insect-pests and diseases resulting in poor germination. It has been observed that even under satisfactory condition hardly 40-45% buds germinate. So improvement in germination can improve growth and yields.

### **Recommendations**

1. Always use disease free quality setts for planting.
2. To save the setts from the attack of termites and ants, Chlorpyriphos 1.0 kg ai/ha on seed cane/ stalk is recommended.
3. To reduce the incidence of soil-borne diseases, setts must be treated with fungicides. Setts are first given heat treatment (50°C for 2 hours) and then treated with fungicides like 0.2% solution of Bavistin have been found effective.
4. If setts are infested with scale insect or wooly aphids, setts should be dipped in Chlorpyripos 20 EC solution (2ml/lit) before planting.
5. To enhance higher germination percentage, soaking of seed cane in normal water for a period of 12-18 hours improves germination by 12-20% particularly under late planting condition in sub-tropical India. Soaking of whole cane has been found more beneficial than soaking the setts or storing the canes in mud or cow dung for 12-24 hours reduces the water loss during cutting, planting and even later, which helps in higher germination or sett treatment with 10% solution of KMnO<sub>4</sub>, MgSO<sub>4</sub> or potassium ferrocyanide accelerates the bud sprouting.
6. To increase biological nitrogen fixation and solubility of phosphatic fertilizers, setts should be treated with N supplying bio-fertilizers or phosphate solubilising inoculants. For one hectare area, dissolve 10 kg of microbial inoculants (CFU > 10<sup>7-8</sup> per ml ) in 200-250 litres of water and deep sets for 10-15 minutes before planting.

**(Source: IISR AICRP (S) Technical Bulletin - No. 1)**

### 3.6.1. Distance:

Effect of row spacing from 45 to 120 cm have been tried on growth, yield and quality of sugarcane. Optimum inter rows spacing range between 60-100 cm under different situation and location.

**Table 11: Optimum seed rate and row spacing for sugarcane in different states in India**

| S.No.                      | State           | Seed rate (3 buded sett (000/ha) | Row spacing (cm) |
|----------------------------|-----------------|----------------------------------|------------------|
| <b>Sub-tropical region</b> |                 |                                  |                  |
| 1.                         | Uttar Pradesh   |                                  |                  |
|                            | Timely planting | 35                               | 90               |
|                            | Late Planting   | 56                               | 60               |
| 2.                         | Bihar           | 37                               | 75-90            |
| 3.                         | Punjab          | 50                               | 60-75            |
| 4.                         | Haryana         | 75 (2 budded)                    | 60-75            |
| 5.                         | Rajasthan       | 40-45                            | 75-90            |
| 6.                         | Madhya Pradesh  | 25-30                            | 90               |
| 7.                         | Assam           | 37-42                            | 90               |
| 8.                         | West Bengal     | 25-30                            | 90               |
| <b>Tropical</b>            |                 |                                  |                  |
| 1.                         | Maharashtra     | 30                               | 90-100           |
| 2.                         | Andhra Pradesh  | 30                               | 80-90            |
| 3.                         | Karnataka       | 25-30                            | 90               |
| 4.                         | Gujarat         | 25-30                            | 90               |
| 5.                         | Tamilnadu       | 42                               | 80               |
| 6.                         | Orissa          | 37-40                            | 90               |
| 7.                         | Kerala          | 35-40                            | 90               |

Source: Sugarcane Production technology in India by Dr. R. S. Verma

### 3.6.2. Depth:

About 80% of the sugarcane roots go up to a depth 60 cm. Hence deep ploughing of sugarcane fields is necessary. Initially one or two deep ploughings with tractor drawn disc plough or Mould Board Plough or animal drawn mould board plough has to be done at least to a depth of 30 cm. This has to be followed by ploughing with other light tillage implements.

**3.7. Varieties:** Selection of improved variety is the important phenomena for achieving higher production. List of varieties is enclosed as **Annexure-III**.

## Chapter 4

# Sugarcane based Cropping Systems

## SUGARCANE BASED CROPPING SYSTEMS

Sugarcane is being a long duration crop, widely spaced and one time income generating crop lends ample scope of crop diversification. Inclusion of short duration high value crops in sugarcane based production system as inter or sequential crops holds great promise in increasing the land utilization efficiency, reducing the production cost, economizing the use of market purchase costly input and making the system sustainable. The prominent sugarcane based is given in **Table No. 12**.

**Table 12: Cropping system for Sub tropical & Tropical region.**

| Cropping system for Sub tropical                         | Cropping system for Tropical region                |
|--|--|
| Paddy- Autumn Sugarcane-ratoon-wheat                     | Bajra-Sugarcane(pre-seasonal)-Ratoon-Wheat         |
| Greengram- Autumn Sugarcane-ratoon-wheat                 | Paddy-Sugarcane-Ratoon- Finger millet              |
| Maize- Autumn Sugarcane-ratoon-wheat                     | Paddy-Sugarcane-Ratoon- Wheat                      |
| Kharif Crops-Potato-Spring Sugarcane-ratoon-Wheat        | Paddy-Sugarcane-Ratoon- Ginger                     |
| Kharif Crops-Mustard-Spring Sugarcane-ratoon-Wheat       | Paddy-Sugarcane-Ratoon- Urd/finger millet/sesamum. |
| Kharif Crops-Pea/Coriander-Spring Sugarcane-ratoon-Wheat | Cotton-Sugarcane-Ratoon–Wheat                      |
| Kharif Crops-Wheat-late Planted Sugarcane-ratoon-Wheat   | Sugarcane-Ratoon-Kharif rice- Winter rice-sunhemp. |

**4.1. Intercropping:** Short duration crop have been capability in growth and exerting less shedding affect of sugarcane are best suited for intercropping. The selection of suitable variety and proper management of the crop are necessary for better return through this system. The intercrops which can be taken with sugarcane

### **Adsali sugarcane**

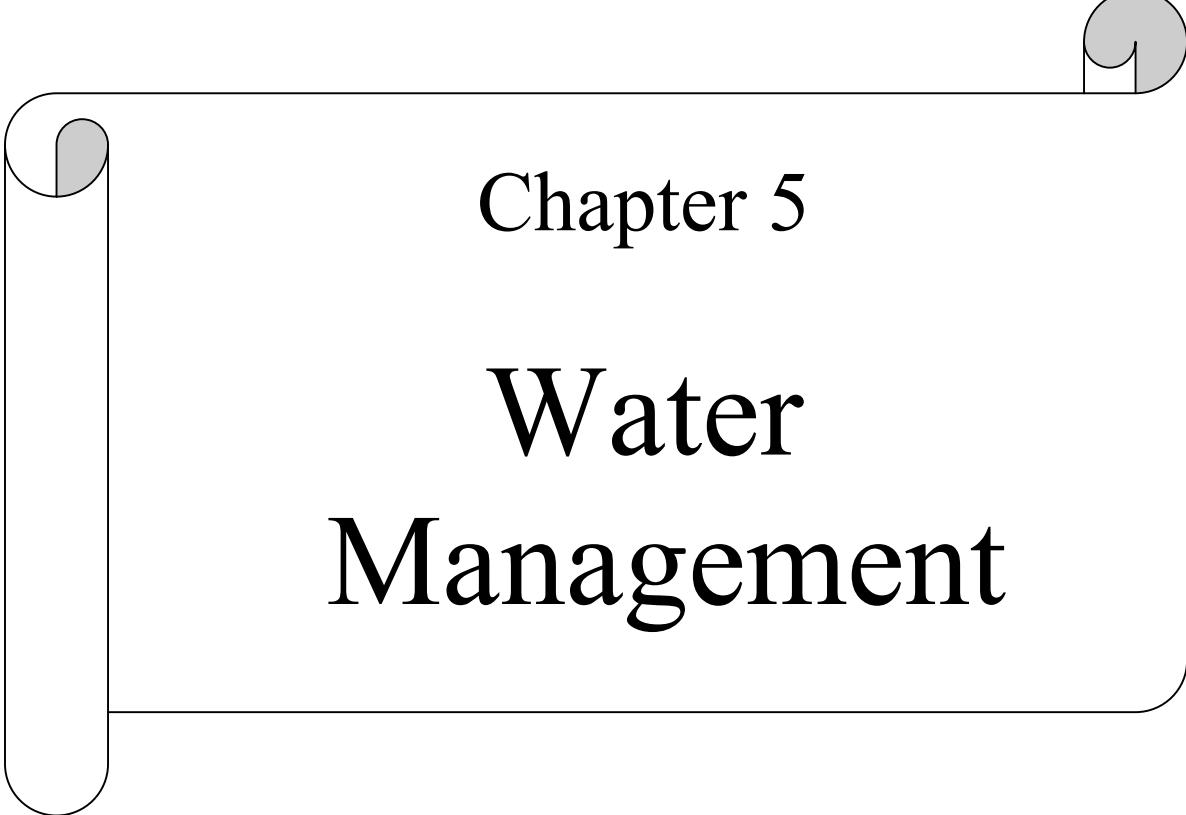
- i. Sugarcane + Groundnut
- ii. Sugarcane + Soybean
- iii. Sugarcane + Cowpea

### **Autumn sugarcane**

- i. Sugarcane + Potato
- ii. Sugarcane + Mustard
- iii. Sugarcane + Lentil
- iv. Sugarcane + Wheat
- v. Sugarcane + Linseed
- vi. Sugarcane + French bean

### **Spring/ Summer**

- i. Sugarcane + Urd
- ii. Sugarcane + Moon
- iii. Sugarcane + Cowpea



# Chapter 5

# Water Management

## WATER MANAGEMENT:

The water requirement of sugarcane is very high. In tropical area, irrigations are to be given once in 7 days during germination phase (1 –35 days after planting), once in 10 days during tillering phase (36–100 days after planting), again once in 7 days during grand growth phase (101 – 270 days after planting) and once in 15 days during maturity phase (271 days after planting up to harvest) adjusting it to the rain fall pattern of the area. About 30 to 40 irrigations are needed. Sugarcane is a high water requirement crop. About 250 tonnes of water is needed to produce one tonne of sugarcane. Methods like alternate furrow irrigation, drip irrigation and trash mulching could be of use to economize irrigation water during water scarcity periods.

### **5.1. Water requirement (WR) in various sugarcane- growing states of India**

**Table 13: Water requirement (WR) in various sugarcane- growing states of India**

| State                          | WR (ha-cm) |
|--------------------------------|------------|
| 1. Andhra Pradesh              | 160–170    |
| 2. Tamil Nadu                  | 180        |
| 3. Karnataka                   | 200–240    |
| 4. Maharashtra                 |            |
| 4.1. Plant cane (seasonal)     | 250        |
| 4.2. Plant cane (pre-seasonal) | 300        |
| 4.3. Plant cane (Adsali)       | 350        |
| 4.4. Ratoon                    | 300        |
| 5. Madhya Pradesh              | 270        |
| 6. Bihar                       | 140        |
| 7. Uttar Pradesh               | 160–180    |
| 8. Punjab                      | 170–180    |

**Table 14: state-wise irrigation requirement in sugarcane cultivation**

| S.N. | State          | No. of irrigation required | Average sugarcane yield (t/ha) | Amount of irrigation water required to produce 1.0 kg sugarcane (kg) |
|------|----------------|----------------------------|--------------------------------|--|
| 1    | Punjab         | 13                         | 72.0                           | 135  |
| 2    | Haryana        | 13                         | 76.0                           | 133  |
| 3    | Rajasthan      | 16                         | 67.4                           | 174  |
| 4    | Uttar Pradesh  | 8                          | 61.7                           | 99   |
| 5    | Bihar          | 7                          | 55.2                           | 95   |
| 6    | West Bengal    | 7                          | 115.0                          | 48   |
| 7    | Assam          | 6                          | 36.1                           | 122  |
| 8    | Gujarat        | 25                         | 70.5                           | 260  |
| 9    | M.P.           | 16                         | 45.8                           | 276  |
| 10   | Maharashtra    | 32                         | 76.1                           | 292  |
| 11   | Karnataka      | 32                         | 85.5                           | 266  |
| 12   | Andhra Pradesh | 28                         | 79.4                           | 262  |
| 13   | Kerala         | 9                          | 91.5                           | 67   |
| 14   | Tamil Nadu     | 25                         | 105.0                          | 181  |

### **Irrigation water management:**

Sugarcane is a long duration and irrigated crop. The plant crop season is being 12-18 months in India, 13-14 months in Iran, 16 months in Mauritius, 13-19 months in Jamaica, 15 months in Queensland (Australia) and 20 - 24 months in Hawaii. Depending on climate, water requirements of sugarcane are 1500 to 2500 mm evenly distributed over the growing season. In India, farmers must plan their acreage to be planted under cane crop according to the available water at their farm. Irrigation water depth of 7-8 cm is recommended. Irrigate the crop depending upon the need during different phases of the crop. For example, in tropical area, irrigations are to be given once in 7 days during germination phase (1 –35 days after planting), once in 10 days during tillering phase (36 – 100 days after planting), again once in 7 days during grand growth phase (101-270 days after planting) and once in 15 days during maturity phase (271 days after planting up to harvest) adjusting it to the rain fall pattern of the area. Generally, sugarcane crop requires 6-8 irrigations in subtropical region whereas in tropical region number of irrigation may range from 20-36 depends upon the availability of rains and climatic conditions, annual rainfall of that region, planting season, and crop duration, soil type etc.

(Source: IISR AICRP (S) Technical Bulletin - No. 1)

### **5.2. Method of irrigation:**

**5.2.1. Surface irrigation:** In this method, the irrigation water is conveyed from the source to the field, usually through earthen channels and in the field, water is allowed to flow on the soil surface. This method is simple, cheap and easy to adopt. But a major portion of the water is lost both during conveyance and application. There are different methods of surface irrigation which are described below:

**5.2.2. Flood irrigation:** This type of irrigation is adopted generally for the crop planted in flat system. In this method, the irrigation water is not regulated in the field and allowed to flow uncontrolled. The irrigation water requirement per irrigation in this method often exceeds 100 mm. As the water stagnates in the field, a lot of the water percolates down beyond the root zone resulting in the wastage of precious irrigation water. Besides the root zone soil remains saturated for a few days every time it is

irrigated which affects the soil aeration and consequently the growth of the crop. The only advantage of this system is that it is easy to adopt when the availability of irrigation water is plenty or unlimited. But this results in poor water use efficiency and poor water application uniformity, in addition to potential water logging and salinity problems.

**5.2.3. Furrow irrigation:** This is the most common irrigation method adopted for sugarcane. Water from the irrigation channel is diverted into small furrows along the slope in between small ridges or broad beds. Water in furrows moves both laterally and vertically to moisten the ridges and sub soil. This is a cheap and easy method but there is some application loss. The method could be improved by adopting a proper irrigation schedule based on soil moisture deficit approach or climatological approach or the depth-interval-yield approach and by regulating the quantity of water per irrigation based on the available moisture holding capacity of the soil.

**5.2.4. Skip furrow irrigation:** It is a modification over furrow irrigation wherein alternate furrows are skipped by bringing two rows in a common furrow, if necessary by suitable adjustment of spaces between the rows. The crop population remains the same whereas the number of furrows irrigated gets reduced. There are reports which show that there could be a saving of 30 to 36 % in the quantity of irrigation water by adopting skip furrow method of irrigation. However, a reduction of 14 % in the cane yield has also been reported. Adoption of 60/90 cm paired rows with irrigation in 60 cm furrows and trash mulching in un-irrigated 90 cm furrows resulted in over 10 % saving in irrigation water with higher cane yield compared to normal 90 cm uniform furrow irrigation.

**5.2.5. Alternate furrow irrigation:** Alternate furrow irrigation is another modification of furrow irrigation wherein irrigations are given in cycles to the odd and even numbered furrows. It has been reported that there is a saving of 41 per cent in the quantity of irrigation water by adopting this method. But there was a reduction in the cane yield to the extent of 26 per cent. This method could be adopted during periods of irrigation

water scarcity and the normal furrow irrigation could be readopted when the availability of irrigation water improves.

**5.2.6. Overhead/Sprinkler irrigation:** In this method, water is transported through easily dismantlable, surface laid pipes under pressure and sprinkled over the canopy by rotating type of nozzles. There are different sizes in sprinklers. The medium sized ones could sprinkle water to a radius of 10 to 15 metres and could be arranged in the field in such a way that sprinkling of water is more or less uniform all over the field. There are larger sized ones known as rain guns which could sprinkle water to a radius of over 30 metres. These could be fixed and operated in semi circles also. Just one rain gun can cover over 0.1 ha at a time. Here the conveyance and application losses are lower and it is easy to regulate the quantity of water to be applied. This is a useful and feasible method when the crop is young. But at later stages, when the height of the crop canopy goes up, shifting of the pipes and sprinklers in the field from one place to the other becomes very difficult and poses practical problems in its adoption. This system of irrigation limits the root system to the surface layer of the soil which leads to lodging of the cane. As the water is sprinkled over the canopy, it wets the canopy, trash and cane before reaching the soil surface. In this process, a small quantity of water is wasted. Sometimes it may induce aerial rooting of the cane which affects the quality. The distribution of water is also not uniform all over the field. The initial cost of the system is very high and the energy requirement for operation of the system is also very high. Of the different sprinkler type systems available, only permanent systems have proved practical in the long run. In clayey soils, sprinkler systems have proved very useful for better germination of the crop and to economize irrigation water as it wets only the surface soil.

**5.2.7. Micro-irrigation:** The term “micro-irrigation” describes a family of irrigation systems that apply water through small devices. These include mini-sprinklers, micro-sprinklers, bubbler irrigation and drip irrigation. These devices deliver water onto the soil surface very near the plant or below the soil surface directly into the plant root zone facilitating precision water application. Micro-irrigation systems are immensely popular in arid as well as sub-humid and humid zones where water supplies are

limited or water is expensive. In irrigated agriculture, micro-irrigation is used extensively for row crops, mulched crops, orchards, gardens, greenhouses and nurseries. Of the different micro-irrigation systems, drip irrigation is gradually becoming popular in India mainly in wide spaced horticultural crops and also in sugarcane.

**5.2.8. Drip/Trickle irrigation:** Drip irrigation was introduced in the 1970s in Hawaii, Australia and Mauritius. The main advantage of drip system is that the irrigation water is transported from the source to the root zone of the crop through a net work of tubing without any conveyance loss. Besides the quantity of irrigation water can be easily regulated in the drip irrigation system to the actual requirement of the crop. Through drip irrigation, the moisture in the root zone of the crop can be maintained near field capacity almost continuously. As the conveyance loss is practically eliminated and the irrigation water is directly fed into the root zone of the crop at the levels required by the crop, it results in the saving in the quantity of irrigation water.

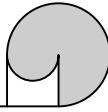
#### **5.2.8.1. Advantages of drip irrigation:**

- (i) Irrigation water is transported from the source to the root zone of the crop without much conveyance and application losses which results in economy of irrigation water.
- (ii) The quantity of irrigation water can be regulated so as to wet only the root zone of the crop.
- (iii) Soil moisture in the root zone of the crop could be maintained near field capacity throughout the crop duration which leads to better crop growth and higher cane yield.
- (iv) Costly inputs like fertilizers and pesticides could be applied through irrigation water and the dose of such inputs could be reduced increasing their efficiency.
- (v) Under situations of acute water shortage, the irrigation interval gets widened beyond the critical limit and the crop often dries up. With drip irrigation it is possible to evenly apply the available irrigation water over the entire cropped area, thereby keeping it alive so that it can be rejuvenated later.

- (vi) With drip irrigation as separate space is not allotted for irrigation channels etc., the effective cropped area is more producing additional cane yield.
- (vii) Drip irrigation reduces the drudgery of the irrigation labour as well as labour cost.

#### **5.2.8.2. Constraints in adoption of drip irrigation in sugarcane**

- (i) The high cost of the system.
- (ii) Operational problems like non-availability of electricity, spare parts, good quality components, trained man power etc.
- (iii) Clogging of drippers particularly when poor quality irrigation water is used.
- (iv) Shallow rooting is a common feature which results in severe lodging affecting yield and quality.
- (v) Filter maintenance.
- (vi) Root intrusion.
- (vii) Damage from farm implements and animals.
- (viii) Difficulties in designing and installation of the drip irrigation system because of the small size of the holdings.
- (ix) The planting geometry of the crop needs to be modified from the conventional uniform rows to paired rows for adoption of drip irrigation.
- (x) Components like pressure gauges, filter screens and water meters become non-functional quite often due to salt deposition necessitating replacements or repairs which add to the maintenance cost.
- (xi) The power consumption is more compared to conventional irrigation.
- (xii) There are different grades of drip irrigation system components with wide variation in quality and longevity, which cannot be easily distinguished, and there are chances for the farmers to lose on account of poor quality.
- (xiii) Once a drip irrigation system is installed for sugarcane, one plant and one or two ratoon crops can be successfully taken. After that, most often the system is not suitable for crops coming in rotation like rice, groundnut etc.



## Chapter 6

# Plant Nutrient Management

## PLANT NUTRIENT MANAGEMENT

**6.1.** Fertilizer management is one of the most important factor for higher cane production.

On an average sugarcane producing 100 tonnes per hectare removes approximately 205 kg N, 55 kg P, 275 kg K, 30 kg S and 55 kg Ca besides 3.5 kg Fe, 1.2 kg Mn, 0.6 kg Zn and 0.2 kg Cu from the soil.

The nitrogen requirement of sugarcane depends upon the soil & climate. It ranges from 150 kg/ha in Uttar Pradesh to 270 kg/ha in Tamil Nadu and 300 to 500 kg/ha in Maharashtra & Karnataka. Nitrogen is given in the form of urea applied one-third at planting & the remaining two-thirds in 2 equal splits at tillering & at the commencement of grand growth stage. The fertilizers may also be applied as basal dose through Diammonium Phosphate to supply full P & part of N. The phosphorous is required at 40-60 kg of P<sub>2</sub>O<sub>5</sub>/ha. The response of sugarcane to potassium has been obtained only in localized pockets of light soils. Now a days deficiency of sulphur is constantly increasing in Indian soils & it has become a limiting factor in sugarcane culture. In marginally deficient soils, the application of 40-60 kg S/ha has been found to be useful. 20-30 kg ZnSO<sub>4</sub>/ha and FYM/Compost of 10 tonnes/ha may be applied.

**Table 15:** Fertilizer recommendations for sugarcane in major sugarcane growing states of India

| State          | Fertilizer recommendations (kg/ha) |                               |                  |
|----------------|------------------------------------|-------------------------------|------------------|
|                | N                                  | P <sub>2</sub> O <sub>5</sub> | K <sub>2</sub> O |
| Andhra Pradesh | 112 – 400                          | -                             | -                |
| Assam          | 130                                | 26                            | 50               |
| Bihar          | 70 – 170                           | 31 – 47                       | 25               |
| Gujarat        | 250                                | 5                             | 104              |
| Haryana        | 150                                | -                             | -                |
| Karnataka      | 187-250                            | 33-55                         | 62-125           |
| Madhya Pradesh | 300                                | 80                            | 37               |
| Maharashtra    | 150 – 400                          | 48 – 74                       | 91 – 141         |
| Orissa         | 200                                | 44                            | 50               |
| Punjab         | 150 - 225                          | -                             | -                |
| Rajasthan      | 150 - 175                          | 26                            | 25               |
| Tamil Nadu     | 175 – 275                          | 27                            | 93               |
| Uttar Pradesh  | 150                                | -                             | -                |
| West Bengal    | 160                                | 26                            | 50               |

(Singh and Yadav, 1996)

**6.2. Micronutrients:** Micronutrients are essential for healthy growth and development of sugarcane plant. They participate in vital processes like energy transformation, stimulation of cells and translocation, distribution, detoxification, splitting and

reconstruction of compound in plant system. When any of these nutrients is present below the minimum amount required by the plant, one or more vital processes are affected and nutritional disorder appears and in extreme causes reduction in yield may occur.

**Table 16: Critical limits of available micronutrients in soil**

| Nutrient                 | Critical levels |
|--------------------------|-----------------|
| Fe (non-calcareous soil) | 4.2 ppm         |
| Fe (calcareous soil)     | 6.3 ppm         |
| Zn (Loamy soils)         | 1.2 ppm         |
| Zn (Clay soils)          | 2.0 ppm         |
| Mn                       | 2.0 ppm         |
| Cu                       | 1.2 ppm         |
| Hot water soluble-B      | 0.44 ppm        |

Source: (Singh, 2008)

### 6.3. Organic manures:

#### 6.3.1. Legumes:

Legumes are grown either in sequence or as intercrops for green manuring grain or fodder. Sunhemp and sesbania are the most common green manure crops. Large amount of green biomass of narrow C:N ratio, when incorporated into the soil during green manuring, contributes sizable amounts of plant nutrients, particularly N and brings improvement in soil physical conditions. Integrated use of green manure crops with mineral fertilizers increases the use efficiency of nitrogenous fertilizers and reduces the N requirement of sugarcane by 41-85 kg per ha. The biomass incorporated through intercrops like green gram and cowpea has been estimated to be around 5 t per ha. It has also been estimated that green manure intercrops like dhaincha and sunhemp can add 4.8 - 7.6 t of green biomass per hectare. Intercrop also prevents the leaching of nitrate-N due to ramification of roots leading to higher nitrogen utilization.

#### 6.3.2. Sugarcane trash

Sugarcane trash accounts for about 10-12 per cent of the cane harvested and its availability is about 30 million tonnes per annum. Trash is a useful source of plant nutrients and contains 0.42 per cent N, 0.15 per cent P, 0.57 per cent K, 0.56 per cent

Ca, 0.30 per cent Mg and 0.12 per cent S besides 360, 110, 90 and 30 ppm of Fe, Mn, Zn and Cu. At many places, farmers prefer to burn the trash before harvest for convenience and even after harvest due to handling difficulties. During burning of sugarcane trash, large amounts of C, N and S, present in the plant residues are lost via volatilization. The benefits of green cane harvesting in increased soil organic matter and cane yield are well recognized. The unburned trash remaining as surface mulch resulted in an average N recycling of 105 kg/ ha/year which may lead to a more efficient recycling of fertilizer N applied to the system and therefore reduce fertilizer needs. It also increases microbial activity and soil enzymes. Recycling high C:N ratio sugarcane trash material may lead to strong N immobilization and thereby affect N cycling processes and N<sub>2</sub> fixation of legumes grown subsequently. Trash could be recycled as mulch or converted into organic manure by proper composting. Compost making from sugarcane trash is a slow process due to its very high C:N ratio (113:1). Many fungal cultures, *viz.*, *Pleurotus* and *Trichoderma viride* have been found to hasten the process of trash decomposition and improve the compost quality. Sprinkling of urea (5 kg t<sup>-1</sup>) to reduce the C:N ratio and fresh cow dung (50 kg t<sup>-1</sup>) as a starter quickens the composting process. vericompost can also be produced by utilizing the partially decomposed sugarcane trash and cow dung.

### **6.3.3. Pressmud**

Sugar factories produce about three tonnes of filter pressmud for every 100 tonnes of cane crushed. Sulphitation pressmud contains about 1.0 to 3.1 % N, 0.6 to 3.6 % P and 0.3 to 1.8 % K on oven dry basis in addition to large amounts of secondary and micronutrients. On an average, one tonne of oven-dry sulphitation press mud contains 17 kg N, 36 kg P, 14 kg K and 23 kg S. Raw press mud cannot be used directly as organic manure in sugarcane because of the evolution of large amount of heat during its decomposition. It can be composted with sugarcane trash or cow dung, either alone or in combination. It takes about six months for compost making. Inoculation with fungal cultures such as *Pleurotus* or *Trichoderma* will hasten the process of decomposition and reduce the time required for compost preparation. The compost has good manurial value containing as much as 1% N, 3% P<sub>2</sub>O<sub>5</sub>, 1% K<sub>2</sub>O and 8% CaO on dry weight basis.

#### 6.4. Bio-fertilizers:

Bio-fertilizers are carrier based microbial inoculants when used through soil inoculation they make available substantial quantity of nutrient to crops at very low cost. By applying bio-fertilizer it may reduce rate of application of N & P fertilizers and optimized the sugarcane yield. Bio-fertilizers are grouped into:

- (i) Nitrogenous Bio-fertilizers: *Azotobacter, Azospirillum,*
- (ii) Phosphorus Solubilizing Microorganism: *Pseudomonas, Bacillus magalerium*
- (iii) Cellulose decomposing micro organism: *Trichoderma viride, Cellulomonas* etc.

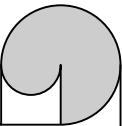
#### 6.5 Nutritional Disorders of Sugarcane:

**Table 17: Nutrient deficiency symptoms and their ameliorative measures:**

| Nitrogen  |   |
|---|---|
|   | <b>Symptoms:</b> <ul style="list-style-type: none"> <li>I. Die back of older leaves.</li> <li>II. Leaf blades turn light green to yellow.</li> <li>III. Short and slender stalks</li> <li>IV. Tips and margins of older leaves become necrotic.</li> </ul> <b>Ameliorative measures:</b><br>Urea 50 kg/ha in soil or foliar spray of 1-1.5% Urea solution |
| Phosphorus  |   |
|  | <b>Symptoms:</b> <ul style="list-style-type: none"> <li>I. Red and purple dis-colouration of tips and margins</li> <li>II. Slender leaves</li> <li>III. Short and slender stalks</li> <li>IV. Poor or no tillering</li> <li>V. Older leaves prematurely die back</li> </ul> <b>Ameliorative measures:</b><br>Di-ammonium Phosphate 106 kg/ha              |
| Potassium   |   |
|  | <b>Symptoms:</b> <ul style="list-style-type: none"> <li>I. Yellow-orange chlorosis of leaf borders &amp; tips,</li> <li>II. Stalks slender,</li> <li>III. Older leaves brown or "fired"</li> <li>IV. Spindles distorted producing "bunched top" or "fan" appearance.</li> </ul> <b>Ameliorative measures:</b><br>MOP 50 kg/ha                             |

|   |   |   |
|---|---|---|
| <b>Calcium</b>  |   |   |
|    |    | <b>Symptoms:</b> <ul style="list-style-type: none"> <li>I. Motalling &amp;chlorosis of older leaves,</li> <li>II. Spindles often become necrotic at the leaf tip and along margins,</li> <li><b>III.</b> Rusty appearance and premature death of older leaves with distorted tips</li> </ul> <b>Ameliorative measures:</b><br>Lime 14.2 kg/ha   |
| <b>Magnesium</b>  |   |   |
|    |   | <b>Symptoms:</b> <ul style="list-style-type: none"> <li>I. Mottled or chlorotic appearance at the tip and margins,</li> <li>II. Red necrotic lesions resulting in "rusty" appearance,</li> <li><b>III.</b> Internal browning of rind</li> </ul> <b>Ameliorative measures:</b><br>Magnesium Sulphat 25kg/ha  |
| <b>Sulphur</b>  |   |   |
|   |   | <b>Symptoms:</b> <ul style="list-style-type: none"> <li>I. Full length mottled chlorotic streaks in young leaves,</li> <li>II. Chlorotic young leaves,</li> <li>III. Narrower and shorter leaves with faint purplish tinge,</li> <li><b>IV.</b> Slender stalks</li> </ul> <b>Ameliorative measures:</b><br>Ammonium Sulphate 165 kg/ha  |
| <b>Boron</b>  |   |   |
|  |  | <b>Symptoms:</b> <ul style="list-style-type: none"> <li>I. Distorted leaves,</li> <li>II. Formation of translucent lesions or water sacks along leaf margins,</li> <li>III. Brittle and bunched with many tillers,</li> <li><b>IV.</b> Death of apical meristem.</li> </ul> <b>Ameliorative measures:</b><br><b>Soil :</b> Sodium Borate Decahydrate 10 kg/ha<br><b>Foliar application:</b> 1 kg borax + 1000 L water /ha |
| <b>Manganese</b>  |   |   |
|  |  | <b>Symptoms:</b> <ul style="list-style-type: none"> <li>I. Occurrence of interveinal chlorosis from leaf tip towards the middle of leaf.</li> <li>II. Bleaching of leaves under severe deficiency.</li> </ul> <b>Ameliorative measures:</b><br><b>Soil :</b> Manganese Sulphate 25 kg/ha<br><b>Foliar application:</b> 5 kg manganese sulphate + 2.5 kg lime in 1000 L of water/ha  |

|  |   |  |
|--|---|--|
| <b>Zinc</b>  |   |  |
|    | <b>Iron</b>   | <p><b>Symptoms:</b></p> <ul style="list-style-type: none"> <li>I. Green and yellowing of leaf blade<br/>Red lesions on leaves,</li> <li>II. Reduced tillering and shorter internodes,</li> <li><b>III.</b> Thin stalks with loss of turgidity.</li> </ul> <p><b>Ameliorative measures:</b></p> <p><b>Soil:</b> Zinc Sulphate 25 kg/ha</p> <p><b>Foliar spray:</b> 5 kg zinc sulphate + 2.5 kg lime in 1000 L of water/ha</p> |
|    |   |  |
| <b>Copper</b>  |   |  |
|   |  | <p><b>Symptoms:</b></p> <ul style="list-style-type: none"> <li>I. Green splotches with leaves eventually showing bleaching</li> <li>II. Stalk and meristems lack turgidity</li> <li>III. Reduced internodal length and tillering.</li> </ul> <p><b>Ameliorative measures:</b></p> <p>Copper Suphate Pentahydrate 7.85 kg/ha</p>  |
| <b>Molybdenum</b>  |   |  |
|  |   | <p><b>Symptoms:</b></p> <ul style="list-style-type: none"> <li>I. Short longitudinal chlorotic streaks on the top one-third of the leaf.</li> <li>II. Short and slender stalks<br/>Slow vegetative growth</li> </ul> <p><b>Amelioration :</b></p> <p><b>Soil:</b> Sodium Molybdate 4.2 kg/ha</p> <p><b>Foliar spray:</b> 1 kg Sodium Molybdate + 1000 L water/ha</p>   |



# Chapter 7

## Weed Management, Earthing-Up and Propping

## **WEED MANAGEMENT, EARTHING-UP AND PROPPING**

### **7.1. Weed Management**

Weed infestations can cause anywhere from a 12% to 72% reduction in the yield of sugarcane. The weed problem with sugarcane can be more severe due to the sugarcane's wider row spacing, its slow initial growth, and its increased water and nutrient requirements. Weeds, if not checked removes about 160 kg nitrogen, 24 kg Phosphorus and 203 kg potassium from one hectare of land. Hoeing is the most common practice in all the areas and all types of planting as it not only control the weeds affectively but also promotes tillering. Three hoeing at 30, 60 and 90 days after planting provide adequate weed control. The most problematic weed in north India is *C. rotundus* which was found in all the seasons at all the places. The common weeds reported in the tropical climatic of southern states of India are *Cynodon dactylon*, *Cyperus rotundus*, *Commelina benghalensis*, *Cleome viscosa*, *Coccinia indica*, *Lipida nodiflora*, *Eclipta alba*, *Ipomoea aquatica*, *Trianthema portulacastrum*, *Sporobolus diander* in the acidic soils of north-eastern India where sugarcane is planted as rainfed in March-April with pre-monsoon rains, the weeds emerge in large numbers are *Boerhaavia diffusa L.*, *Ageratum conyzoides*, *Erechthites valerianaifolia*, *Mikania micrantha*, *Colocasia sp.* In addition to the above mentioned weeds in respective areas, there are a few weeds which also parasitise on sugarcane plants such as *Striga sp.* and *Orobanche sp.* Heavy losses in cane yields due to parasitisation by *Striga* and *Orobanche* have been reported from Punjab, Western Uttar Pradesh and Bihar.

**i. Mechanical Method** - The mechanical methods for weed management in sugarcane is by far the most common and effective method. The only negative is that it takes a lot of time. The mechanical method of weed control involves deep ploughing and collecting grass weeds, burying weed seeds deep so they are ineffective, and hand weeding. This is the best way to make sure that you are completely removing the weed problem, but due to its manual steps, it can be a very slow process.

**ii. Cultural Practices-** There are certain practices in the production of sugarcane and other crops that can help you manage weed growth. Some of these practices include proper crop rotations, crop competition, clean cultivation, mulching, and more. By rotating your crops, you help break apart the weeds so that they eventually die off. For

mulching, you can use the trash you get from your sugarcane to help suppress the growth of weeds.

**iii. Chemical Control** — Weed management in sugarcane can be controlled through chemicals or herbicides. These herbicides are sprayed onto the sugarcane crops and are designed to kill off certain types of weeds. When applying herbicides, it is important that you rotate chemical groups and also use more than one method of weed control in sugarcane. This control method must also be monitored so that you can find surviving weeds early in the process

**Herbicides approved for use in sugarcane:** Though a large number of herbicides have been found to be effective for weed management in sugarcane, only a few of them have been approved for use in sugarcane crop by the Central Insecticides Board. The details of the approved herbicides are given in **Table 18**.

**Table 18: Herbicides approved for use in sugarcane**

| Herbicide name  | (Dosage/ha)         | Waiting period before harvest (days) |
|---|---------------------|--------------------------------------|
| 2,4-D Dimethyl Amine salt 58% SL  | 3.5 kg              | -                                    |
| 2,4-D Na salt Technical (having 2,4-D acid 80% w/w) (Earlier Registered as 80%WP) | 2.0-2.6 kg          | 300                                  |
| 2,4-D Ethyl Ester 38 % EC(having 2,4-D acid 34% w/w)                              | 1.2 to 1.8 kg       | 300 - 330                            |
| Diuron 80% WP   | 1.6-3.2 kg          | -                                    |
| Metsulfuron Methyl 20% WP (Add non -ionic surfactant 0.2%v/v)                     | 6 g                 | 346                                  |
| Hexazinone 13.2% + Diuron 46.8 % WP   | 1200 g<br>(264+936) | 282-306                              |
| Sulfentrazone 39.6% w/w SC  | 720 g               | 306                                  |
| Sulfentrazone 28% + Clomazone 30% WP  | 700+750 g           | 302                                  |
| Clomazone 50% EC  | 750-1000 g          | 296                                  |
| Halosulfuron Methyl 75% WG  | 60-60.7 g           | 294                                  |

## **7.2. EARTHING-UP**

Earthing-up operation is generally followed in the tropical states where furrow irrigation is common. In tropical region, earthing up operation is done in two stages. The first earthing-up is known as ‘partial earthing-up’ and the second operation is ‘full earthing-up’. The partial earthing-up is done after first top-dressing essentially to cover the fertilizers. This practice could be carried out either by manual labour or by using a tractor/bullock drawn implement. While doing partial earthing-up, the furrow in which cane row is present gets partially filled. Irrigation continues to be given in the partially filled up furrow. Full earthing-up is done after the final manuring, i.e. at 90-100 days. During full earthing up, the soil from the ridges is completely removed and placed near the cane on both the sides. This operation converts the furrow into ridges and ridges into furrows.

The furrows thus formed are used for irrigation. Earthing up suppresses weeds and provides adequate support to the stalks and discourages the emergence of late shoots, which leads to poor juice quality. In some places one more earthing up is also done around six months when a stable cane population has been established. This is helpful to prevent lodging, minimize soil erosion and to prevent late shoot or water shoot formation. Wet earthing- up is also practiced in certain areas. This is usually done when the crop is about 6 months old. The furrows are irrigated and the wet soil removed from the furrow is plastered on the ridges. This gives a firm support to the canes against lodging and also effectively checks late shoot formation. Heavy and high earthing-up is useful especially during floods to drain the excess water quickly. The earthing-up operations also help in covering the fertilizers applied and promote better root system development and anchorage.

## **7.3. PROPPING:**

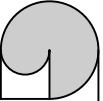
With good growth of cane achieved and height exceeding 2.5 m the possibility of cane lodging is considerably enhanced. To provide support different techniques of propping are in vogue.

**7.3.1. Binding of clumps:** It is common in sub-tropical India. The clumps are tied up by its lower dry leaves. (a) Single clumps are tied up in the early stage of cane growth i.e. about 150 to 180 cm (b) Two or more clumps are tied together in the later stages of growth.

**7.3.2. Trash- twisting method:** It is mostly prevalent in the tropical India. In this method the dried and partially dried lower leaves on stalks are twisted together into two trash ropes which are then tied criss-cross around the clumps, more leaves being collected from successive clumps and twisted into ropes.

Trash twisting may be done as follows:

- Single-row trash-twisting is done in early monsoon period.
- Trash-twisting of two adjacent rows is done in the later stages of growth
- In case the growth is very luxuriant as in the region of east coast, trash twisting is done in two or three tiers as per requirement of the crop, This is also useful in minimizing the damage due to cyclonic winds.



## Chapter 8

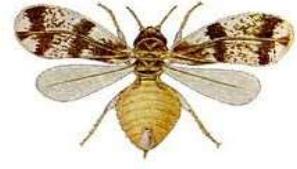
# Plant Protection

## PLANT PROTECTION

Sugarcane is vulnerable to several insects pest and diseases at all the stages of crop growth both in tropical and sub tropical region of the country. A conservative state of losses due to diseases on total sugarcane produce ranges from 10-15 % under endemic conditions. The setts transmissible diseases cause maximum damage to the crop both in term of yield and juice quality.

**Table 19: Insect-pests and Diseases**

| S. N.                  | Insect-pest  | Subtropical states                | Tropical states  |   |
|------------------------|--|-----------------------------------|--|---|
| <b>a. Insect-pests</b> |  |                                   |  |   |
| 1                      | Shoot borer<br>( <i>Chilo infuscatellus</i><br>Snellen)          | All the states                    | All the states   |    |
| 2                      | Top borer<br>( <i>Scirpophaga excerptalis</i> )                  | Major pest                        |  |   |
| 3                      | Internode borer<br>( <i>Chilo sacchariphagus indicus kapur</i> ) | U.P., Bihar,<br>Haryana           | Maharashtra,<br>Gujarat, A.P.,<br>Karnataka, Tamil<br>Nadu, Kerala | <br><small>Internode borer (<i>Chilo sacchariphagus indicus</i>)</small> |
| 4                      | Stalk borer<br>( <i>Chilo auricilius</i><br>Dudgeon)             | U.P., Bihar,<br>Haryana, Punjab   | Major pest of<br>Odisha  |    |
| 5                      | Gurdaspur borer<br>( <i>Acigona steniellus</i><br>Hampson)       | Serious pest in all<br>the states | -  | <br><small>Bark bug</small>  |

|    |  |  |   |   |
|----|--|--|---|---|
| 6  | White grub<br>- <i>Holotrichia consanguinea</i> Blanch<br>- <i>Holotrichia serrata</i> F.<br>- <i>H. insularis</i> Brenske<br>- <i>H. robustus</i> Arrow<br>- <i>Leucopholis lepidophora</i> Brum. | All the states<br>U.P.<br>Rajasthan<br>Eastern U.P. and Bihar<br>- | A.P., Tamil Nadu and Karnataka, Maharashtra and Karnataka |    |
| 7  | Black bug ( <i>Macropes Cavelerius</i> ) excavates Dist.)  | Western U.P., Haryana, & Punjab                                    | -   |    |
| 8  | Scale insect ( <i>Melanaspis glomerata</i> Green)  | U.P., Bihar, Haryana, Punjab                                       | Maharashtra, Gujarat, A.P., Karnataka                     |    |
| 9  | Pyrilla ( <i>Pyrilla perpusilla</i> Walker)  | U.P., Bihar, Haryana, Punjab, Delhi and M.P.                       | Maharashtra, Gujarat, & Orissa (it is on the increase)    |   |
| 10 | Termites   | All the states   | All the states  |  |
| 11 | White flies<br>- <i>Aleurolobus barodensis</i> Mask<br>- <i>Neomaskellia bergii</i> Sign.<br>- <i>N. andropogonis</i>  | Bihar, Haryana, Punjab<br>Bihar and U.P.<br>-                      | Gujarat, A.P. and Tamil Nadu<br>-<br>-                    |  |
| 12 | Root borer ( <i>Emmalocera depressella</i> Swinhoe)  | All the states   | Maharashtra, Northern Gujarat, A.P. & Karnataka           |  |
| 13 | Mites ( <i>Oligonychus (Paratetranychus) indicus</i> Hirst. and <i>Schizotetranychus andropogoni</i> Hirst.)   | -  | Sometimes serious infestations have been reported.        |  |

| <b>b. Diseases</b> |  |   |  |
|--------------------|--|---|--|
| S. N.              | Pathogen   | Subtropical states  | Tropical states  |
| 1                  | Red rot<br>( <i>Colletotrichum falcatum</i> )  | U.P., Bihar,<br>Haryana, Punjab<br>(particularly<br>rampant in eastern<br>U.P. and Bihar) | Odisha, A.P. and Coastal Tamil<br>Nadu   |
| 2                  | Smut ( <i>Ustilago scitaminea</i><br>Sydow)  | All the states  | More prevalent in A.P.,<br>Maharashtra, Karnataka and TN   |
| 3                  | Wilt ( <i>Cephalosporium</i><br><i>sacchari</i> Butler or/and<br><i>Fusarium moniliforme</i> ) | Serious disease in<br>U.P., Bihar and<br>Punjab   | Serious disease in Gujarat &<br>Tamil Nadu   |
| 4                  | Pineapple disease<br>( <i>Ceratocystis paradoxa</i> )  | Punjab  | Maharashtra, Karnataka, Tamil<br>Nadu and Kerala (elicits more<br>damage in Adsali planted crop) |
| 5                  | Leaf spot (Yellow spot,<br><i>Cercospora koepkei</i> )   | -   | Karnataka (in 1976, it was in<br>epidemic form in Mandya)  |
| 6                  | Ratoon stunting disease (RSD)  | U.P.  | Incidence is lower   |
| 7                  | Leaf scald ( <i>Xanthomonas</i><br><i>albilineans</i> (Ashby) Dowson)                          | Wide spread in<br>U.P. and Punjab   | -  |
| 8                  | Gummosis ( <i>Xanthomonas</i><br><i>compestris p.v. vasculorum</i> )                           | Not reported  | Tamil Nadu   |
| 9                  | Grassy shoot disease (GSD)   | Most of the states  | Most of the states; incidence is<br>higher in Maharashtra  |
| 10                 | Sugarcane mosaic virus<br>(SCMV)   | Most of the states  | Most of the states   |

Nb: The problem of insect-pests and diseases is relatively more in the ratoon crops. (Source: Agnihotri, 1990;  
Sundara, 1988)

## 8.1. Important sugarcane diseases & their prevalence in India

### A. Fungal Diseases

**Red Rot** (*Colletotrichem falcatum*)-Uttar Pradesh, Bihar, Punjab, Haryana, Andhra Pradesh, Tamil Nadu, Rajasthan, Madhya Pradesh, Kerala, Odisha, Gujarat, Nagaland, Assam, Goa & Pondecherry.

**Wilt** (*Fusarium moniliforme*) Uttar Pradesh, Bihar, Punjab, Haryana, Andhra Pradesh, Tamil Nadu, Maharashtra & Gujarat.

**Smut** (*Ustilogo scitaminea*) All sugarcane growing area.

### B. Bacterial Diseases:

**Leaf Scald** (*Xanthomonas albilineans*) Uttar Pradesh, Bihar, Punjab, Haryana, Andhra Pradesh, Tamil Nadu & Maharashtra.

**Ratoon Stunting Disease** (*Clavibacter xyli*) Uttar Pradesh, Bihar, Punjab, Haryana, Tamil Nadu & Karnataka.

### C. Mycoplasmal and Viral Diseases

Grassy Shoot Disease (MLO)- Maharashtra, Punjab, Uttar Pradesh, Haryana, Bihar, West Bengal, Madhya Pradesh, Andhra Pradesh, Karnataka & Tamil Nadu.

**Table 20: Important Diseases of Sugarcane, their symptoms & Management**

| Sl. No. | Name of disease | Causal agent                   | Symptoms  | Disease management.   |
|---------|-----------------|--------------------------------|---|---|
| 1       | Red rot         | <i>Glomerella tucumanensis</i> | The spindle leaves (3 <sup>rd</sup> /4 <sup>th</sup> ) display drying. At a later stage, stalks become discoloured and hollow. Acervuli (black fruiting bodies) develop on rind and nodes. After splitting open the diseased stalk, a sour smell emanates. The internal tissues are reddened with intermingled transverse white spots. In advanced stage of the disease, the colour becomes earthy brown with pith cavity in the centre showing white cottony hyphae and sometimes fruiting bodies of fungus (acervuli). In rainy season, the disease spreads so fast that whole crop dries and not a single millable cane is obtained. | <ul style="list-style-type: none"> <li>i) Resistant or moderately resistant varieties should be used.</li> <li>ii) Any sett showing reddening at the cut ends or at the nodal region should be discarded.</li> <li>iii) Healthy seed should be planted. Such seed must be produced from crop raised from heat treatment of seed canes in moist hot air at 54°C for 2.5 hour at 99% humidity.</li> <li>iv) As soon as disease' is noticed, the affected clump along with root system should be uprooted and burnt.</li> <li>v) Bunding of affected field should be done to avoid movement of rain or floodwater. Ratooning of diseased crop should be avoided.</li> <li>vi) Diseased crop should be harvested at early as possible.</li> </ul> |

|   |              |                                |   |   |
|---|--------------|--------------------------------|---|---|
|   |              |                                |   | vii) Crop rotation should be followed in affected fields.   |
| 2 | Smut         | <i>Ustilago scitaminea</i>     | The new sprouts are lean and lanky, profuse in number and the growing point projects out a long black whip covered with black spores. Affected plants have slender and thin canes with erect and pointed leaves. Such plants can be easily located before the production of smut whip.                                | i) Resistant or moderately resistant varieties should be used.<br>ii) Healthy seed (as mentioned under red rot) should be planted.<br>iii) Pre-treatment of seed pieces by dipping in 2.5% organomercurial fungicide helps reduce the incidence.<br>iv) Removal of affected clump showing smut whip during tillering phase effectively reduced the disease incidence. |
| 3 | Wilt         | <i>Cephalosporium sacchari</i> | Wilt symptoms usually appear after monsoon. Infected clumps, individually or collectively, show stunting and yellowing of top leaves. In severe cases, whole clump dries, cane becomes hollow and lighter in weight. Red discolouration in internodes is more intense towards nodes which do not emit specific odour. | i) Healthy seed (as mentioned under red rot) should be planted.<br>ii) Seed setts may be treated with Bavisitin @ 0.2% before planting.<br>iii) Crop rotation should be followed in affected field.<br>iv) Application of Organic manure along with Trichoderma.  |
| 4 | Grassy shoot | Mycoplasma like organism (MLO) | A large number lean and lanky, pale sprouts in the clump appear like a 'bunchy grass'. Normal stalks are not formed.  | i) Resistant or moderately resistant varieties should be planted.<br>ii) Healthy seed (as mentioned under red rot) should be used.<br>iii) Hot water treatment for 52oC for 2 hours.<br>Vector (Aphid) should be  |

|   |                          |                               |  | control by spraying insecticide.  |
|---|--------------------------|-------------------------------|--|---|
| 5 | Mosaic                   | Sugarcane Mosaic Virus (SCMV) | Young leaves of the crown held against the light source display chlorotic and normal green area imparting mosaic pattern. The chlorotic area may show reddening or necrosis. Leaf sheath may also display such symptoms.   | i) Seed should be obtained from disease free plant crop.<br>ii) Secondary transmission of the disease by insect vectors can be controlled by application of insecticides. |
| 6 | Pokkah boeng/<br>Top rot | Fusarium spp                  | The pokkah boeng phase of the disease exhibits characteristics twisted top in affected canes with different types of leaf malformation.<br><br>In severe disease condition, the top rot phase occurs which is characterized by rotting of growing points/the spindle leaves.   | Spraying of 0.2% Bavistin or 0.2% Blitox 50 or 0.2% Copper oxychloride.   |
| 7 | Yellow leaf disease      | Sugarcane yellow leaf virus   | The symptoms appears initially on matured leaves in maturing plant. On the leaves it appears as yellowish midrib on the lower surface. The yellowing may be confined to midrib region or the yellow discolouration of midrib may spread laterally to adjoining laminar region parallel to midrib upto a distance of 2.0 cm. Reddish to pinkish | There is no effective control measure for this disease.   |

|   |      |                      |  |   |
|---|------|----------------------|--|---|
|   |      |                      | discolouration of midrib and laminar region is also noticed in certain varieties. The meristem culture technique is most widely used method for virus elimination in meristematic tissue of apical shoots. |   |
| 8 | Rust | <i>Melanocephala</i> |  | Spray the crop with Propineb @0.25% and Mancozeb @ 0.20% thrice at 15 days interval |

**8.2. Insect Pest:** Sugarcane is infested by about 288 insects of which nearly two dozen causes heavy losses to the quality as well as quantity of the crop. The scenario of insect pests and diseases varies in sub-tropical and tropical belt of sugarcane. Top borer and stalk borer are found pre-dominantly in sub-tropical areas whereas internodes borer and early shoot borer and among disease rust & eye spot are prevalent in tropical region. The extent of losses due to different insect & pests in India. Management of insect pests of sugarcane is given in **Table 21**.

**Table 21: Important Insect pests of Sugarcane, their nature of damage & Management**

| Sl. No. | Name of Insect pests | Scientific name                    | Nature of damage  | Insect pest management   |
|---------|----------------------|------------------------------------|---|--|
| 1       | Shoot borer          | <i>Chilo infuscatellus</i> Snellen | <ul style="list-style-type: none"> <li>Damage caused by caterpillar by boring into cane stalk laterally by one or more holes, move upward and downwards and cutting off the central leaf spindly which dries up and forms dead heart. The central unfurled leaf gets rotten. The dead heart is pulled out easily and</li> </ul> | Application of Chlorpyriphos 20 EC @ 1.0 Kg a. i. per ha in 1600 litres of water over cane setts.<br>If the infestation persist, drenching in the month of April with Chlorendaniliprol (Coragen 16.5 SC) 323 ml in 800 liters of water.<br>Release egg parasite <i>T.</i> |

|   |                 |  |  |   |
|---|-----------------|--|--|---|
|   |                 |  | <p>sensed offensive smell.</p> <ul style="list-style-type: none"> <li>The infestation is high during premonsoon period from April to June.</li> <li>High temperature and low to moderate humidity is conducive for its development</li> </ul>  | <p><i>chilonis</i> adult at 50,000 and larval parasite <i>Cotesia plevips</i> 500 gravid females per ha at 7 days interval during March to April</p>  |
| 2 | Root borer      | <i>Polyocha depressella</i> Swinhoe      | <ul style="list-style-type: none"> <li>The larvae infest young as well as mature canes.</li> <li>The damage is very peculiar because caterpillars enter at the stalk from soil surface by making one entry hole. The larvae do not move upward but remained coincide with the base.</li> <li>The dead hearts are formed by root borer in germination or tiller phase and dead heart can be differentiated with other borer's dead hearts. The dead heart do not emit any smell and pull easily as in the case of shoot borer.</li> </ul> | <p>Application of Chlorpyriphos 20 EC @ 5 litre per ha over cane setts at the time of planting.</p> <p>Drenching Imidacloprid 200 SL @ 100 g a.i. (450 ml) per ha in 1600 litres of water or Quinolphos 25 E (6 litre) or Chlorpyriphos 20 EC @ 1.5 kg a.i. (7.5 litre ) per ha in 1000 litres of water ha during mid of August.</p>  |
| 3 | Internode borer | <i>Chilo Sacchariphaga indicus</i> Kapur | <p>The newly hatched larvae feed on leaf sheath by scrapping which are visible in the form of white streaks on leaf opening. Later the larvae bore into tender cane top. The borer feeds on inner tissue and frass is pushed out to exterior. He damage nodes get hardened thus become hard to crush.</p>  | <ul style="list-style-type: none"> <li>Remove dried leaves of cane at 5<sup>th</sup>, 6<sup>th</sup> &amp; 9<sup>th</sup> month.</li> <li>Use nitrogen as per recommended dose.</li> <li>Spraying of Quinolphos 25 E @ 2 litre per ha in 1000 litres of water at the time when crop 6 month old.</li> <li>Release <i>Trichogramma chilonis</i> @ 50000 parasitized eggs per ha. at 10 days intervals during July to October and larval parasite <i>Cotesia plevips</i> 500 gravid females per ha at 7 days interval during</li> </ul> |

|   |             |                                       |   |  |
|---|-------------|---------------------------------------|---|--|
|   |             |                                       |   | July to November.  |
| 4 | Stalk borer | <i>Chilo auricillus</i> Dugden        | The creamy white eggs are laid on under surface of leaves in 2-3 rows, parallel to mid rib. The larvae soon after hatching wander for sometime on leaf surface and move downward to central whorl where they feed by scrapping the leaf sheath. Longitudinal orange yellow streaks are observed from tip to base on the both side of the mid rib. The third instar larvae bore into shoots and internodes of the canes and feed on soft tissues, thus, reduces the quantity and quality of canes.   | Same as for internode borer  |
| 5 | Top borer   | <i>Scirpophaga excerptalis</i> Walker | In sub-tropical region, this is the most serious pest as it infests crop at all the stages of growth.<br><br>The newly hatched larvae enter the spindle through midrib of the leaves. The tunneling in mid rib causes white streak which turns reddish brown. The larva reaches central core of the spindle makes several cuts in unfurled leaves in spindle and the cuts become visible in the form of shot holes on open leaves. The larva feeds by boring into the narrow central core towards growing point, it also nibbles the inner half of the leaf surrounding the feeding zone. The damaged leaf dries up and forms 'dead hearts' when the mature larva cuts the growing point. The dead hearts thus formed can't | <ul style="list-style-type: none"> <li>• Soil application of 3 G Carbofuran @ 1 Kg a. i. 33 kg against third brood of the pest</li> <li>• Drenching with Chlorendraniliprol (Coragen 16.5 SC) 375 ml in 1000 liters of water.</li> <li>• Release <i>Teliomus sp.</i> Or <i>Trichogramma japonicum</i> @ 50000 parasitized eggs per ha at 10 days interval usually from July to October.</li> </ul> |

|   |              |  |  |   |
|---|--------------|--|--|---|
|   |              |  | easily be pulled out. When central shoot has been damaged, side shoots develop and produce which is known as 'Bunchy Top'. A bored tiller can be easily identified with a reddish brown, charred and sometimes curved dead-hearts besides leaves having shot holes and galleries in the midrib of leaves indicating downward movement of larva to the growing point.   |   |
| 6 | Pyrilla      | <i>Pyrilla perpusilla</i><br>Walker      | Nymph and adult are sucking the sap from the under surface of leaves near midrib resulting into yellowing of the crop. The hopper excretes a sweet fluid (honey dew) that falls on upper surface of lower leaves. Honey dew invites black sooty mould ( <i>Capnodium</i> sp.) that results hindrance in photosynthesis   | <ul style="list-style-type: none"> <li>• Spray the crop with Quinolphos 25 EC 1-2 litre per ha in 500 litres of water.</li> <li>• Release 4000-5000 viable cocoons or 4-5 lakh eggs of <i>Epiricania</i> parasites per ha.</li> </ul>                                 |
| 7 | Wooly Aphids | <i>Ceratovacuna lanigera</i><br>Zehntner | The leaves of the infested plants look white due to white woolly coating of the insects. Both nymphs and adults suck the sap from the leaves which adversely affect the sugar recovery. The aphids also secrete honey dew on which sooty mould fungus develops which hinders the photosynthesis activity of the plant. The white molted skin of the aphids and white powdery secretions fall on the ground and lower leaves giving an appearance of white chalk powder coating on the ground and leaves. | <ul style="list-style-type: none"> <li>• Spray Imidacloprid 17.8 SL @ 500-600 ml per ha in 1000 litres of water.</li> <li>• Release larva of <i>Dipha aphidivora</i> @ 1000 per ha in 10-15 days interval or <i>Micromus igorotus</i> grubs @ 2000 per ha.</li> </ul> |

|    |               |  |   |  |
|----|---------------|--|---|--|
| 8  | White flies   | <i>Aleurolobus barodensis</i> Mask           | The leaves of affected plants turn yellowish and later on dry up. During heavy infestation black sooty mould develops on leaves causing hindrance in the photosynthesis. The damage caused by the pest results into retardation in plant growth besides reducing the sugar content in the canes | <ul style="list-style-type: none"> <li>Spray Imidacloprid 17.8 SL @ 500-600 ml per ha in 1000 litres of water.</li> </ul>  |
| 9  | Scale insects | <i>Melanspis glomerata</i> Green             | The pest is prevalent in tropical belt of our country .The scales are grayish black in colour.<br>They infest the cane in large numbers under the leaf sheath in nodal region. A thick encrustation gets deposited on the internodes, the canes shrivel up and growth is stunted.               | <ul style="list-style-type: none"> <li>Soaking of setts in 0.1 percent Dimethoate for 15 minutes.</li> <li>Release of <i>Chilocorus nigrita</i> @ 1500 adult beetles per ha at the first appearance of the pest.</li> </ul>  |
| 10 | White grub    | <i>Holotrichia consanguinea</i> a Blanch     | The grubs feed on roots of sugarcane but adult beetle feed on foliage of trees like <i>Ber</i> , <i>Neem</i> , <i>Sheeshum</i> etc. Plants wilt and gradually dry up due to feeding of grubs on roots. The canes in affected clumps fall down.  | <ul style="list-style-type: none"> <li>Hand collection of adult beetles and grubs.</li> <li>Mass trapping killing of beetles with IISR Light trap onset of monsoon.</li> <li>Spraying with contact and stomach insecticide such as Monocrotophos (0.05%) in June and July.</li> <li>Soil application of Fipronol 40% = Imadacloprid 40% WG 437.5 to 500 g formulation per ha.</li> </ul> |
| 11 | Thrips        | <i>Stenchaetothrips saccharicidus</i> (Ramk) | The nymphs rasp the upper surface of leaves and suck the oozing sap as a result leave tips are rolled.  | <ul style="list-style-type: none"> <li>Spray Imidacloprid 17.8 SL @ 125 ml per ha in 600 litres of water.</li> </ul>   |
| 12 | Mealy bug     | <i>Sacchari coccus sacchari</i> Cockerell    | The oval and flattened nymphs stick in wax over the nodal region  | <ul style="list-style-type: none"> <li>Spray Monocrotophos 36 SL 1.5 litre per ha in 800-1000 litres of water.</li> </ul>  |

|    |             |                                       |   |   |
|----|-------------|---------------------------------------|---|---|
| 13 | White flies | <i>Aleurolobus barodensis</i><br>Mask | The leaves of affected plants turn yellowish and later on dry up. During heavy infestation black sooty mould develops on leaves causing hindrance in the photosynthesis. The damage caused by the pest results into retardation in plant growth besides reducing the sugar content in the canes | <ul style="list-style-type: none"> <li>• Spray Imidacloprid 17.8 SL @ 500-600 ml per ha in 1000 litres of water.</li> </ul> |
|----|-------------|---------------------------------------|---|---|

## Chapter 9

# Sugarcane Ripening, Harvesting and Post Harvest Management

## SUGARCANE RIPENING, HARVESTING AND POST HARVEST MANAGEMENT

### 9.1. RIPENING

The maturity of sugarcane is generally recognized by the gradual withering of lower leaves and presence of fewer green leaves on the top. The sugarcane when enters the ripening phase its growth retard and formation of new leaves almost seizes. The synthesized sucrose is stored in the cytoplasm vacuoles in the parenchymatus cells in the stem. The changes has been use to guide the stage of maturity. The various factors such as variety, climate, age of shoot, fertilization, moisture stress during formative phase affect the ripening.

### 9.2. HARVESTING:

To ensure maximum yield of sugarcane and ultimately sugar from the crop, it could be necessary to have selective harvesting to achieve higher sugar recovery, which naturally increases sugar production per unit area. Cut stalks at the ground level preferably at least 3-5 cm above the ground level. The dried leaves are stripped off upto the top most mature internode. The harvested cane should always be crush quickly.

**Table 22: Harvesting schedule for high sugar- recovery from sugarcane**

| October  | November           | December           | January            | February                              | March                                 | April             |
|--|--------------------|--------------------|--------------------|---------------------------------------|---------------------------------------|-------------------|
| <b>For subtropical region</b>                        |                    |                    |                    |                                       |                                       |                   |
| Ratoon II of A                                       | Plant of A         | Ratoon II of SE    | Ratoon I of SE     | Ratoon I of SML                       | Plant of SML                          | Plant of SML      |
| Ratoon I of A  | Ratoon II of SE    | Ratoon I of SE     | Ratoon II of SML   | Plant of SE                           | Plant of SE                           | Plant of SML      |
| <b>For tropical region (excluding coastal areas)</b> |                    |                    |                    |                                       |                                       |                   |
| Ratoon of October                                    | Plant of October   | Plant of November  | Ratoon of December | Ratoon of January                     | Ratoon of February                    | -                 |
| Plant of October                                     | Ratoon of November | Ratoon of December | Plant of December  | Plant of January<br>Plant of December | Plant of February<br>Plant of January | Plant of February |

### **9.3. POST HARVEST MANAGEMENT**

Due care need to be taken after harvesting to reduce the losses occurred due to late supply of cane to the factory. Canes carries mud, roots and sheath bites etc lowers the recovery so cleaning of cane need to be followed. Highly immature top portion of cane should be removed. The problem of decrease sugar recovery due to deterioration of cane cause by laps of time between harvesting and crushing is of vital importance in the sugar industry. Deterioration of cut cane starts immediately after harvesting. However, not much harm is caused if the cane is crushed within 24 hour after harvesting. Staling beyond 24 hours resulted in considerable losses in cane weight due to moisture losses and reduction in juice sucrose due to inversion. To minimize the post harvest deterioration following measures to be adopted:

- Selection of varieties less prone to post harvest deterioration.
- Harvesting of over mature and immature canes should be avoided.
- Storage the harvested canes in shaded places in small heaps covered with trash and frequently sprinkled with water to keep the cover moist.

#### **9.3.1. Ratoon Management in Sugarcane**

Ratooning is a method where the lower parts of the plants along with the roots are left uncut at the time of harvesting. It is the most commonly followed and important practice in sugarcane cultivation. In ratoon crops, there is a saving in cost of cultivation in terms of land preparation, seed canes, etc. If ratoons are well maintained, they give high yields. But, for a better ratoon crop, a better plant crop is necessary. Within a week after harvesting the plant crop, ratoon management practices like stubble shaving, off barring, gap filling etc., should be initiated.

##### **9.3.1.1. Stubble shaving**

- The stubbles just above ground level should be cut using a very sharp blade.
- This helps the healthy underground buds to sprout and establish a deeper root system.

- The deeper root system thus obtained facilitates optimum utilization of the nutrients and moisture available in the lower soil layers and provides good support for growth of the ratoon crop.

#### **9.3.1.2. Off barring**

- It is an operation wherein the ridges are broken or cut on either side using a plough.
- This will loosen the soil to develop better root system and thereby better absorption of nutrients and water.

#### **9.3.1.3 Gap filling**

- If there are no cane clumps for a distance of more than 60 cms or so, it can be considered as a gap.
- Clumps with excess sprouting can be uprooted, cut into quarters and planted in the gaps.
- Gap filling can be done using the seedlings raised in the nursery.

#### **9.3.1.4. Row thinning**

In areas where close spaced plantings are followed, entire canes of alternate rows can be removed. This can be done by ploughing along the sides of the alternate ridges selected for removal of the cane rows. This will break or loosen the ridges and facilitate easy lifting and removal of the plants. While removing the canes, gap filling in the adjacent rows can be done. This practice of removing alternate rows of canes will increase the space between the rows and thus facilitate sprouting of more tillers because of optimum utilization of the available nutrients and sunlight.

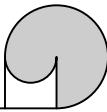
#### **9.3.1.5. Fertilizer application**

- Entire dose of phosphorous, one-third each of nitrogen and potassium as recommended for plant crops can also be applied to ratoon crops. The suggested dose should be applied soon after stubble shaving and off barring, and covered with soil.

- The remaining dose of nitrogen and potassium can be top dressed in equal splits around 30th and 60th days.

Besides the above mentioned practices, all the other crop management practices like irrigation, weeding and earthing-up should be continued and followed as done for plant crops. Ratoon crops mature one month prior to the plant crops. In the conventional method of sugarcane cultivation, ratoon crops are maintained for only a maximum of two seasons but farmers practicing SSI methods maybe able to achieve 5 to 6 ratoon crops.

**9.3.1.6. Ratoon management device (RMD):** It is the device which is very useful for ratoon management is developed by IISR, Lucknow. It works as stubble shaving, sub-soiler and ridge making etc. The RMD can do harrowing, weeding, dispensing FYM, pesticides, fungicides, fertilizer and earthing-up in a single pass. About 1 ha ratoon field can be worked in 4-5 hrs.



## Chapter 10

# Mechanization in Sugarcane

## **MECHANIZATION IN SUGARCANE**

Mechanization aims at: **i)** Timeliness of operation, **ii)** Reduced cost of unit operations **iii)** Reduced human drudgery, **iv)** Increasing productivity of other critical inputs such as labour, fertilizer and insecticide *etc.*

Approximately 400 man-days are needed per hectare in sugarcane cultivation. Most of the cultural operations involved in sugarcane production are performed with traditional tools and equipments which result into high cost of cultivation and human drudgery. Mechanization will help in accomplishing cultural operations on time and precise application of critical inputs will ultimately lead to higher level of productivity at reduced cost per unit time, area and input besides removing the human drudgery.

### **10.1. Planting Implements**

The different operations carried out during sugarcane planting are (i) Making of furrow or trench (ii) Sett cutting (iii) Placement of setts in furrows (iv) Fertilizer application in bands on either sides of setts (v) Application of fungicide, termitecide and insecticide solution (vi) Covering and pressing of setts. The various machineries and planters involved in sugarcane planting are discussed here.

#### **10.1.1. Deep furrow sugarcane cutter planter**

Deep furrow sugarcane cutter planter is a multitasking machine, which performs all the unit operations involved in sugarcane planting including sett cutting, in single pass of the machine. It facilitates planting of sugarcane in deep furrow (20-25 cm) and maintains 5-7 cm loose soil bed underneath the planted seed setts. Cost of equipment Rs. 1.00 lakh.



**Picture: 7**

#### 10.1.2. Sugarcane trench planter

Planting of sugarcane in deep and wide trenches under wide spaced paired row geometry (30:120 cm) has shown promising results on cane yield, water saving, reduced lodging and better ratooning. In order to reap the benefit of trench method of planting, tractor operated trencher and trench planter were developed at IISR. While trencher performs opening of deep and wide furrow for paired row planting of sugarcane manually whereas, trench planter performs all the unit operations involved in cane planting including sett cutting, like earlier developed sugarcane cutter planters, in single pass of the machine. Cost of equipment Rs. 1.00 lakh.



**Picture: 8**

### **10.1.3. Pit digger for mechanizing ring-pit method of sugarcane planting**

The ring pit planting technique is very good from the point of view of increased cane productivity but digging of large number of pits over the entire field was found to be very cumbersome and labour intensive. Therefore, the technique could not be pushed up for large scale adoption by the 60 farmers. Efforts were made at IISR to develop tractor drawn pit digger for mechanization of pit digging operation. The developed pit digger was able to dig one pit at a time. There was a problem of excessive vibrations and dynamic instability during the operation. Design refinements were made and modified prototypes of pit digger was developed. The equipment dig two pits simultaneously at a time. The developed equipment was tested and evaluated in sandy loam soil at IISR farm. With the help of the equipment, approximately 150 pits (75 cm diameter X 30 cm depth) at a spacing of 30 cm were dug per tractor-hour operation. Cost of pit digging operation was saved by 70 per cent by using the pit digger.



**Picture: 9**

### **10.1.4. Planters for mechanizing planting of intercrops with sugarcane**

Two types of machineries have been developed at IISR for intercropping on the raised bed with sugarcane (i) raised bed seeder -cum-fertilizer applicator (RBS) and (ii) raised bed seeder-cum sugarcane planter (RBS cane planter). Recently, sugarcane-cum automatic potato planter, deep furrow sugarcane cutter planter-cum-multicrop bed seeder, sugarcane trench planter-cum-multicrop bed seeder have also been developed for planting/sowing of intercrop simultaneously with sugarcane.

| <b>Raised bed seeder</b>   |
|--|
|  <ul style="list-style-type: none"> <li>• Performs opening of three furrows and making of two raised beds and sowing of three rows of seeds of companion crop like wheat, pulses etc on each raised bed simultaneously in a single pass.</li> <li>• Source of power: 30 hp tractor or more</li> <li>• Output: 0.35-0.40 ha/h</li> <li>• Unit cost: 40,000/-</li> <li>• Saving in cost of operation: 20% as compared to conventional method</li> </ul> |

**Picture: 10**

| <b>IISR Raised Bed Seeder-cum- Sugarcane Planter</b>   |
|--|
|  <ul style="list-style-type: none"> <li>• Planting of two rows of sugarcane in furrows and Sowing of two rows of seeds of companion crop like wheat, pulses etc on the raised beds simultaneously in a single pass of the machinery.</li> <li>• Source of power: 45 hp tractor or more</li> <li>• Output: 0.20 ha/h</li> <li>• Unit cost: 1,20,000/-</li> <li>• Saving in cost of operation: 60% as compared to conventional method</li> </ul> |

**Picture: 11**

| <b>IISR Sugarcane-cum-potato planter</b>   |
|--|
|  <ul style="list-style-type: none"> <li>• Planting of two rows of sugarcane in furrows and two rows of potato on ridges simultaneously in a single pass of the machinery.</li> <li>• Source of power: 45 hp tractor or more</li> <li>• Output: 0.20 ha/h</li> <li>• Labour requirement: 4 or 5</li> <li>• Unit cost: 1,20,000/-</li> <li>• Saving in cost of operation: 60% as compared to conventional method</li> </ul> |

**Picture: 12**

## 10.2. Inter-culturing operations

About 4-5 inter-culture operations are quite common in sugarcane and each operation, if carried out manually, requires 25-30 man-days/ha. During early stage of crop growth (up to 50 cm of crop height), intercultural operations can easily be mechanized by using conventional 9-tine cultivators, engine operated walking type rotary weeders and tractor operated rotary weeders. These equipments are commercially available. Performance of sweep shovels in place of reversible shovels has shown better results in terms of weeding efficiency. Sweep shovels completely cover the spacing and no weed is left in the covered space. A tractor operated inter-culturing equipment with sweep shovels for conventional as well as wide spaced paired row planted cane crops has been developed at IISR. It covers 0.50 ha/h. Of late, tractor operated sugarcane manager has also been developed which performs inter-culturing as well as band application of fertilizer near to root zone of cane crop. Effective field capacity of this machine is 0.40 ha/h.



Picture: 13

## 10.3. Ratoon management

About more than 50 per cent of the total sugarcane area is occupied by ratoon crop in India. It is an integral part of sugarcane cultivation being a profitable proposition. Raising ratoon crop of sugarcane has economic benefits not only for cutting down the cost of land preparation, seed material and cost of planting, but also ensure an economically high recovery in the initial phase of the crushing season because of early maturity than the plant cane. In the tropical part 3-5 ratoon is quite common, but in sub-tropical India, farmers generally take only 1-2 ratoon crop. Keeping a good ratoon crop is always a problem and it is often less cared for. On an

average yield of conventionally grown sugarcane, ratoon crop is lower than the sugarcane plant crop. Investigations reveal the fact that the productivity of sugarcane ratoon crop could be improved by applying crop inputs orderly in time and by executing cultural operations like i) shaving stubbles close to the ground surface, ii) off-barring or cutting old roots on either side of the stubbles, iii) interculturing, iv) applying fertilizer, insecticide or pesticides. These operations are not only difficult and arduous but also far too uneconomical to be carried over by using conventional tools like spades, cultivators, ridgers etc. Concerted efforts have been made at IISR and prototypes were developed to undertake most of the cultural operations simultaneously in a single pass.

#### **10.3.1. Ratoon management device (RMD)**

Equipment namely ratoon management device (RMD) was developed at IISR. The equipment performs all the recommended cultural operations viz., stubble shaving, off-barring & deep tilling, fertilizer, manure and chemical application, interculturing & soil-covering in its single pass. It consisted of units namely stubble shaving, off-barring including old root pruning, Manure, fertilizer, liquid chemical dispensing and earthing up units for performing all recommended cultural operations independently or in a single pass of the tractor. It is a two row tractor mounted type equipment that requires a minimum of 35 hp to execute operations in field. The performance of the equipment was satisfactory and output of equipment was 0.25 ha/h.



**Picture: 14**

### **10.3.2. Disc type ratoon management device (Disc RMD)**

Disc type ratoon management device (Disc RMD) was developed at IISR for performing cultural operations in ratoon field even having surface trash. It was equipped with stubble shaving serrated blades mounted on a disc, two tillage discs for off-barring (pruning of old roots) on either side of the stubbles and application of fertiliser near to root zone. The effective field capacity of the equipment was 0.28 ha/h.

|   |  |
|---|--|
|  | <ul style="list-style-type: none"><li>• Stubble shaving, Off barring, Fertilizer application simultaneously</li><li>• Could be operated in trash field also</li><li>• Out put: 0.30 ha/h</li><li>• Cost: Rs 1,20,000</li></ul> |
|---|--|

**Picture: 15**

### **10.4. Sugarcane harvesting**

Development of sugarcane harvester to mechanize the operation has also been made in India. Attempts have been made at IISR, Vasantdada Sugar Institute (VSI), Pune and to some extent at Tamil Nadu Agricultural University (TNAU), Coimbatore to develop tractor operated whole stalk harvester to partially mechanize the harvesting operation. The harvesters were intended to cut the cane stalks and windrow it. The other operations such as de-topping, removal of dry trash, bundle making and loading were to be performed manually. These harvesters are yet not available for commercial exploitation. Power operated de-trasher was developed at IISR and Punjab Agricultural University (PAU) for de-topping and de-trashing of harvested sugarcane stalks. Few self propelled whole stalk harvesters were also imported by few sugar mills. These machines were capable of performing topping of green top in addition to cutting and windrowing. Removal of trash, making of bundles and its loading for transportation to be performed manually. These harvesters could not be popularized due to some constraints in their working. Of late, commercially available self propelled billet harvesters have been introduced at 62 sugar mills of Tamil Nadu, Karnataka, Maharashtra, Andhra Pradesh, Madhya Pradesh for mechanizing sugarcane harvesting. These are cut and load type of harvesters and harvested cane is

simultaneously loaded in transport vehicles for supply to sugar mill for its processing. Being a high cost machine, self propelled billet harvesters needed to be managed efficiently and effectively in order to achieve cost efficiency in sugarcane harvesting and transportation system.

- Whole cane harvesters
  - Tractor Operated -linear windrowing (Carrib, IISR)
  - transverse windrowing (Cameco)



**Picture: 16**

Self propelled- Hansen



**Picture: 17** Self propelled- Hansen Self propelled billet harvesters  
(CNH, John Deere, Sakthiman)



**Picture: 18**



**Picture: 19**

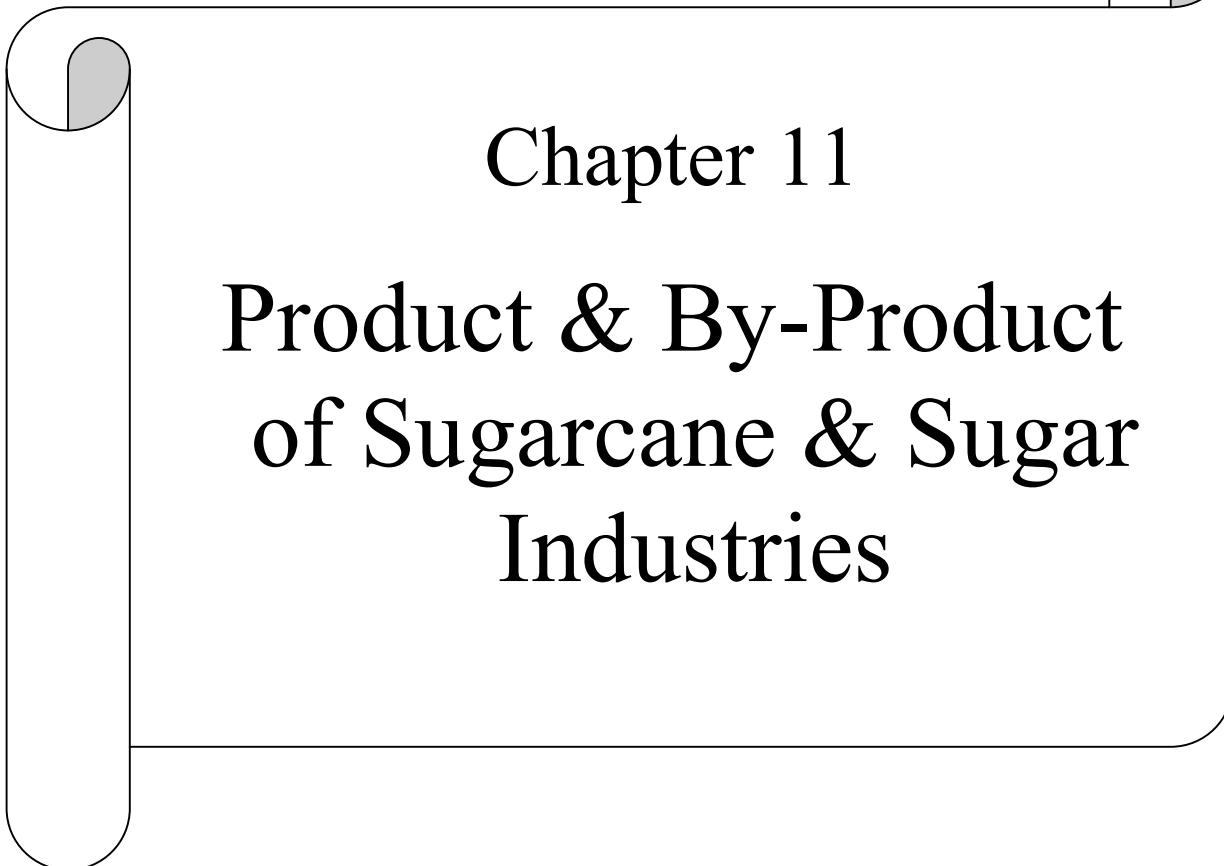
### 10.5. Trash management

In the present scenario where manual harvesting is in vogue, handling of trash is another area requiring attention of the researchers. Research conducted has indicated that application of vinasse and filter cake to the residues, promotes decomposition of the dry matter so that resulting compost can be harrowed into the soil within 30 days. Nutrients derived from the trash may include 32 kg N/ha, 6 kg P<sub>2</sub>O<sub>5</sub>/ha and 30 kg K<sub>2</sub>O/ha. Plant residue shredder has been developed at IISR for trash shredding in the field. The equipment is mounted with the tractor and is operated by PTO shaft. The system picks up trash, passes it on to the chopping unit where trash is chopped into small bits. Provision has also been made for applying chemical/ other substances for quick decomposition of

trash. Proper management of trash helps in its effective use either as a mulch to conserve soil moisture and improving the soil health by adding organic content of the soil due to its decomposition.



**Picture: 20** Trash Shredder



# Chapter 11

## Product & By-Product of Sugarcane & Sugar Industries

## **PRODUCTS AND BY-PRODUCTS OF SUGARCANE AND SUGAR INDUSTRIES**

Sugarcane based Sugar industry is one of the largest and most important industry in tropical and sub tropical countries of the world and Indian Sugar industry has emerged as the leader in the Sugar world, both in respect of sugarcane and sugar production. Sugarcane crop is multi use, multi-product operation. The Sugarcane plant offers a huge potential, not only as the sucrose of a very important food but also as a source of energy and valuable commercial products from fermentation and chemical synthesis. Sugarcane processing is focused on the production of cane sugar from sugarcane. The scientist and technologist realized the value of Sugarcane, its by-products and co-products. today Sugarcane is considered as one of the best converters of solar energy into biomass and Sugar. Sugarcane is a versatile crop as it is a rich source of food (Sucrose, jaggery and syrups), fibre (cellulose, fodder (green top, bagasse, molasses) fuel and chemicals (Bagasse molasses & alcohol). During the process of sugar production from sugarcane several by products are formed, the main by product of cane sugar industry are Bagasse, Molasses and Press mud. The other co products and by products of less commercial value are Green leaves, green tops, trash, Boiler ash and effluents generated by sugar industry and distillery. There are many other industries which are based on sugarcane by diversification and utilization of co products and by products of the sugar industry, instead of merely depending on production of sugar. Thus the effort should be for integral utilization of sugarcane, its co-products and by products to produce many value added products so that the higher value of product are manufactured from them and the sugar industry derives maximum benefits from sugarcane crop has become imperative ultimately sustaining the sugar industry as well as sugarcane cultivation.

### **11.2. Bagasse based industries:**

Bagasse is a fibrous residue left over after the sugarcane is crushed in the milling plant of the sugar factories for extracting its juice. Bagasse consists of water, fibre and relative small quantity of soluble solids. The fibre content of bagasse (cellulose) is responsible for its use in very cellulosic industries like pulp plant, paper plant, particle boards industries, co generation unit using bagasse as a fuel, cattle feed from bagasse, cultivation of edible mushroom on bagasse, production of furfural from bagasse etc.

### **11.3. Molasses based industries:**

Molasses is another important by product of the sugar industry. It is the mother liquor left over after the crystallization of sucrose from which further quantity of sucrose can not be recovered economically. The yield of molasses per tonne of cane is influenced by many factors and may vary within a range of 2.2- 3.7%. Molasses contains about 30-35% of sugar and 15-20% of reducing sugar (Glucose and fructose) thus the total sugar content of molasses is 45-55%. It is by virtue of its total sugar content the molasses is a valuable raw material for the production of many value added products. The main products that can be produced from molasses on commercial scale are (i) Distillery (ii) Acetic Acid plant (iii) Fuel Alcohol plant (iv) Bio gas from effluent treatment plant (v) Cattle feed (vi) Ethyl Alcohol (vii) Bakers yeast (viii) Lactic Acid (ix) Citric Acid (x) Glycerol (xi) Butanol- Acetone (xii) Monosodium Glutamate (xiii) Ephedrine Hydrochloride as Pharmaceutical use etc.

### **11.4. Ethanol Production**

Ethanol produced from molasses, a byproduct of sugar industry is an alternative fuel to meet our growing transportation energy needs. From one tonne of sugarcane, mill can produce 115 kg sugar (at 11.5% recovery) and 45 kg molasses (18 kg TFS) that gives 10.8 litres ethanol.

The Government of India has initiated several policies to augment the production and use of ethanol during the past decade. The Ministry of Petroleum and Natural Gas issued a notification in September, 2002 for a mandatory blending of 5 per cent in nine major states and Union Territories. The Government of India launched the National Policy on biofuels on December 24, 2009 (MNRE, 2009). The Government of India came out the national policy on Biofuel 2018 to reduce the import dependency on petroleum and natural gas and to move towards renewable clean energy and mitigating climate change. The target has been fixed to 20% ethanol blending with gasoline and 5% biodiesel blending with diesel by 2030. During 2019-20 (Dec-Nov) 170 crores litres of ethanol for blending with petrol was fixed against which 92.50 crores liters has been supplied between 1, Dec., 2019 to 22, June, 2020 achieving 5.09% blending. The

Government of India, targeting an ethanol production and supply target of 300-350 crores litres in 2020-21 to achieve 7.5-8 % blending levels with petrol.

### **11.5. Press mud based industries:**

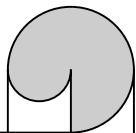
Press mud is soft, spongy, amorphous dark brown material containing sugars, fibre, coagulated colloids which includes wax, albuminoids, inorganic salts. In the process of manufacturing of cane sugar the impurities of cane juice are precipitated either through sulphitation or carbonation process. The amount of filter mud percent cane and its composition varies greatly with the locality, variety of cane, milling efficiency and method of clarification etc. Press mud is a rich source of organic carbon and contains a good proportion of N, P, Ca, Fe & Mn. In early stage the disposal of press mud is posing a problem before the sugar factories not only related to the volume to be handled but also to its polluting effect and an increase in population of insects such as house flies etc. Now as a developmental and technological advancement take place the press mud is largely utilizing as a fertilizer and in the wax and compost industries. Following are the main press mud based industries- Use of press mud as fertilizer, press mud as animal feed, Cane wax from press mud, Bio-gas from press mud, steam generation from press mud cake and use of press mud cake in building materials.

### **11.6. Sugar Industry:**

Before the year 1900 there were no sugar factories in India to produce crystal sugarcane. The first vacuum pan sugar factory for producing crystal sugar from sugarcane was established in Uttar Pradesh in 1903. By 1931-32 there were total 31 sugar factories under operation in India. During 2017-18, 525 sugar factories are operational in India.

- (i) The area, production and yield of sugarcane, factories in operation, duration, capacity, cane crushed, sugar and molasses production and their recovery percent - **Annexure-VI**.
- (ii) Opening stock, production, imports, consumption and export of sugar during last ten years- **Annexure-VII**.
- (iii) Utilization of Sugarcane for different purposes- **Annexure-VIII**.

- (iv) State-wise utilization of Sugarcane for sugar production in major states- **Annexure-IX**
- (v) State-wise cane crushed by sugar factories in India- **Annexure-X**
- (vi) Per capita consumption of sugar, gur and khandsari- **Annexure-XI**
- (vii) State-wise number of sugar factories in operation in India- **Annexure-XII**
- (viii) State-wise duration of crushing season for sugarcane in India- **Annexure-XIII**
- (ix) State-wise sugar recovery percent in India- **Annexure-XIV**
- (x) State-wise and sector-wise installed annual sugar production capacity and utilization of capacity during last 5 years- **Annexure-XV**
- (xi) State-wise sugar production during last 10 years - **Annexure-XVI**
- (xii) Import-Export of sugar from 2001 onwards- **Annexure-XVII**
- (xii) Cane growers Cooperative societies/ Cane Development Commissions in various states- **Annexure-XVIII**
- xiii) State-wise rate of cess/ purchase tax of sugarcane paid by sugar factories- **Annexure-XIX.**



## Chapter 12

# Sugarcane Economics

## SUGARCANE ECONOMICS

### 12.1. The cost of production of sugarcane in the country annually of major Sugarcane growing states:

The Commission on Agricultural Costs and Prices considers the cost of production and other important factors such as demand and supply situation, trends in domestic and international prices, inter-crop price parity, margin for sugarcane growers on account of risk and profits, sugar recovery, price realized from sale of sugar and its by-products, viz., molasses, bagasse and press-mud, terms of trade between agricultural and non-agricultural sectors, the likely impact of Fair and Remunerative Price (FRP) on consumers, producers and overall economy along with rational utilization of land, water, and other production resources, and a minimum of 50 percent as the margin over cost of production, while recommending FRP of sugarcane.

As per the Report on Price Policy for Sugarcane prepared by Commission on Agricultural Costs and Prices (2019-20), cost of cultivation/production of sugarcane in various States of the country is given in **Table 23**.

**Table No 23: Projected cost of production of sugarcane, sugar season 2020-21  
(Rs/qlt.)**

| State          | Costs at State-specific recovery rates |                    |                | Costs at 10 per cent recovery rate |                    |                |
|----------------|--|--------------------|----------------|------------------------------------|--------------------|----------------|
|                | A <sub>2</sub>                         | A <sub>2</sub> +FL | C <sub>2</sub> | A <sub>2</sub>                     | A <sub>2</sub> +FL | C <sub>2</sub> |
| Andhra Pradesh | 168                                    | 190                | 274            | 179                                | 203                | 293            |
| Karnataka      | 113                                    | 138                | 195            | 109                                | 133                | 188            |
| Maharashtra    | 144                                    | 171                | 224            | 134                                | 158                | 208            |
| Tamil nadu     | 157                                    | 187                | 241            | 178                                | 212                | 273            |
| Uttar Pradesh  | 133                                    | 168                | 246            | 125                                | 158                | 231            |
| Uttarakhand    | 104                                    | 130                | 223            | 107                                | 133                | 229            |
| All-India      | <b>135</b>                             | <b>166</b>         | <b>235</b>     | <b>129</b>                         | <b>159</b>         | <b>225</b>     |

**Table No 24: Average Gross Returns of Sugarcane, TE 2017-18**

| State            | Cost A2      | Cost A2+FL   | GVO           | Gross Returns over A2    |                                  | Gross Returns over A2+FL |                                  |
|------------------|--------------|--------------|---------------|--------------------------|----------------------------------|--------------------------|----------------------------------|
|                  | /ha          |              |               | /ha<br>(Col.4-<br>Col.2) | Percent<br>(Col.5/<br>Col.2)*100 | /ha<br>(Col.4-<br>Col.3) | Percent<br>(Col.7/<br>Col.3)*100 |
|                  | (1)          | (2)          | (3)           | (4)                      | (5)                              | (6)                      | (7)                              |
| A.P.             | 106585       | 121246       | 223447        | 116862                   | 110                              | 102201                   | 84                               |
| Karnataka        | 55740        | 67752        | 200126        | 144386                   | 259                              | 132374                   | 195                              |
| Maharashtra      | 116622       | 138353       | 227168        | 110547                   | 95                               | 88815                    | 64                               |
| Tamil Nadu       | 117465       | 139428       | 246078        | 128613                   | 109                              | 106651                   | 76                               |
| Uttar Pradesh    | 48510        | 61679        | 182738        | 134229                   | 277                              | 121059                   | 196                              |
| Uttrakhand       | 42890        | 53626        | 159658        | 116768                   | 272                              | 106031                   | 198                              |
| <b>All-India</b> | <b>71043</b> | <b>86482</b> | <b>199442</b> | <b>128399</b>            | <b>181</b>                       | <b>112960</b>            | <b>131</b>                       |

Source: Price policy for Sugar for the sugar season 2020-21, Commission on Agricultural Costs and Prices, Department of Agriculture, Cooperation and Farmers welfare, Ministry of Agriculture and Farmers Welfare, Govt. of India.

**Table No 25: Sugarcane: Break-up of cost of Cultivation (/ha)**

|                        | Andhra Pradesh |          | Karnataka |         | Maharashtra |          |
|------------------------|----------------|----------|-----------|---------|-------------|----------|
| Cost Items             | 2016-17        | 2017-18  | 2016-17   | 2017-18 | 2016-17     | 2017-18  |
| Operational Cost       | 113011.7       | 129881.4 | 74948.0   | 60374.2 | 103861.4    | 164934.4 |
| Human Labour           |                |          |           |         |             |          |
| Casual                 | 60936.8        | 83576.5  | 26518.1   | 13770.8 | 23620.4     | 42934.8  |
| Attached               | 297.4          | 147.2    | 0.0       | 54.6    | 769.4       | 1282.5   |
| Family                 | 17641.0        | 10210.1  | 13752.2   | 8761.8  | 17578.9     | 22153.4  |
| Total                  | 78875.2        | 93933.8  | 40270.2   | 22587.2 | 41968.7     | 66370.7  |
| Bullock Labour         |                |          |           |         |             |          |
| Hired                  | 2124.2         | 1350.4   | 1136.3    | 1391.7  | 3549.3      | 6405.1   |
| Owned                  | 395.6          | 186.8    | 2655.1    | 1383.5  | 1203.5      | 1914.1   |
| Total                  | 2519.9         | 1537.2   | 3791.4    | 2775.2  | 4752.9      | 8319.2   |
| Machine Labour         |                |          |           |         |             |          |
| Hired                  | 1265.5         | 1858.2   | 446.7     | 4168.3  | 16243.9     | 26071.4  |
| Owned                  | 60.1           | 59.7     | 86.4      | 1532.4  | 603.7       | 1277.2   |
| Total                  | 1325.7         | 1917.9   | 533.2     | 5700.7  | 16847.5     | 27348.6  |
| Seed                   | 9512.2         | 11469.4  | 734.9     | 10252.3 | 3082.4      | 10730.2  |
| Fertilisers and Manure |                |          |           |         |             |          |
| Fertilisers            | 8595.9         | 9267.4   | 15504.7   | 12028.6 | 14554.0     | 19739.7  |
| Manure                 | 1119.4         | 697.0    | 1143.8    | 1174.4  | 1498.3      | 5237.0   |
| Total                  | 9715.3         | 9964.4   | 16648.5   | 13203.0 | 16052.3     | 24976.6  |

|   |          |          |          |          |          |          |
|---|----------|----------|----------|----------|----------|----------|
| Insecticides                                | 1058.7   | 1523.6   | 181.6    | 674.9    | 505.2    | 824.2    |
| Irrigation charges                          | 4394.7   | 1943.3   | 9188.6   | 1862.2   | 15577.0  | 17163.1  |
| Interest on working capital                 | 5610.0   | 7039.5   | 3599.8   | 3036.0   | 5075.4   | 8398.9   |
| Miscellaneous                               | -        | 552.4    | -        | 282.8    | 0.0      | 798.0    |
| Crop Insurance                              | -        | 0.0      | -        | 0.0      | -        | 5.0      |
| Payment to contractor                       | -        | -        | -        | -        | -        | -        |
| Fixed Cost                                  | 68912.0  | 73967.8  | 59662.2  | 54101.5  | 50672.9  | 66772.6  |
| Rental value of owned land                  | 64520.0  | 70383.6  | 53351.7  | 48189.2  | 34326.2  | 46856.2  |
| Rent paid for leased-in land                | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      | 0.0      |
| Land revenue, cesses & taxes                | 0.0      | 0.0      | 14.0     | 7.2      | 351.9    | 34.1     |
| Depreciation on implements & Farm buildings | 428.2    | 324.4    | 373.9    | 547.0    | 1260.0   | 1603.0   |
| Interest on fixed capital                   | 3963.8   | 3259.9   | 5922.6   | 5358.1   | 14734.8  | 18279.3  |
| Total Cost (C2/ha)                          | 181923.7 | 203849.3 | 134610.2 | 114475.7 | 154534.3 | 231707.0 |
| A2+(`/Qtl)                                  | 146.9    | 153.1    | 80.3     | 68.8     | 124.9    | 139.1    |
| C2 (`/Qtl)                                  | 235.8    | 239.7    | 143.5    | 129.3    | 183.1    | 193.5    |
| Yield (Qtl/ha)                              | 763.5    | 850.0    | 931.4    | 869.7    | 808.5    | 1135.4   |

**Table No 26: Sugarcane: Break-up of cost of Cultivation (/ha)**

|                       | <b>Tamil Nadu</b> |                | <b>Uttar Pradesh</b> |                | <b>Uttarakhand</b> |                |
|-----------------------|-------------------|----------------|----------------------|----------------|--------------------|----------------|
| <b>Cost Items</b>     | <b>2016-17</b>    | <b>2017-18</b> | <b>2016-17</b>       | <b>2017-18</b> | <b>2016-17</b>     | <b>2017-18</b> |
| Operational Cost      | 133305.4          | 144348.1       | 50918.3              | 73272.6        | 53063.6            | 55940.7        |
| <b>Human Labour</b>   |                   |                |                      |                |                    |                |
| Casual                | 65771.6           | 59388.9        | 16843.0              | 30310.9        | 20734.7            | 29374.1        |
| Attached              | 2645.0            | 203.5          | 48.3                 | 160.2          | 114.7              | 656.2          |
| Family                | 21336.4           | 23397.5        | 14702.0              | 10611.8        | 13447.8            | 8115.1         |
| <b>Total</b>          | <b>89753.0</b>    | <b>82989.9</b> | <b>31593.3</b>       | <b>41083.0</b> | <b>34297.3</b>     | <b>38145.4</b> |
| <b>Bullock Labour</b> |                   |                |                      |                |                    |                |
| Hired                 | 1279.2            | 1247.5         | 92.9                 | 75.0           | 229.6              | 267.5          |
| Owned                 | 18.9              | 4.5            | 662.7                | 635.4          | 386.4              | 0.0            |
| <b>Total</b>          | <b>1298.1</b>     | <b>1252.0</b>  | <b>755.6</b>         | <b>710.4</b>   | <b>616.0</b>       | <b>267.5</b>   |
| <b>Machine Labour</b> |                   |                |                      |                |                    |                |
| Hired                 | 3848.5            | 3015.0         | 1047.0               | 1840.7         | 525.6              | 70.0           |
| Owned                 | 1115.4            | 193.7          | 316.0                | 1689.7         | 1038.7             | 1827.5         |
| <b>Total</b>          | <b>4963.9</b>     | <b>3208.7</b>  | <b>1363.0</b>        | <b>3530.3</b>  | <b>1564.3</b>      | <b>1897.5</b>  |

|   |                 |                 |                |                 |                 |                 |
|---|-----------------|-----------------|----------------|-----------------|-----------------|-----------------|
| Seed  | 5336.7          | 7888.9          | 4873.7         | 8135.7          | 7117.4          | 6914.4          |
| <b>Fertilisers and Manure</b>               |                 |                 |                |                 |                 |                 |
| Fertilisers                                 | 10074.9         | 12945.3         | 3628.7         | 4243.1          | 2386.2          | 3257.8          |
| Manure                                      | 2770.7          | 3644.8          | 266.8          | 715.3           | 25.0            | 0.0             |
| <b>Total</b>                                | <b>12845.6</b>  | <b>16590.1</b>  | <b>3895.5</b>  | <b>4958.4</b>   | <b>2411.3</b>   | <b>3257.8</b>   |
| Insecticides                                | 839.3           | 1167.2          | 973.2          | 1867.9          | 3.8             | 0.0             |
| Irrigation charges                          | 11682.4         | 13810.2         | 5259.1         | 9299.3          | 4723.3          | 2645.0          |
| Interest on working capital                 | 6586.4          | 7114.7          | 2130.4         | 3685.9          | 2330.3          | 2813.2          |
| Miscellaneous                               | 0.0             | 169.7           | 74.7           | 1.7             | 0.0             | 0.0             |
| Crop Insurance                              | -               | 0.0             | -              | 0.0             | -               | 0.0             |
| Payment to contractor                       | -               | 10156.7         | -              | -               | -               | -               |
| Fixed Cost                                  | 46081.6         | 70504.2         | 47550.7        | 52364.4         | 51876.2         | 57398.1         |
| Rental value of owned land                  | 35237.5         | 46424.2         | 39408.3        | 38756.1         | 45780.9         | 52485.3         |
| Rent paid for leased-in land                | 266.2           | 0.0             | 291.8          | 14.0            | 0.0             | 0.0             |
| Land revenue,cesses & taxes                 | 12.9            | 14.2            | 12.4           | 16.2            | 23.3            | 24.9            |
| Depreciation on implements & Farm buildings | 726.2           | 1418.5          | 1761.1         | 1891.1          | 958.1           | 1121.1          |
| Interest on fixed capital                   | 9838.8          | 22647.2         | 6077.1         | 11687.1         | 5113.9          | 3766.8          |
| <b>Total Cost ( C/ha)</b>                   | <b>179387.0</b> | <b>214852.3</b> | <b>98469.0</b> | <b>125637.0</b> | <b>104939.8</b> | <b>113338.8</b> |
| A,+FL ('/Qtl)                               | 141.5           | 164.2           | 92.6           | 119.1           | 102.2           | 97.4            |
| C,('/Qtl)                                   | 188.9           | 242.1           | 171.9          | 199.1           | 198.7           | 193.3           |
| Yield (Qtl/ha)                              | 933.1           | 872.0           | 548.8          | 602.4           | 494.7           | 557.7           |

## Chapter 13

# Seed Production

## SEED PRODUCTION

A good seed in sugarcane is defined as the setts obtained from a healthy crop. It should be free from pests & diseases and have a good germination of more than 85%. The germination purity of a variety which plays a pivotal role in sugarcane & sugar production per se should be maintained. The use of poor quality seed over years has resulted in varietal degeneration.

### **13.1. Kind of Seed Cane:**

A systematic programme for producing disease-free seed to check the multiplication of diseases is essential. The seed production programme consists of the following three steps commonly referred to as Three-tier seed cane programme.

- I. Breeder Seed** is produced under the direct supervision of the breeder/scientists and crop is raised through heat treated seed at experimental farms/seed cane centers. The breeder seed should conform to highest standard of purity. It is better to produce breeder seed from heat-treated seed material once in three years. Breeder seed can be supplied to sugar mills for taking up primary nursery or it can be distributed to state producing agencies for the production of foundation and certified seed.
- II. Foundation Seed** The foundation seed is generated from breeder seed. This can be produced either in sugar factory farms or seed farms of Agricultural department or in progressive farmer's fields. Inspection and monitoring of crop by competent and qualified personnel is essential so as to maintain purity of variety and freedom from disease and pests. Foundation seed cane production is the responsibility of the research and extension agencies. Foundation seed is harvested at the age of six to eight months and supplied for certified seed production.
- III. Certified Seed** Foundation seed forms the source for the production of certified seed. It is produced in state seed farms or selected progressive farmers fields. As in foundation seed, crop monitoring to maintain varietal purity and freedom from

pests and diseases is necessary. Certified seed is harvested at the age of six to eight months and distributed to farmers for commercial planting.

### **13.2. Seed Certification Standards**

Govt. of India in consultation with Sugarcane Breeding Institute, Coimbatore & Indian Institute of Sugarcane Research, Lucknow formulated Sugarcane Seed Certification Standard as approved by the Technical Committee of Central Seed Certification Board in 2001.

**Seed Standards** Age of the seed cane crop at harvest for seed purpose shall be 6 to 8 months & 8 to 10 months for the sowing in tropical & sub tropical respectively. Seed cane material undamaged & reasonably clean. Each node of cane shall bear one sound bud. The number of nodes without sound bud shall not exceed 5% (by number) of the total number of buds per seed cane. The number of buds, which have swollen up or have projected beyond one centimeter from the rind surface, shall not exceed 5% (by number) of the total number of buds.

#### **13.2.1. Application and Amplification of General Seed Cane Certification Standards**

The General Seed Cane Certification Standards are basic and together with the following specific standards constitute the standards for certification of sugarcane seed cane. The certified classes shall be produced from seed canes and/or meri-clones whose sources and identity may be assured and approved by the Certification Agency.

#### **13.2.2. Land Requirements:**

- i) A seed crop of sugarcane shall not be eligible for certification if planted on land on which sugarcane was grown in the previous season.
- ii) Land/seed crop shall be kept free from sugarcane residues and drainage from other sugarcane fields.

### **3. Heat Treatment:**

**3.1. Moist hot air treatment-** The Moist hot water treatment system was developed by Srivastava *et al* (1979). Full length canes or setts of desired length are loaded inside a

treatment chamber and treated at 54°C for two to three hours. Maintenance of high humidity (above 95%) inside the treatment chamber is essential to avoid desiccation of buds. This system has been said to be effective against many seed borne diseases of sugarcane such as GSD, RSD, smut red rot and leaf scald.

Foundation Stage (1) shall be raised from heat-treatment seed cane.

#### **4. Field Inspection**

A minimum of three inspections shall be made as under:

**Stage-I** The First inspection shall be made at 45-60 days after planting in order to verify isolation and detect volunteer plants, designated diseases and pests & other relevant factors.

**Stage-II** The second inspection shall be made at 120-130 days after planting to verify off-types, designated diseases and pests and other relevant factors.

**Stage-III** The third inspection shall be made 15 days prior to the harvesting of seed canes to verify the age of cane, off-types, designated diseases and pests and other relevant factors.

#### **5. Field Standards:**

##### **A. General Requirements**

**Isolation:** The sugarcane seed production fields shall be isolated from other fields with a minimum distance of 5 m to avoid mechanical mixture of other varieties.

**Table 27. Specific Requirements**

| S.No. | Factors                                    | Stage of field inspection | Maximum permissible limits (%) |                |
|-------|--|---------------------------|--------------------------------|----------------|
|       |  |                           | Foundation                     | Certified      |
| I     | Off-types                                  | 1, II, III                | None                           | None           |
| II    | Plants affected with designated diseases   |                           |                                |                |
|       | Red rot                                    | I,II,III                  | None                           | None           |
|       | Smut                                       | I                         | 0.02*                          | 0.10*          |
|       |  | II                        | 0.01*                          | 0.10*          |
|       |  | III                       | None                           | None           |
|       | Grassy shoot                               | II                        | 0.05*                          | 0.50*          |
|       |  | III                       | None                           | None           |
|       | Wilt                                       | III                       | 0.01*                          | 0.05*          |
| III   | Leaf scald                                 | II                        | 0.01*                          | 0.05*          |
|       |  | III                       | None                           | None           |
|       | Plants affected by designated Insect-pests |                           |                                |                |
|       | Top borer                                  | II & III                  | 5.0                            | 5.0            |
|       | Internode borer                            | III                       | 10.0*<br>None**                | 10.0<br>None** |

|  |  |     |                 |                |
|--|--|-----|-----------------|----------------|
|  | Stalk borer  | III | 20.0+<br>None** | 20.0<br>None** |
|  | Plessey borer,<br>Gurdaspur borer,<br>Scale insect, mealy<br>bug | III | 5.0<br>None**   | 5.0<br>None**  |

\* Subject to immediate rouging of the whole clump

\*\* In areas where the presence of the pest has not been recorded

# It gives around 10% affected buds

+ It gives around 0.5% affected buds.

#### **Designated diseases shall be:**

1. Red rot (*Glomerella tucumanensis* (Speg.) Arx & Muller)
2. Smut (*Ustilago scitaminea* Sydow)
3. Wilt (*Cephalosporium sacchari* Butler)
4. Grassy shoot disease (Mycoplasma-like-organism)
5. Leaf scald (*Xanthomonas albilineans* (Ashby) Dowson

#### **Designated Insect-Pests shall be :**

1. Top borer (*Scirphophaga excerptalis* Wlk.)
2. Internode borer (*Chilo sacchariphagus indicus* Kapur)
3. Stalk borer (*Chilo auricilius* Ddgn.)
4. Plassey borer (*Chilo tumidicostalis* Hmpsn.)
5. Gurdaspur borer (*Acigona steniellus* Hmpsn.)
6. Scale insect (*Melanaspis glomerata* Green)
7. Mealy bug (*Sacchariphagus sacchari* Cockerell)

#### **Note:**

1. All off-types and diseased plants shall be rogued out along with roots and destroyed.
2. Maximum permissible limits for the stripping of dry foliage shall be 2.0%
3. The crop should not have more than 10% lodged canes.
4. Seed canes should not have nodal roots. In water logged areas, relaxation may be given up to a maximum of 5%.
5. Moisture in seed cane should not be less than 65% on wet weight basis.
6. Germinability of buds should not be less than 85%
7. Physical purity of seed should be 98%.
8. Genetic purity of seed should be 100%.

## Chapter 14

# Production Constraints

## PRODUCTION CONSTRAINTS

- Continued mono-cropping of sugarcane for several years leads to nutritional imbalance, decrease in soil organic carbon. About 4.5 to 7.9 % losses in cane yield was reported due to soil degradation. Excess nitrogenization (unbalanced application of N alone) also another concerned in this crop.
  - **Improper nutrient balance-** Micronutrient deficiency particularly Fe, Zn, Mo were reported from Northern Karnataka and parts of Tamil Nadu.
  - **Poor ratoon stands-** Ratoon occupies 50-55% area, farmers not paid much attention on agronomic practices, 10-15 % gaps reduces the crop stand, Although ratoon produce much higher number of tillers, around 65-70% tillers die out and do not contribute to the yield. Insect pests and diseases problems are also higher in ratoon crop.
- 
- **Biotic and Abiotic Stresses**
    - **Drought-** Frequently drought like situations/moisture stress in parts of Maharashtra, Karnataka, Tamil Nadu in past years leads to decline in crop coverage and productivity. Drought stress associated with high day temperature causes poor growth and high tiller mortality particularly during primary growth stage. High temperature has deleterious effects on plant photosynthesis, respiration and reproduction. This warrants the introduction/development of genotypes suitable under this condition.
    - **Flood and Water logging-** Floods also major constraints in states like Uttar Pradesh, Bihar, Odisha, Coastal Andhra Pradesh & parts of Maharashtra where the stagnated water remain in the fields for many days. Water logging affects all stages of crop growth and can reduce germination, root establishment, tillering and growth resulting in reduction in yield. Prolonged water logging deteriorates cane quality.
    - **Pest and diseases-** Due to diseases losses in yield is estimated about 10-15%. The incidence of yellow leaf disease, Pokkah boeng diseases and insect like wooly aphids, root borer, white grub insect pests in many parts of sugarcane growing areas were the major concerned.

**Depleting water resources** - Sugarcane is a water intensive crop. It requires about 30-40 irrigations on an average in tropics. Moderating the water use for sugarcane cultivation is the need of the hour, since water is a limited resource.

- **Climate Change**- Rise in the temperature, decrease or altered rainfall pattern, drought, floods, water logging, increased CO<sub>2</sub> etc. are affecting the sugarcane crop. High temperature is likely to impact plant growth, yield (reduced 20-30%), increase weed competition, increased incidence of pests and diseases and most importantly juice sucrose content vis-à-vis recovery. The sucrose losses in standing crop and after harvest (post harvest) stage are bound to increase due to high temperature
- **Marketing and post harvest constraints**- Bulkiness, non-storability, post harvest deterioration, restricted buyers, government regulations etc.

#### 14.1. Constraints in Important Sugarcane Growing States:

**Table No. 28: State-wise constraints of Sugarcane Cultivation**

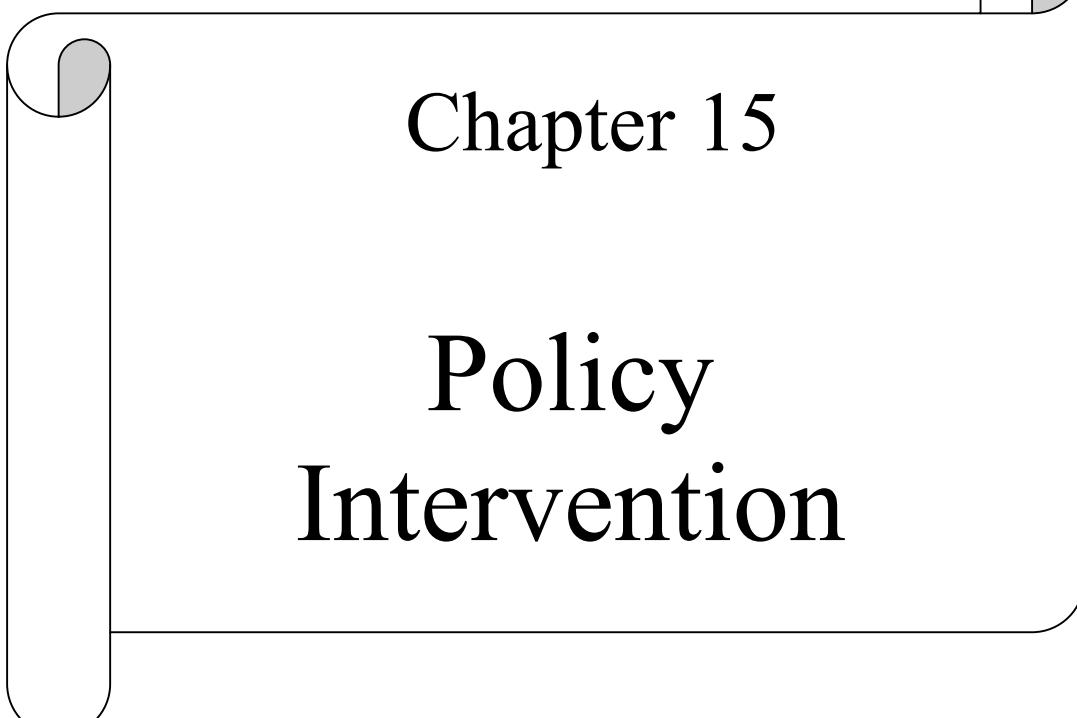
|               |  |
|---------------|--|
| Uttar Pradesh | <ul style="list-style-type: none"> <li>(i) Extreme of climatic conditions; western parts extreme cold to extreme hot, and moving eastwards, climate becomes progressively milder, BSS low during early ripening period.</li> <li>(ii) Saline, Alkaline soils, shallow and excessively permeable soils, water logging, deficiency of micro-nutrients, Zn, Cu, Fe, Mn, low N, P, and medium K, poor in organic carbon.</li> <li>(iii) Drought like conditions from last week of May to 2<sup>nd</sup> week of June.</li> <li>(iv) Recurrent flooding and water logging in eastern U.P.; the flood waters cannot be drained, the problem has aggravated due to canal system; drainage in Central and Eastern U.P.</li> <li>(v) In Western U.P. and Tarai region poor ratoon crops from winter initiated ratoons.</li> <li>(vi) In Western/ Central U.P. depletion of water table due to over exploitation.</li> <li>(vii) Non-availability of labour during peak period</li> <li>(viii) In Western U.P. low temperature during ripening while in eastern</li> </ul> |
|---------------|--|

|                |  |
|----------------|--|
|                | U.P. lack of BSS during ripening.  |
| Bihar          | <ul style="list-style-type: none"> <li>(i) Cultivation is shifting to marginal.</li> <li>(ii) Recurrent flooding and water logging in North Bihar for 3-4 months.</li> <li>(iii) Salinity/ alkalinity induced by water logging.</li> <li>(iv) Lack of knowledge of scientific crop production</li> <li>(v) Occurrence of insect-pests and diseases</li> <li>(vi) Non-availability of processing industries (sugarcane crushing machine)</li> <li>(vii) Inability to purchase modern agricultural implements</li> </ul>   |
| Haryana        | <ul style="list-style-type: none"> <li>(i) Extreme hot during summer and cold during winter; prone to occurrence of frost in winter.</li> <li>(ii) Wind erosion, water erosion, salinity, water logging, brackish ground water, poor drainage in South West part, Zn, Fe deficiency.</li> <li>(iii) Water logging condition in Ambala region.</li> <li>(iv) Low temperature at ripening/ harvesting.</li> <li>(v) Use of hazardous chemicals for pest and disease management</li> <li>(vi) Non-availability of labour during peak period</li> </ul>  |
| Punjab         | <ul style="list-style-type: none"> <li>(i) Extreme hot during summer and cold during winter; prone to occurrence of frost in winter.</li> <li>(ii) Sodic soils, water and wind erosion, coarse texture, leading to high permeability, high bulk density in the sub- surface layer, brackish ground water, dry land area and low inherent soil fertility, deficiency of S, Zn (Central and South Western parts), Fe, Mn, B &amp; Mo.</li> <li>(iii) Water logging condition in south western part.</li> <li>(iv) Low temperature at ripening/ harvesting.</li> <li>(v) Lack of adequate irrigation and bad quality of irrigation water. 63% of ground water is blackish. In 40% of cultivated area, underground water is not fit for irrigation.</li> <li>(vi) Use of hazardous chemicals for pest and disease management</li> <li>(vii) Non-availability of labour during peak period</li> </ul> |
| Madhya Pradesh | <ul style="list-style-type: none"> <li>(i) Salinity/ alkalinity, acid soils (in eastern part) ravines, deficiency</li> </ul>   |

|             |  |
|-------------|--|
|             | <p>of Zn, S &amp; Mn.</p> <ul style="list-style-type: none"> <li>(ii) Drought like condition during summer month. Water scarcity is increasing.</li> <li>(iii) Lack of knowledge about Sugarcane production technology.</li> <li>(iv) Lack of knowledge about use of water and its critical stages of application.</li> <li>(v) Lack of knowledge about spraying of insecticides.</li> <li>(vi) Lack of technical guidance.</li> <li>(vii) Lack of training at village level</li> </ul>  |
| Maharashtra | <ul style="list-style-type: none"> <li>(i) Precipitation has decreased over the last 10 years.</li> <li>(ii) Salinity, alkalinity, water logging, inundation by sea water along west coast, accumulation of salt due to dry, semiarid climate, topographical situation and poor water management.</li> <li>(iii) Water allocated to other crops during growth phase.</li> <li>(iv) Water logging/ improper drainage due to uncontrolled irrigation (in Kolhapur area).</li> <li>(v) Salt stress due to uncontrolled irrigation, Deccan Canal areas.</li> <li>(vi) Deficiency of Fe, Zn and B.</li> <li>(vii) Over stands &amp; low recovery of Adsali crop in Deccan Canal region.</li> <li>(viii) Irrigation water inadequate in Vidarbha and Marathawada region.</li> <li>(ix) Coastal belt not conducive to ripening.</li> <li>(x) Non availability of labour for intercultural operation.</li> <li>(xi) Inadequacy of irrigation water at proper time.</li> <li>(xii) Irregular supply of electricity.</li> <li>(xiii) Payment by factory through installments so it is not profitable.</li> <li>(xiv) Lack of knowledge about use of water and its critical stages of application.</li> <li>(xv) Lack of knowledge about spraying of insecticides.</li> </ul> |
| Gujarat     | <ul style="list-style-type: none"> <li>(i) Salinity, alkalinity, erosion, shallow depth high <math>\text{CaCO}_3</math> poor permeability, poor drainage.</li> <li>(ii) In South Gujarat water logging condition due to improper drainage.</li> <li>(iii) Problem of salt stress in Coastal areas.</li> </ul>  |

|                |  |
|----------------|--|
|                | <ul style="list-style-type: none"> <li>(iv) Deficiency of S, Zn &amp; Fe. In North Gujarat, Kutch, Kheda &amp; Vadodara are affected by residual <math>\text{Na}_2\text{CO}_3</math>.</li> <li>(v) Salt stress occurs in patches alongside natural streams in all the districts of Gujarat which are adjoin to Deccan canal area in Maharashtra.</li> <li>(vi) Coastal belt not conducive to ripening.</li> </ul>  |
| Andhra Pradesh | <ul style="list-style-type: none"> <li>(i) Low organic matter, Deficiency of Fe, Mn, P &amp; Zn, poor drainage, Sulphide injury in some red and black soils of NSP left canal area.</li> <li>(ii) In Godavari and Krishna Deltas Drought condition during growth phase.</li> <li>(iii) Water logging condition in sugarcane field which is surrounded by paddy fields or in coastal areas.</li> <li>(iv) South-East belt not conducive to ripening.</li> <li>(v) Inadequacy of irrigation water at proper time.</li> <li>(vi) Irregular supply of electricity.</li> <li>(vii) Payment by factory through installments so it is not profitable.</li> </ul>  |
| Karnataka      | <ul style="list-style-type: none"> <li>(i) Acidity, salinity, alkalinity and water logging, deficiency of Ca &amp; Mg in southern plain, Maland coast and hill areas. Wide spread Zn, Fe &amp; Mn deficiency.</li> <li>(ii) Water logging/ improper drainage in area coming under major irrigation projects.</li> <li>(iii) Salt stress in area coming under major irrigation projects and Deccan canal area which is attached to Maharashtra state.</li> <li>(iv) Water from Hagari and Don rivers contain high amounts of salts. Well waters of Southern Maidan are also saline.</li> <li>(v) Coastal belt not conducive to ripening.</li> <li>(vi) Non availability of labour for intercultural operation.</li> </ul> |
| Tamil Nadu     | <ul style="list-style-type: none"> <li>(i) Shallow soils, acidity, alkalinity, poor drainage and water logging in Cauvery Delta Area.</li> <li>(ii) There are some dry land areas in the state.</li> <li>(iii) Late growth/ ripening stage in June-July planted crop.</li> <li>(iv) Heavy rainfall, cyclonic storms during flooding at ripening stage;</li> </ul>  |

|  |  |
|--|--|
|  | <p>cane lodge; climatic conditions not favorable for high recovery; water logging condition in sugarcane field which is surrounded by paddy field.</p> <ul style="list-style-type: none"> <li>(v) Salinity has increased in areas using effluents for irrigation.</li> <li>(vi) Deficiency of Cu, Zn, Mn, Fe; N &amp; P low and K medium.</li> <li>(vii) South-east belt not conducive to ripening.</li> <li>(viii) High cost of sugarcane sets at sugarcane seed set plot.</li> <li>(ix) High cost of fertilizers.</li> <li>(x) High cost of pesticides.</li> <li>(xi) Low price given by factory.</li> </ul> |
|--|--|



# Chapter 15

# Policy Intervention

## POLICY INTERVENTIONS

### **15.1. Price Policy: Minimum support price (MSP) including additional incentives (Bonus) on procurement of crop produce from the states:**

The Minimum Support Price or Fair and Remunerative Price (FRP) in sugarcane is declared by Govt. of India every year to protect the benefits of the sugarcane growers keeping in view the inflation of the inputs and other parameters. The State Government also declared State Agreed Price for Sugarcane over the FRP. The minimum statutory price/ fair & remunerative price of sugarcane fixed by the government is given in **Table 29**.

**Table 29: Sugarcane prices in different years**

| Year     | Minimum Statutory price of Sugarcane (Rs. Per quintal) | Linked to basic sugar recovery % cane | Premium on every 0.1% increase in sugar recovery % cane (Rs. Per quintal) | Range of Minimum Sugarcane Price on the basis of Col. 1, 2 & 3 (Rs. Per quintal) |
|----------|--|---------------------------------------|---|--|
| 2000- 01 | 59.50  | 8.50                                  | 0.70  | 59.50 to 96.60   |
| 2001- 02 | 62.05  | 8.50                                  | 0.73  | 62.05 to 100.74  |
| 2002- 03 | 69.50  | 8.50                                  | 0.82  | 69.50 to 113.78  |
| 2003- 04 | 73.00  | 8.50                                  | 0.85  | 73.00 to 118.90  |
| 2004- 05 | 74.50  | 8.50                                  | 0.88  | 74.50 to 110.58  |
| 2005- 06 | 79.50  | 9.00                                  | 0.88  | 79.50 to 112.94  |
| 2006- 07 | 80.25  | 9.00                                  | 0.90  | 80.26 to 119.85  |
| 2007- 08 | 81.18  | 9.00                                  | 0.90  | 81.18 to 118.98  |
| 2008- 09 | 81.18  | 9.00                                  | 0.90  | 81.18 to 123.48  |
| 2009- 10 | 129.84 (FRP)   | 9.50                                  | 1.37  | 129.84 to 179.16   |
| 2010-11  | 139.12(FRP)  | 9.50                                  | 1.46  | 139.12 to 197.52   |
| 2011- 12 | 145.00 (FRP)   | 9.50                                  | 1.53  | 145.00 to 203.14   |
| 2012- 13 | 170.00 (FRP)   | 9.50                                  | 1.79  | 170.00 to 241.60   |
| 2013-14  | 210.00 (FRP)   | 9.50                                  | 2.21  | 210.00 to 302.82   |
| 2014-15  | 220.00 (FRP)   | 9.50                                  | 2.32  | 220.00 to 310.48   |
| 2015-16  | 230.00 (FRP)   | 9.50                                  | 2.42  | 230.00 to 324.38   |
| 2016-17  | 230.00 (FRP)   | 9.50                                  | 2.42  | 230.00 to 321.96   |
| 2017-18  | 255.00 (FRP)   | 9.50                                  | 2.68  | NA   |
| 2018-19  | 275.00 (FRP)   | 10.00                                 | 2.75  | NA   |
| 2019-20  | 275.00(FRP)  | 10.00                                 | 2.75  | NA   |
| 2020-21* | 285.00(FRP)  | 10.00                                 | 2.85  | NA   |

**Source:** Cooperative Sugar, Vol-51, No.6, February, 2020. \*- declared by GoI on 19.08.2020

## **15.2. DEVELOPMENTAL PROGRAMMES**

### **A. Past:**

A Central Sector Scheme (CSS), the Sustainable Development of Sugarcane Based Cropping System (SUBACS) was under implementation from 1995-1996 to 1999-2000 in 191 districts of 20 states and one union territory. Following strategies were undertaken under the scheme:

1. Propagation of improved crop production technologies through organization of field demonstration on farmers holdings and training of farmers including farm women and extension workers.
2. Setting up the Heat Treatment Plant for multiplication of disease free seed and making availability healthy seed material to the farmers.
3. Encouraging the use Integrated Pest Management (IPM) Technology.
4. Introduction of Tissue Culture Technique for quicker multiplication of seed material.
5. Replacement of low-yielding varieties with high yielding varieties having biotic and abiotic resistance.
6. Planting and harvesting of sugarcane use of improved farm implements.
7. Promotion a sense of competition among farmers for maximizing of productivity.

**Table 30: Pattern of Assistance in Sustainable Development of Sugarcane Based Cropping System (SUBACS):**

|   | <b>Components/ interventions</b>   | <b>Unit</b> | <b>Pattern of Assistance</b>                                 |
|---|--|-------------|--|
| 1 | Demonstration of Technology on Sugarcane production  |             |  |
| a | Frontline demonstration through ICAR System  | Ha.         | Rs. 15000/- per demonstration of one hectare (100% GoI)      |
| b | Field demonstration by Govt. on farmers field  | Ha.         | Rs. 5000/- per demonstration of 0.5 hectare (on 75:25 basis) |
| 2 | Transfer of Technology to farmers and extension staff  |             |  |
| a | National Level Training by three leading national Sugarcane institute viz. IISR, Lucknow; SBI, Coimbatore and Vasant Dada Sugar Institute, Pune. | No.         | Rs. 12500/- per training programme (100% GoI)                |
| b | State level training by State  |             | Rs. 12500/- per training                                     |

|    |   |     |  |
|----|---|-----|--|
|    | Government for two days with 30 participants  |     | programme<br>(on 75:25 basis)  |
| c  | Farmers training by state Government  |     | Rs. 5000/- per training programme<br>(on 75:25 basis)  |
| 3  | Implements  |     |  |
| a  | Improved bullock drawn/ manually operated   | No. | @50% of cost limited to Rs. 1500/- per implement per farmer (on 75:25 basis)   |
| b  | Tractor operated (Sugarcane planter, Rotavator etc.)  | No. | @25% of cost limited to Rs. 10000/- per implement per farmer (on 75:25 basis)  |
| 4  | Strengthening of existing tissue culture units of ICAR Research Institute/ SAUs/ NGO units                                  | No. | Rs. 5 Lakh per unit (100% GoI)   |
| 5  | Strengthening of existing bio-pesticides units of ICAR Research Institute/ SAUs/ NGO units                                  | No. | Rs. 5 Lakh per unit (100% GoI)   |
| 6  | Seed Production   |     |  |
| a  | Breeder Seed through ICAR/ SAUs/ NGOs   | Ha. | Rs. 20000/- per hectare (100% GoI)   |
| b  | Multiplication of seed on contract basis by the State Govts.  | Ha. | 10% of the cost of cultivation or Rs. 2000/- per ha. whichever is less (on 75:25 basis)  |
| 7  | Setting up/ Strengthening of heat treatment plant in district/ research station/ KVKs/ Sugar factory/ Taluka Seed Farm etc. |     | Rs. 2 lakh per plant without accessories<br>(on 75:25 basis)   |
| 8  | Productivity award to Sugarcane growers   | No. | Rs. 25000 per award at district level<br>(on 75:25 basis)  |
| 9  | Drip irrigation   |     |  |
| a  | Infrastructure on drip irrigation   | Ha. | 90% of cost subject to the ceiling of Rs. 25000/- per ha. for small and marginal, SC/ST and woman farmers and 70% of cost subject to Rs. 25000 per ha for other farmers (on 75:25 basis) |
| b  | Demonstration on drip irrigation  | Ha. | Rs. 22500 per hectare (on 75:25 basis)   |
| 10 | Transfer of Technology through electronic media, printing of literature, video films, seminars, symposia etc.               |     | 100 % by GoI   |
| 11 | Contingency to State for POL etc.   |     | Rs. 30000/- per districts (75:25 basis)  |

From October 2000, the Crop oriented Centrally Sponsored Scheme was implemented in different States subsumed with Macro Management Mode on Agriculture (**MMMA**) with the approval of Planning Commission. **The pattern of assistance changed to 90:10 between GOI and State Govt.** The main components were same as it was in the SUBACS **with the flexibility to incorporate new components as per the requirement of the state.** The main component of the scheme were: Field demonstration, IPM demonstration, Farmers Training, State level training, Distribution of implements (Manual/tractor drawn), Seed multiplication, MHAT Plant, Drip irrigation infrastructure, Bio-fertilizer distribution, Biological control etc.

**Table 31: Pattern of Assistance in Sugarcane Development Programme under Macro Management Mode:**

| S. No | Components/interventions   | Unit   | Pattern of Assistance   |
|-------|--|--------|---|
| 1     | Demonstration of Technology  | No.    | 0.5 ha. @ Rs. 7500/- per demo.  |
| 2     | Distribution of Farm Implementation  | No.    | a) Bullock/Manual Drawn @ 25% of the cost limited to Rs. 2500/- per unit.<br>b) Tractor/Power drawn @ 25% of the cost limited to Rs.15000/- |
| 3     | Multiplication of Planting Materials (Cane sets)   | Ha.    | a) Foundation nursery @ 10% of the cost limited to Rs.4000/- per ha.<br>b) Primary nursery @ 10% of the cost limited to Rs.2,000/- per ha.  |
| 4     | Training   | No.    | a) Farmers: 50 farmers for 2 days @ Rs.10000/- per training.<br>b) State Level: 30 participants for 3 days @ Rs. 20,000/- per training.     |
| 5     | Setting up of Moist heat treatment units for treatment of planting material by Farmer's Association, Mills | No.    | @ 50% of the cost per plant including generator, limited to Rs. 3,00,000/-.   |
| 6     | Supply of Drip irrigation Infrastructure   | Ha.    | @ 50% of the cost limited to Rs. 30,000/- per ha.   |
| 7     | Setting up/Strengthening up<br>a) Tissue Culture Lab<br>b) Bio Agent Lab by SAU /ICAR Instt., Mills        | No.    | @ 25% of the cost limited to Rs. 10,00,000/- per tissue culture lab or bio agent lab.   |
|       | Monitoring/Inspection/vi sit/ Preparation of   | Distt. | Rs. 50,000/- lump sum per major sugarcane growing district.   |

|  |  |      |  |
|--|--|------|--|
|  | reports, POL etc. as contingency                               |      |  |
|  | Area specific intervention                                     |      | 10% of allocation  |
|  | <b>OTHER COMPONENTS</b>  |      |  |
|  | Assistance for Boring of Tubewells/pumpsets                    | No.  | @25% of cost limited to Rs. 12,000/- per set.                  |
|  | Assistance for distribution of Micro Nutrients                 | Ha.  | @25% of cost limited to Rs. 1000/- per ha.                     |
|  | Distribution of Planting Material and Soil Treatment Chemicals | Ha.  | @25% of cost limited to Rs. 1000/- per ha..                    |
|  | Visit of Farmers to model farms, institutes etc.               | Nos. | 40 sugarcane farmers @ 50% of the cost limited to Rs. 50,000/- |

### B. Present:

- i) **National Food Security Mission-Commercial Crops–Sugarcane:** The Government of India has approved Crop Development Programme -Sugarcane for enhancing the production and productivity under National Food Security Mission- Commercial Crops (NFSM-CC) w.e.f. 2014-15. Under this Scheme thrust has been given on transfer of technology through demonstrations and training in order to extend benefits to the farmers. From, 2015-16, in view of increased devolution to the States on account of implementation of recommendations of 14th Finance Commission, NFSM is being implemented on sharing basis between Government of India and States on 60:40 basis for general category states & 90:10 basis for North East & hilly states. However, the Central Agencies are funded 100% by GOI.

**Table 32: Pattern of Assistance- NFSM-Commercial Crops - Sugarcane:**

| S.N. | Component   | Unit cost   | Implementing agency   |
|------|---|---|---|
| 1    | Demonstration on intercropping and single bud chip technology with Sugarcane. | Rs.9000 per ha<br>(Rs.8000 for inputs & Rs. 1000 for Contingency) | ICAR/SAUs/ KVKS/ NGOs / Cooperatives / State Dept. of Agriculture |
| 2    | Assistance for Breeder Seed Production  | Rs.40000 per ha (Rs. 34000 for inputs & Rs. 6000 for Contingency) | SAUs/ ICAR and Sugarcane Research Institute                       |
| 3    | Production of tissue  | Rs. 3.5 per seedlings   | Sugarcane Institutions,   |

|   |   |   |  |
|---|---|---|--|
|   | culture raised plantlets/ seedlings                       |   | Sugar Factories, NGOs                                |
| 4 | National Level Trainings (25 Participants X 2 days)       | Rs.50000 per training   | ICAR/IISR/SBI/UPCSR                                  |
|   | State level training (20 participants X 2 days)           | Rs.40000 per training   | SDA  |
| 5 | Distribution of plant protection chemicals and Bio agents | Rs 500/ha or 50% of the cost, whichever is less                   | SDA/ICAR   |
| 6 | Local Initiatives   | As per the state specific need limited to 25% of total allocation |  |
| 7 | Contingencies & Electronic Print Media                    | Need Based  | Directorate of Sugarcane Development (DOSD), Lucknow |

ii. **NFMS- Intercropping of Pulses with sugarcane** is under implementation for two years 2018-19 & 2019-20 by Govt. of India and being implemented from Spring season of 2019 in 13 states. Pattern of assistance given in **Table 32**.

**Table 33: Pattern of Assistance- NFMS- Intercropping of Pulses with sugarcane**

| S. No | Name of Component                        | Unit cost          | Implementing agency                 |
|-------|--|--------------------|-------------------------------------|
| 1     | Demonstrations                           | Rs. 9000/ha        | IISR/SBI/State Dept. of Agriculture |
| 2     | Distribution of Seeds                    | Rs. 5000/QtL       | State Dept. of Agriculture          |
| 3     | Distribution of PP Chemicals/ bio-agents | Rs. 500/ha         | State Dept. of Agriculture          |
| 4     | Distribution of bio-fertilizer           | Rs. 300/ha         | State Dept. of Agriculture          |
| 5     | State level training                     | Rs. 40000/training | State Dept. of Agriculture          |
| 6     | National level training                  | Rs. 50000/training | IISR/SBI/DOSD                       |

**Table 34: Financial summary of Implementation-NFSM- Commercial crop- Sugarcane- during: 2019-20**

**As on 31.03.2020 (updated as on 12.06.2020)**

**Rs. in lakh**

| Sl. | State          | Approved Allocation by Ministry |               |                | Unspent balance revalidated (CS) | Release       |               | Total fund available (CS+SS) | Achievements  |               |               | % Achievement over Total Allocation |
|-----|----------------|---------------------------------|---------------|----------------|----------------------------------|---------------|---------------|------------------------------|---------------|---------------|---------------|-------------------------------------|
|     |                | CS                              | SS            | Total          |                                  | (CS)          | (SS)          |                              | CS            | SS            | Total         |                                     |
| 1   | Andhra Pradesh | 18.70                           | 12.47         | 31.17          |                                  | 14.03         | 9.35          | 23.38                        | 14.12         | 9.41          | 23.53         | 75.49                               |
| 2   | Telangana      | 4.96                            | 3.31          | 8.27           | 1.48                             | 2.24          | -             | 3.72                         | 0.77          | 0.51          | 1.28          | 15.48                               |
| 3   | Gujarat        | 15.00                           | 10.00         | 25.00          | 8.77                             | 3.53          | 8.70          | 21.00                        | 13.14         | 8.76          | 21.90         | 87.60                               |
| 4   | Haryana        | 30.26                           | 20.18         | 50.44          | 19.21                            | 3.49          |               | 22.70                        | -             | -             | -             | -                                   |
| 5   | Karnataka      | 45.28                           | 30.18         | 75.46          | 0.44                             | 33.52         | 22.63         | 56.59                        | 30.31         | 20.21         | 50.52         | 66.95                               |
| 6   | MP             | 35.66                           | 23.78         | 59.44          |                                  | 17.96         | 11.97         | 29.93                        | 4.81          | 3.20          | 8.01          | 13.48                               |
| 7   | Maharashtra    | 289.55                          | 193.03        | 482.58         | 162.98                           | 126.56        | 144.77        | 434.31                       | 188.50        | 125.67        | 314.17        | 65.10                               |
| 8   | Tamil Nadu     | 45.54                           | 30.36         | 75.90          | 8.54                             | 25.62         | 17.08         | 51.24                        | 41.56         | 27.71         | 69.27         | 91.26                               |
| 9   | Uttar Pradesh  | 349.35                          | 232.9         | 582.25         | 10.27                            | 251.74        | 174.51        | 436.52                       | 261.76        | 174.51        | 436.27        | 74.93                               |
| 10  | Punjab         | 23.10                           | 15.40         | 38.50          |                                  |               |               |                              | 0.00          | 0.00          | 0.00          | 0.00                                |
| 11  | Uttarakhand    | 44.02                           | 4.89          | 48.91          |                                  | 31.43         |               | 31.43                        | 31.43         | 3.49          | 34.92         | 71.40                               |
| 12  | Bihar          | 128.78                          | 85.85         | 214.63         | 87.80                            | 8.78          |               | 96.58                        | 0.00          | 0.00          | 0.00          | 0.00                                |
| 13  | Odisha         | 33.60                           | 22.40         | 56.00          |                                  |               |               |                              | 0.00          | 0.00          | 0.00          | 0.00                                |
|     | <b>Total</b>   | <b>1063.80</b>                  | <b>684.75</b> | <b>1748.55</b> | <b>299.49</b>                    | <b>518.90</b> | <b>389.01</b> | <b>1207.40</b>               | <b>586.40</b> | <b>373.47</b> | <b>959.87</b> | <b>54.90</b>                        |

**Table No. 35: Component-wise Physical & Financial progress of “NFSM-Commercial crop- Sugarcane” scheme during 2019-20**

**Period of report: 31.03.2020 (updated on 12.06.2020)**

| S.N. | Name of Component  | Rate of Assistance  | Target   |                | Achievement |               | % Achievement |              | Rs. in lakh |
|------|--|---------------------|----------|----------------|-------------|---------------|---------------|--------------|-------------|
|      |  |                     | Physical | Financial      | Physical    | Financial     | Physical      | Financial    |             |
| 1.   | Demonstration on intercropping & single bud chip technology with Sugarcane | Rs. 9000/ha         | 16856.33 | 1517.07        | 12527.11    | 854.90        | 74.32         | 56.35        |             |
| 2.   | Assistance for breeder seed production                                     | Rs. 40000/ ha       | 12       | 4.80           | 5           | 2.00          | 41.67         | 41.67        |             |
| 3.   | Production/ Supply of Tissue Culture plantlets/ Seedlings                  | Rs. 3.5/ Seedlings  | 1204570  | 42.16          | 931068      | 32.59         | 77.29         | 77.30        |             |
| 4.   | Distribution of PP Chemicals/ bio-agents                                   | Rs. 500/ha          | 9839     | 49.20          | 8347        | 28.59         | 84.84         | 58.11        |             |
| 5    | State Level Training   | Rs. 40000/ Training | 128      | 51.20          | 20          | 6.95          | 15.63         | 13.57        |             |
| 6    | Local Initiatives  |                     | 315      | 68.83          | 46          | 19.55         | 14.60         | 28.40        |             |
| 7    | Financial Liability (2018-19)  |                     |          | 15.29          |             | 15.29         |               | 100.00       |             |
|      | <b>Total</b>   |                     |          | <b>1748.55</b> |             | <b>959.87</b> |               | <b>54.90</b> |             |

**Table No. 36: Financial summary of Implementation-NFSM- Commercial crop- Sugarcane- during:  
2018-19**

| Sl.<br>No | State          | Allocation    |               |                | Unspent<br>balance<br>revalidation<br>(CS) | Release<br>(CS) | Total fund<br>available<br>(CS) | Achievements  |               |               | %<br>Achievement<br>over Total<br>Allocation |
|-----------|----------------|---------------|---------------|----------------|--|-----------------|---------------------------------|---------------|---------------|---------------|--|
|           |                | CS            | SS            | Total          |  |                 |                                 | CS            | SS            | Total         |  |
| 1         | Andhra Pradesh | 17.00         | 11.33         | 28.33          | 3.66                                       | 9.09            | 12.75                           | 17.00         | 11.33         | 28.33         | 100.00                                       |
| 2         | Telangana      | 4.51          | 3.01          | 7.52           | 4.05                                       | 0.00            | 4.05                            | 2.57          | 1.71          | 4.28          | 56.91  |
| 3         | Gujarat        | 21.42         | 14.28         | 35.70          |  | 12.96           | 12.96                           | 11.66         | 7.78          | 19.44         | 54.45  |
| 4         | Haryana        | 27.51         | 18.34         | 45.85          |  | 20.63           | 20.63                           | 1.66          | 1.11          | 2.77          | 6.04   |
| 5         | Karnataka      | 41.16         | 27.44         | 68.60          | 2.16                                       | 28.71           | 30.87                           | 30.42         | 20.28         | 50.70         | 73.91  |
| 6         | M,P            | 30.75         | 20.50         | 51.25          | 1.04                                       | 19.59           | 20.63                           | 11.84         | 7.90          | 19.74         | 38.52  |
| 7         | Maharashtra    | 263.23        | 175.49        | 438.72         | 35.16                                      | 162.52          | 197.68                          | 34.70         | 23.14         | 57.84         | 13.18  |
| 8         | Tamil Nadu     | 41.40         | 27.60         | 69.00          | 2.82                                       | 38.58           | 41.40                           | 33.81         | 22.54         | 56.35         | 81.67  |
| 9         | Uttar Pradesh  | 353.33        | 235.55        | 588.88         |  | 264.99          | 264.99                          | 254.72        | 169.81        | 424.53        | 72.09  |
| 10        | Punjab         | 21.00         | 14.00         | 35.00          |  | 0.00            | 0.00                            | 0.00          | 0.00          | 0.00          | 0.00   |
| 11        | Uttarakhand    | 27.51         | 3.06          | 30.57          |  | 13.75           | 13.75                           | 13.75         | 1.53          | 15.28         | 49.98  |
| 12        | Bihar          | 117.07        | 78.05         | 195.12         |  | 87.80           | 87.80                           | 0.00          | 0.00          | 0.00          | 0.00   |
| 13        | Odisha         | 30.522        | 20.348        | 50.87          |  | 22.82           | 22.82                           | 24.07         | 16.05         | 40.12         | 78.87  |
|           | <b>Total</b>   | <b>996.41</b> | <b>649.00</b> | <b>1645.41</b> | <b>48.89</b>                               | <b>681.44</b>   | <b>730.33</b>                   | <b>436.20</b> | <b>283.18</b> | <b>719.38</b> | <b>43.72</b>                                 |

**Table No 37: Component-wise Physical & Financial progress of “NFSM- Commercial crop- Sugarcane” scheme during 2018-19**

**Period of report:** 31.03.2019

| S.<br>No. | Name of Component  | Rate of<br>Assistance  | Target   |                | Achievement |               | Rs. in lakh |              |
|-----------|--|------------------------|----------|----------------|-------------|---------------|-------------|--------------|
|           |  |                        | Physical | Financial      | Physical    | Financial     | Physical    | Financial    |
| 1.        | Demonstration on intercropping & single bud chip technology with Sugarcane | Rs. 9000/ha            | 16083    | 1446.54        | 7952.38     | 620.11        | 49.45       | 42.87        |
| 2.        | Assistance for breeder seed production                                     | Rs. 40000/<br>ha       | 5        | 2.00           | 5           | 2.00          | 100.00      | 100.00       |
| 3.        | Production/ Supply of Tissue Culture plantlets/ Seedlings                  | Rs. 3.5/<br>Seedlings  | 1144285  | 38.69          | 913550      | 31.03         | 79.84       | 80.20        |
| 4.        | Distribution of PP Chemicals/ bio-agents                                   | Rs. 500/ha             | 6979     | 34.90          | 3993        | 19.98         | 57.21       | 57.25        |
| 5         | State Level Training   | Rs. 40000/<br>Training | 99       | 39.60          | 51          | 20.00         | 51.52       | 50.51        |
| 6         | Local Initiatives  |                        |          | 83.68          |             | 26.26         |             | 31.38        |
|           | <b>Total</b>   |                        |          | <b>1645.41</b> |             | <b>719.38</b> |             | <b>43.72</b> |

**Table No 38 : Financial Progress under Implementation of NFSM- Intercropping of Pulses with Sugarcane-during: 2019-20**

As on 31.03.2020

Financial Rs. in lakh

| S.<br>No. | State/<br>Agency  | Allocation     |                |                | Release       |               |               | Achievement  |              |                            |
|-----------|-------------------|----------------|----------------|----------------|---------------|---------------|---------------|--------------|--------------|----------------------------|
|           |                   | CS             | SS             | Total          | CS            | SS            | Total         | CS           | SS           | Total                      |
| 1         | Bihar             | 3.600          | 2.400          | 6.000          | 3.60          |               | 3.60          | 0.00         | 0.00         | 0.00                       |
| 2         | Gujarat           | 8.598          | 5.732          | 14.330         | 8.59          | 5.72          | 14.31         | 6.03         | 4.02         | 10.05                      |
| 3         | Haryana           | 6.762          | 4.508          | 11.270         | 6.76          |               | 6.76          |              |              |                            |
| 4         | Karnataka         | 31.210         | 20.807         | 52.017         | 31.21         | 20.80         | 52.01         | 13.76        | 9.17         | 22.93                      |
| 5         | Madhya<br>Pradesh | 5.268          | 3.512          | 8.780          | 5.26          | 3.51          | 8.77          | 1.22         | 0.81         | 2.03                       |
| 6         | Maharashtra       | 50.068         | 33.378         | 83.446         | 50.06         | 33.38         | 83.44         | 8.66         | 5.78         | 14.44                      |
| 7         | Odisha            | 0.798          | 0.532          | 1.330          | 0.79          |               | 0.79          | 0.79         | 0.52         | 1.31                       |
| 8         | Punjab            | 5.553          | 3.702          | 9.254          | 5.55          |               | 5.55          | 0.00         | 0.00         | 0.00                       |
| 9         | Tamil Nadu        | 5.984          | 3.990          | 9.974          | 5.98          | 3.99          | 9.97          | 5.38         | 3.59         | 8.97                       |
| 10        | Telangana         | 2.234          | 1.489          | 3.724          | 2.23          | 0.00          | 2.23          | 0.00         | 0.00         | 0.00                       |
| 11        | Uttar Pradesh     | 102.688        | 68.458         | 171.146        | 102.68        | 53.94         | 156.62        | 0.00         | 0.00         | 0.00                       |
| 12        | Uttarakhand       | 5.982          | 0.665          | 6.647          | 5.98          |               | 5.98          | 5.98         | 0.66         | 6.64                       |
|           | <b>Total</b>      | <b>228.745</b> | <b>149.173</b> | <b>377.918</b> | <b>228.69</b> | <b>121.34</b> | <b>350.03</b> | <b>41.82</b> | <b>24.55</b> | <b>66.37<br/>(17.56 %)</b> |

**Table No 39: Component-wise Physical & Financial progress of “NFSM- Intercropping of Pulses with Sugarcane” scheme during 2019-20**

**Period of report:** 31.03.2019

| S.<br>No. | Name of Component                           | Rate of<br>Assistance  | Target   |               | Achievement |              | % Achievement |              | <b>Rs. in lakh</b> |
|-----------|---|------------------------|----------|---------------|-------------|--------------|---------------|--------------|--------------------|
|           |   |                        | Physical | Financial     | Physical    | Financial    | Physical      | Financial    |                    |
| 1.        | Distribution of seeds                       | Rs. 5000/QtL           | 6307.50  | 298.60        | 1113.80     | 45.88        | 17.66         | 15.37        |                    |
| 2.        | Distribution of PP<br>Chemicals/ bio-agents | Rs. 500/ ha            | 4539.20  | 22.66         | 1496        | 7.15         | 32.96         | 31.55        |                    |
| 3.        | Distribution of bio-<br>fertilizer          | Rs.300/ ha             | 4620.46  | 13.86         | 1585.33     | 4.63         | 34.31         | 33.41        |                    |
| 4.        | State level training                        | Rs. 40000/<br>training | 107      | 42.80         | 20          | 7.08         | 18.69         | 16.54        |                    |
|           | Others (liability of<br>2018-19 etc.)       |                        |          |               |             | 1.63         |               |              |                    |
|           |   | <b>Total</b>           |          | <b>377.92</b> |             | <b>66.37</b> |               | <b>17.56</b> |                    |

**Table No 40: Financial Progress under Implementation of NFSM- Intercropping of Pulses with Sugarcane- during: 2018-19**

**Period of report:** 31.03.2019

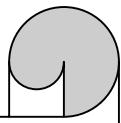
**Financial: Rs. in lakh**

| S.No. | State          | Total Allocation | Fund Released (CS) | Achievement     |              |               | % Achievement over total allocation |
|-------|----------------|------------------|--------------------|-----------------|--------------|---------------|-------------------------------------|
|       |                |                  |                    | CS              | SS           | Total         |                                     |
| 1     | Andhra Pradesh | 22.95            | 13.77              | Not implemented |              |               | 0.00                                |
| 2     | Bihar          | 53.50            | 32.10              | Not implemented |              |               | 0.00                                |
| 3     | Gujarat        | 16.57            | 9.94               | 5.28            | 3.52         | 8.80          | 53.11                               |
| 4     | Haryana        | 30.42            | 18.25              | Not implemented |              |               | 0.00                                |
| 5     | Karnataka      | 90.10            | 54.07              | 47.16           | 31.44        | 78.60         | 87.25                               |
| 6     | Madhya Pradesh | 22.95            | 13.77              | 0.00            | 0.00         | 0.00          | 0.00                                |
| 7     | Odisha         | 3.40             | 2.04               | 2.04            | 1.36         | 3.40          | 100.00                              |
| 8     | Punjab         | 24.49            | 14.70              | Not implemented |              |               | NA                                  |
| 9     | Tamil Nadu     | 26.87            | 16.12              | 13.45           | 8.97         | 22.42         | 83.44                               |
| 10    | Telangana      | 9.29             | 5.57               | Not implemented |              |               | 0.00                                |
| 11    | Uttar Pradesh  | 540.45           | 324.27             | 28.19           | 18.79        | 46.98         | 8.69                                |
| 12    | Uttarakhand    | 21.83            | 19.65              | 19.65           | 2.18         | 21.83         | 100.00                              |
|       | <b>Total</b>   | <b>862.82</b>    | <b>524.24</b>      | <b>115.78</b>   | <b>66.26</b> | <b>182.03</b> | <b>21.10</b>                        |

**Table No 41: Component-wise Physical & Financial progress of “NFSM- Intercropping of Pulses with Sugarcane” scheme during 2018-19**

**Period of report: 31.03.2019**

| S.No. | Name of Component                                       | Rate of Assistance       | Target   |               | Achievement |               | Rs. in lakh |              |
|-------|---|--------------------------|----------|---------------|-------------|---------------|-------------|--------------|
|       |   |                          | Physical | Financial     | Physical    | Financial     | Physical    | Financial    |
| 1.    | Demonstration on intercropping of Pulses with Sugarcane | Rs. 9000/- per ha        | 7712     | 685.45        | 2415        | 155.91        | 31.31       | 20.88        |
| 2.    | Distribution of seeds                                   | Rs. 5000/- per Qtl.      | 2870     | 135.98        | 361.44      | 11.24         | 12.59       | 8.27         |
| 3.    | Distribution of PP Chemicals/ bio-agents                | Rs. 500/- per ha         | 2075     | 10.37         | 1780        | 8.90          | 85.78       | 85.82        |
| 4.    | Distribution of bio-fertilizer:                         | Rs. 300/- per ha.        | 2073     | 6.22          | 302         | 0.90          | 14.57       | 14.47        |
| 5     | State Level Training                                    | Rs. 40000/- per Training | 62       | 24.80         | 13          | 5.08          | 20.97       | 20.48        |
|       | Total   |                          |          | <b>862.82</b> |             | <b>182.03</b> |             | <b>21.10</b> |



## Chapter 16

# Future Strategy

## FUTURE STRATEGY

**16.1. Horizontal Expansion:** Sugarcane is also facing stiff competition from food grains, oilseeds, pulses and other high value crops including vegetables in the share of area due to continuous rise in their prices. In view of these, it may be possible to slowly increase and stabilize area around 5.5 million hectares by 2030.

**16.2. Vertical Expansion:** The projected demand at 2030 will be 600 million tonnes which can be met mainly by increasing the productivity and quality of the crop. The average productivity level needs tremendous boost and it should be around 100-120 tonnes/ha mark by 2030, the best performing varieties with high sugar recovery need to be explored. To meet the targeted white sugar requirement, improvement in sugar recovery to 11.0-11.5 %, also needs attention.

**16.3. Varietal development:** Development of climate resilient sugarcane varieties, resistant to biotic and abiotic stresses, high yield, high biomass, high sugar, multiple stress tolerance, input efficiency and better ratoonability.

**16.4. Reducing the cost of cane cultivation:** By balance use of INM, Water use efficiency through micro-irrigation, Land use efficiency through companion cropping, bio-intensive IPM, IDM and mechanizing sugarcane farming.

**16.5. Promotion of Micro-irrigation for Effective water management:** Sugarcane crop is considered as water guzzling crop, by adopting micro-irrigation, the water quantity will be saved. Drip irrigation system has proved to be a great success in terms of water saving up to 30-41% and increase in the yield by about 20-30 % in sugarcane crop. The state like Maharashtra started adopting micro-irrigation technology – drip system and targeted to cover all sugarcane cultivated are under this system.

**16.6. Diversification and value addition through production of jaggery and allied products:** emphasis should be given on production of diversified products from sugarcane viz. quality jaggery, vinegar to capture elite market and even to explore export market. Enhancement of ethanol blended petrol programme (EBP) to meet the target.

**16.7. Increase of productivity in ratoon-** Good management practices alongwith suitable variety having good ratooning need to be explored. Popularization of Ratoon Management Device (RMD).

**16.8. Intercropping in sugarcane-** Intercropping of pulses, oilseeds, cereals, vegetables with sugarcane need to be promoted to utilize the inter space till the sugarcane crop develop canopy (90-120 days) and to get interim return from the intercrop.

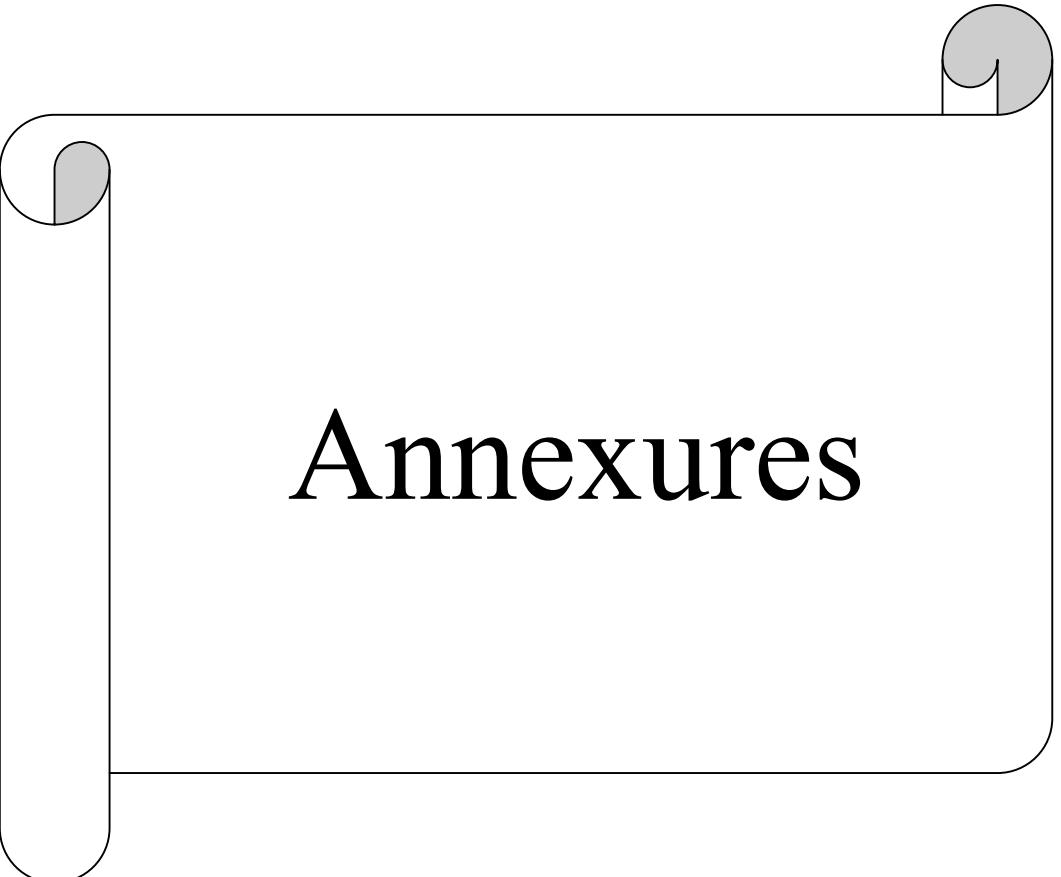
**16.9. Mechanization-** To mitigate labour scarcity and to ensure timely farm operations along with reduction in human drudgery mechanization in sugarcane from planting to harvesting need to be focused.

**16.9.** Diversification of sugar factories into bio-refineries or multi product factories or Agro-business complexes or smart factories producing sugar as per requirement and utilization of by product to other value added products (Cellulose ethanol, surfactants, xylitol & dietary fibres).

**16.10.** Execution of strong seed production programme to supply quality seed to the farmers.

**16.11.** Robust mechanism for sugarcane pricing and ensuring timely payment to the growing farmers.

**16.12.** There is need of full fledge Centrally Sponsored Developmental programme on Sugarcane including the components of FLDs, Seed production, implements, Micro irrigations devices, Training to extension officer, farmers etc.



# Annexures

**State wise Area (000 ha) of Sugarcane from 2009-10 to 2018-19**

**Annexure-I**

| S.No. | STATES/UT         | 2009-10 | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 2014-15 | 2015-16 | 2016-17 | 2017-18 | 2018-19 |
|-------|-------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 1     | Andhra Pradesh    | 158.00  | 152.00  | 159.00  | 155.00  | 152.96  | 139.00  | 122.00  | 103.00  | 99.00   | 102.00  |
| 2     | Arunachal Pradesh | 1.50    | 1.50    | 1.55    | 1.53    | 1.56    | 1.52    | 1.95    | 1.76    | 1.79    | 2.13    |
| 3     | Assam             | 27.10   | 29.70   | 25.73   | 28.87   | 29.08   | 29.90   | 29.46   | 31.38   | 30.56   | 31.20   |
| 4     | Bihar             | 115.90  | 248.00  | 218.29  | 250.34  | 258.07  | 254.34  | 244.02  | 239.57  | 233.77  | 225.57  |
| 5     | Chhattisgarh      | 12.40   | 8.30    | 9.10    | 13.50   | 8.50    | 18.50   | 35.50   | 20.80   | 24.10   | 32.75   |
| 6     | Gujarat           | 154.00  | 190.00  | 202.00  | 176.00  | 174.00  | 208.00  | 157.00  | 169.00  | 182.00  | 154.77  |
| 7     | Goa               | 0.90    | 0.90    | 0.92    | 0.85    | 0.87    | 0.81    | 0.00    | 0.90    | 0.00    | 0.89    |
| 8     | Haryana           | 74.00   | 85.00   | 95.00   | 101.00  | 102.00  | 97.00   | 93.00   | 102.00  | 114.00  | 108.70  |
| 9     | Himachal Pradesh  | 2.20    | 1.70    | 2.06    | 1.88    | 1.54    | 1.63    | 1.94    | 1.73    | 1.87    | 1.70    |
| 10    | Jammu & Kashmir   | 0.00    | 0.02    | 0.02    |         | 0.02    | 1.31    | 0.19    | 0.00    |         |         |
| 11    | Jharkhand         | 6.50    | 6.60    | 6.61    | 6.69    | 6.69    | 6.76    | 10.20   | 7.40    | 8.21    |         |
| 12    | Karnataka         | 337.00  | 423.00  | 430.00  | 425.00  | 420.00  | 480.00  | 450.00  | 397.00  | 370.30  | 471.20  |
| 13    | Kerala            | 3.00    | 2.85    | 2.60    | 1.74    | 2.21    | 1.52    | 1.36    | 1.06    | 1.05    | 1.01    |
| 14    | Madhya Pradesh    | 62.10   | 65.10   | 69.20   | 59.50   | 73.10   | 111.00  | 103.00  | 92.00   | 98.00   | 108.00  |
| 15    | Maharashtra       | 756.00  | 965.00  | 1022.00 | 933.00  | 937.00  | 1030.00 | 987.00  | 633.30  | 902.00  | 1162.80 |
| 16    | Manipur           | 0.60    | 5.20    | 5.75    | 5.50    | 5.85    | 5.85    | 6.00    | 6.00    | 6.00    | 5.45    |
| 17    | Meghalaya         | 0.08    | 0.10    | 0.07    | 0.07    | 0.10    | 0.11    | 0.12    | 0.12    | 0.12    | 0.13    |
| 18    | Mizoram           | 1.40    | 1.40    | 1.41    | 1.32    | 1.42    | 1.47    | 1.54    | 1.59    | 1.56    | 1.46    |
| 19    | Nagaland          | 5.10    | 4.30    | 4.29    | 4.31    | 4.33    | 4.35    | 4.37    | 4.42    | 4.43    | 4.44    |
| 20    | Odisha            | 8.00    | 13.10   | 14.50   | 14.53   | 14.21   | 10.05   | 8.96    | 5.49    | 3.71    | 6.78    |
| 21    | Punjab            | 60.00   | 70.00   | 80.00   | 83.00   | 89.00   | 94.00   | 90.00   | 88.00   | 96.00   | 95.00   |
| 22    | Rajasthan         | 6.00    | 5.50    | 6.42    | 5.50    | 5.26    | 5.57    | 6.14    | 6.85    | 5.43    | 5.37    |
| 23    | Tamil Nadu        | 293.20  | 316.00  | 346.35  | 347.22  | 313.34  | 263.07  | 252.27  | 218.26  | 171.86  | 166.41  |
| 24    | Telangana         |         | 40.00   | 45.00   | 41.00   | 39.04   | 38.00   | 35.00   | 29.00   | 35.00   | 40.00   |
| 25    | Tripura           | 0.88    | 0.90    | 0.92    | 0.90    | 0.96    | 0.00    | 0.79    | 0.82    | 0.81    | 0.66    |

|    |               |                |                |                |                |                |                |                |                |                |                |
|----|---------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| 26 | Uttar Pradesh | 1977.00        | 2125.00        | 2162.00        | 2212.00        | 2228.00        | 2140.80        | 2169.00        | 2160.00        | 2234.00        | 2224.00        |
| 27 | Uttarakhand   | 96.00          | 106.70         | 108.00         | 109.90         | 104.26         | 101.72         | 96.85          | 93.00          | 90.00          | 91.00          |
| 28 | West Bengal   | 13.80          | 15.00          | 16.08          | 16.10          | 17.02          | 17.73          | 17.40          | 21.00          | 19.16          | 15.81          |
| 29 | A & N Islands | 0.10           | 0.20           | 0.17           |                | 0.27           | 0.19           | 0.03           | 0.07           | 0.11           | 0.06           |
| 30 | D & N Havelli |                | NA             | 0.67           | 0.66           | 0.67           | 0.66           | 0.20           | 0.17           | 0.17           | 0.37           |
| 31 | Pondicherry   | 1.80           | 1.77           | 1.95           | 2.03           | 2.02           | 1.92           | 1.82           | 0.00           | 1.45           | 1.44           |
|    | All India     | <b>4174.56</b> | <b>4884.83</b> | <b>5037.66</b> | <b>4998.94</b> | <b>4993.35</b> | <b>5066.78</b> | <b>4927.12</b> | <b>4435.69</b> | <b>4736.45</b> | <b>5061.09</b> |

### State wise Production ( 000 tonnes) of Sugarcane from 2009-10 to 2018-19

| S. No. | STATES/UT         | 2009-10  | 2010-11  | 2011-12  | 2012-13  | 2013-14  | 2014-15  | 2015-16  | 2016-17  | 2017-18  | 2018-19  |
|--------|-------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 1      | Andhra Pradesh    | 11708.00 | 11893.49 | 12842.46 | 11993.00 | 12008.78 | 9987.00  | 9353.00  | 7830.00  | 7789.62  | 8094.62  |
| 2      | Arunachal Pradesh | 27.10    | 29.00    | 30.00    | 30.15    | 30.35    | 29.67    | 40.76    | 37.74    | 38.38    | 45.80    |
| 3      | Assam             | 1059.00  | 1075.02  | 993.46   | 1028.16  | 1075.17  | 1099.13  | 1038.33  | 1207.17  | 1142.97  | 1093.93  |
| 4      | Bihar             | 5032.60  | 12763.60 | 11288.58 | 12741.42 | 12881.78 | 14034.12 | 12649.32 | 13036.00 | 13824.63 | 20116.29 |
| 5      | Chhattisgarh      | 29.20    | 21.80    | 24.40    | 37.30    | 22.10    | 49.30    | 67.80    | 848.00   | 1158.49  | 1452.14  |
| 6      | Gujarat           | 12400.00 | 13760.00 | 12750.00 | 12690.00 | 12550.00 | 14330.00 | 11120.00 | 11950.00 | 12072.06 | 11326.38 |
| 7      | Goa               | 52.30    | 49.10    | 46.58    | 46.01    | 47.67    | 49.22    | 0.00     | 40.22    | 0.00     | 35.31    |
| 8      | Haryana           | 5335.00  | 6042.00  | 6959.00  | 7437.00  | 7499.00  | 7169.00  | 6692.00  | 8223.00  | 9632.89  | 8505.01  |
| 9      | Himachal Pradesh  | 45.60    | 38.30    | 28.25    | 42.01    | 35.69    | 37.57    | 38.72    | 21.05    | 36.73    | 33.32    |
| 10     | Jammu & Kashmir   | 0.00     | 0.03     | 0.03     |          | 0.02     | 1.96     | 0.29     | 0.00     | 0.00     | 0.00     |
| 11     | Jharkhand         | 447.00   | 457.30   | 457.31   | 461.89   | 462.84   | 469.82   | 708.90   | 512.93   | 574.84   | 0.00     |
| 12     | Karnataka         | 30443.00 | 39657.00 | 38808.00 | 35732.00 | 37905.00 | 43776.00 | 37833.75 | 27378.00 | 31135.19 | 42408.00 |
| 13     | Kerala            | 285.00   | 271.84   | 263.03   | 165.72   | 221.52   | 148.53   | 138.13   | 113.13   | 115.11   | 106.30   |
| 14     | Madhya Pradesh    | 2535.00  | 2667.00  | 2677.00  | 2641.88  | 3173.67  | 4567.00  | 5281.00  | 4730.00  | 5430.00  | 5281.74  |
| 15     | Maharashtra       | 64159.00 | 81895.69 | 86733.05 | 69648.08 | 76901.00 | 84698.96 | 73679.55 | 52262.45 | 82984.00 | 89768.16 |
| 16     | Manipur           | 21.30    | 301.31   | 333.00   | 311.69   | 339.31   | 339.31   | 348.00   | 348.00   | 348.00   | 315.07   |

|    |               |           |           |           |           |           |           |           |           |           |           |
|----|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 17 | Meghalaya     | 0.20      | 0.20      | 0.19      | 0.19      | 0.29      | 0.34      | 0.36      | 0.36      | 0.36      | 0.37      |
| 18 | Mizoram       | 12.40     | 7.90      | 7.45      | 6.79      | 6.97      | 44.25     | 51.27     | 50.53     | 44.84     | 44.26     |
| 19 | Nagaland      | 152.90    | 184.90    | 186.67    | 187.57    | 188.46    | 189.33    | 190.20    | 192.39    | 192.75    | 193.18    |
| 20 | Odisha        | 489.90    | 902.70    | 884.71    | 952.37    | 936.51    | 722.89    | 577.16    | 344.30    | 240.05    | 417.80    |
| 21 | Punjab        | 3700.00   | 4170.00   | 5653.00   | 5919.00   | 6675.00   | 7039.00   | 6607.00   | 7152.00   | 8023.68   | 7773.66   |
| 22 | Rajasthan     | 344.50    | 367.90    | 451.28    | 401.81    | 362.88    | 408.86    | 531.27    | 488.65    | 381.87    | 447.95    |
| 23 | Tamil Nadu    | 29745.60  | 34251.80  | 38575.70  | 33919.17  | 32454.14  | 28092.78  | 25494.09  | 18987.56  | 17153.98  | 17140.23  |
| 24 | Telangana     |           | 3070.51   | 3843.45   | 3574.00   | 3376.22   | 3343.00   | 2405.00   | 2061.00   | 2604.46   | 3183.60   |
| 25 | Tripura       | 44.91     | 46.48     | 45.00     | 45.44     | 49.60     | 0.00      | 40.49     | 44.10     | 42.49     | 35.91     |
| 26 | Uttar Pradesh | 117140.00 | 120545.00 | 128819.00 | 132427.68 | 134688.62 | 133061.42 | 145385.00 | 140169.20 | 177033.33 | 179714.77 |
| 27 | Uttarakhand   | 5842.00   | 6497.60   | 6311.00   | 6784.82   | 5939.80   | 6165.07   | 5885.76   | 6477.00   | 6271.38   | 6329.32   |
| 28 | West Bengal   | 1000.80   | 1134.10   | 1681.44   | 1617.03   | 1945.04   | 2105.51   | 2075.00   | 1549.75   | 1437.00   | 1335.37   |
| 29 | A & N Islands | 2.00      | 2.30      | 2.46      |           | 7.14      | 3.96      | 0.71      | 0.86      | 1.54      | 3.28      |
| 30 | D & N Havelli |           | NA        | 53.20     | 52.96     | 53.20     | 52.80     | 1.58      | 13.60     | 13.60     | 26.70     |
| 31 | Pondicherry   | 247.30    | 277.68    | 287.79    | 304.52    | 304.07    | 316.97    | 213.97    | 0.00      | 180.63    | 187.72    |
|    | All India     | 292301.62 | 342381.56 | 361036.49 | 341199.65 | 352141.83 | 362332.77 | 348448.40 | 306069.00 | 379904.85 | 405416.18 |

#### State wise Yield (Ton/ha) of Sugarcane from 2009-10 to 2018-19

| S. No. | STATES/UT         | 2009-10 | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 2014-15 | 2015-16 | 2016-17 | 2017-18 | 2018-19 |
|--------|-------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 1      | Andhra Pradesh    | 74.10   | 78.25   | 80.77   | 77.37   | 78.51   | 71.85   | 76.66   | 76.02   | 78.68   | 79.36   |
| 2      | Arunachal Pradesh | 18.07   | 19.33   | 19.35   | 19.71   | 19.46   | 19.52   | 20.90   | 21.40   | 21.41   | 21.50   |
| 3      | Assam             | 39.08   | 36.20   | 38.61   | 35.61   | 36.97   | 36.76   | 35.25   | 38.47   | 37.40   | 35.06   |
| 4      | Bihar             | 43.42   | 51.47   | 51.71   | 50.90   | 49.92   | 55.18   | 51.84   | 54.41   | 59.14   | 89.18   |
| 5      | Chhattisgarh      | 2.35    | 2.63    | 2.68    | 2.76    | 2.60    | 2.66    | 1.91    | 40.77   | 48.07   | 44.34   |
| 6      | Gujarat           | 80.52   | 72.42   | 63.12   | 72.10   | 72.13   | 68.89   | 70.83   | 44.84   | 66.33   | 73.18   |
| 7      | Goa               | 58.11   | 54.56   | 50.63   | 53.87   | 54.79   | 60.77   |         | 70.71   |         | 39.76   |
| 8      | Haryana           | 72.09   | 71.08   | 73.25   | 73.63   | 73.52   | 73.91   | 71.96   | 80.62   | 84.50   | 78.24   |

|    |                  |              |              |              |              |              |              |              |              |              |              |
|----|------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| 9  | Himachal Pradesh | 20.73        | 22.53        | 13.71        | 22.35        | 23.18        | 23.05        | 19.97        | 12.17        | 19.60        | 19.60        |
| 10 | Jammu & Kashmir  | 2.00         | 1.67         | 1.58         | 0.00         | 1.00         | 1.50         | 1.50         |              |              |              |
| 11 | Jharkhand        | 68.77        | 69.29        | 69.22        | 69.04        | 69.21        | 69.50        | 69.50        | 69.32        | 70.00        |              |
| 12 | Karnataka        | 90.34        | 93.75        | 90.25        | 84.08        | 90.25        | 91.20        | 84.08        | 68.96        | 84.08        | 90.00        |
| 13 | Kerala           | 95.00        | 95.52        | 101.17       | 95.24        | 100.24       | 97.72        | 101.42       | 106.43       | 109.84       | 105.05       |
| 14 | Madhya Pradesh   | 40.82        | 40.97        | 38.68        | 44.40        | 43.42        | 41.14        | 51.27        | 51.41        | 55.41        | 48.91        |
| 15 | Maharashtra      | 84.87        | 84.87        | 84.87        | 74.65        | 82.07        | 82.23        | 74.65        | 82.52        | 92.00        | 77.20        |
| 16 | Manipur          | 35.50        | 57.94        | 57.91        | 56.67        | 58.00        | 58.00        | 58.00        | 58.00        | 58.00        | 57.81        |
| 17 | Meghalaya        | 2.62         | 2.00         | 2.71         | 2.68         | 2.90         | 3.09         | 3.04         | 3.00         | 2.98         | 2.99         |
| 18 | Mizoram          | 8.86         | 5.64         | 5.28         | 5.14         | 4.91         | 30.10        | 33.25        | 31.82        | 28.76        | 30.27        |
| 19 | Nagaland         | 29.98        | 43.00        | 43.51        | 43.52        | 43.52        | 43.52        | 43.52        | 43.53        | 43.51        | 43.51        |
| 20 | Odisha           | 61.24        | 68.91        | 61.01        | 65.55        | 65.90        | 71.93        | 64.42        | 62.71        | 64.70        | 61.62        |
| 21 | Punjab           | 61.67        | 59.57        | 70.66        | 71.31        | 75.00        | 74.88        | 73.41        | 81.27        | 83.58        | 81.83        |
| 22 | Rajasthan        | 57.42        | 66.89        | 70.29        | 73.06        | 68.99        | 73.40        | 86.51        | 71.29        | 70.36        | 83.45        |
| 23 | Tamil Nadu       | 101.45       | 108.39       | 111.38       | 97.69        | 103.57       | 106.79       | 101.06       | 87.00        | 99.81        | 103.00       |
| 24 | Telangana        | 0.00         | 76.76        | 85.41        | 87.17        | 86.48        | 87.97        | 68.71        | 71.07        | 74.41        | 79.59        |
| 25 | Tripura          | 51.10        | 51.65        | 48.91        | 50.54        | 51.67        | 0.00         | 51.06        | 53.65        | 52.72        | 54.25        |
| 26 | Uttar Pradesh    | 59.25        | 56.73        | 59.58        | 59.87        | 60.45        | 62.15        | 67.03        | 64.89        | 79.25        | 80.81        |
| 27 | Uttarakhand      | 60.85        | 60.90        | 58.44        | 61.74        | 56.97        | 60.61        | 60.77        | 69.65        | 69.68        | 69.55        |
| 28 | West Bengal      | 72.52        | 75.61        | 104.57       | 100.44       | 114.27       | 118.75       | 119.23       | 73.82        | 75.00        | 84.49        |
| 29 | A & N Islands    | 20.00        | 11.50        | 14.47        | 0.00         | 26.43        | 20.84        | 21.17        | 12.79        | 13.97        | 56.40        |
| 30 | D & N Havelli    |              |              | 79.40        | 80.00        | 79.40        | 80.00        | 80.00        | 80.00        | 80.00        | 72.15        |
| 31 | Pondicherry      | 137.39       | 157.33       | 147.66       | 150.23       | 150.53       | 165.09       | 117.50       |              | 125.00       | 130.00       |
|    | <b>All India</b> | <b>70.02</b> | <b>70.09</b> | <b>71.67</b> | <b>68.25</b> | <b>70.52</b> | <b>71.51</b> | <b>70.72</b> | <b>69.00</b> | <b>80.20</b> | <b>80.11</b> |

**Annexure-II**

**State-wise - District wise area, production and yield of sugarcane**

**A. Andhra Pradesh**

| S.<br>No | District         | 2014-15       |                |                 | 2015-16       |                |                 | 2016-17      |                |                 | 2017-18      |                |                 | 2018-19      |                |                 |
|----------|------------------|---------------|----------------|-----------------|---------------|----------------|-----------------|--------------|----------------|-----------------|--------------|----------------|-----------------|--------------|----------------|-----------------|
|          |                  | Area<br>(ha)  | Prod<br>(T)    | Yield<br>(T/ha) | Area<br>(ha)  | Prod<br>(T)    | Yield<br>(T/ha) | Area<br>(ha) | Prod<br>(T)    | Yield<br>(T/ha) | Area<br>(ha) | Prod<br>(T)    | Yield<br>(T/ha) | Area<br>(ha) | Prod<br>(T)    | Yield<br>(T/ha) |
|          |                  |               |                |                 |               |                |                 |              |                |                 |              |                |                 |              |                |                 |
| 1        | Srikakulam       | 7300          | 547000         | 75              | 6501          | 487000         | 75              | 6545         | 490875         | 75              | 5336         | 400000         | 75              | 6227         | 468000         | 75              |
| 2        | Vijaynagaram     | 13750         | 756000         | 55              | 12230         | 675000         | 55              | 10530        | 579000         | 55              | 11105        | 610000         | 55              | 9536         | 470000         | 49              |
| 3        | Visakhapatnam    | 33916         | 1527558        | 45              | 32252         | 1453200        | 45              | 25523        | 1189975        | 47              | 22939        | 1104106        | 48              | 17801        | 912238         | 51              |
| 4        | East Godavari    | 8693          | 582726         | 67              | 7493          | 571889         | 76              | 6867         | 454867         | 66              | 7439         | 561907         | 76              | 6172         | 435469         | 71              |
| 5        | West Godavari    | 17507         | 1311479        | 75              | 13979         | 1051668        | 75              | 9302         | 668267         | 72              | 9518         | 675148         | 71              | 10592        | 812369         | 77              |
| 6        | Krishna          | 16079         | 1294752        | 81              | 14289         | 1396745        | 98              | 10584        | 785934         | 74              | 12236        | 891449         | 73              | 12859        | 1201206        | 93              |
| 7        | Nellore          | 3273          | 268032         | 82              | 2379          | 198486         | 83              | 2391         | 192458         | 80              | 1473         | 120752         | 82              | 1509         | 123087         | 82              |
| 8        | Chittoor         | 28152         | 1624385        | 58              | 21652         | 1542997        | 71              | 21760        | 1640259        | 75              | 21547        | 1562950        | 73              | 17545        | 1363307        | 78              |
| 9        | Kurnool          | 4             | 280            | 70              | 8             | 600            | 75              | 114          | 8500           | 75              | 401          | 30000          | 75              | 204          | 15280          | 75              |
|          | <b>T O T A L</b> | <b>128674</b> | <b>7912212</b> | <b>61</b>       | <b>110783</b> | <b>7377585</b> | <b>67</b>       | <b>93616</b> | <b>6010135</b> | <b>64</b>       | <b>91994</b> | <b>5956312</b> | <b>65</b>       | <b>82445</b> | <b>5800956</b> | <b>70</b>       |

**B. Bihar**

| S.No | District    | 2014-15      |             |                 | 2015-16      |             |                 | 2016-17      |             |                 | 2017-18      |             |                 | 2018-19      |             |                 |
|------|-------------|--------------|-------------|-----------------|--------------|-------------|-----------------|--------------|-------------|-----------------|--------------|-------------|-----------------|--------------|-------------|-----------------|
|      |             | Area<br>(ha) | Prod<br>(T) | Yield<br>(T/ha) |
|      |             |              |             |                 |              |             |                 |              |             |                 |              |             |                 |              |             |                 |
| 1    | W.Champaran | 148505       | 9698430     | 65.31           | 122725       | 8529695     | 69.50           | 132857       | 9252174     | 69.64           | 145331       | 9921033     | 68.27           | 172303       | 10671410    | 61.93           |
| 2    | E.Champaran | 52685        | 5575677     | 105.83          | 43300        | 3431910     | 79.26           | 43310        | 3447082     | 79.59           | 34700        | 2208480     | 63.65           | 38543        | 1898859     | 49.27           |
| 3    | Gopalgunj   | 33322        | 1455351     | 43.67           | 25976        | 1791130     | 68.95           | 21162        | 1464146     | 69.19           | 25107        | 1629911     | 64.92           | 25949        | 1627634     | 62.72           |
| 4    | Siwan       | 6388         | 432847      | 67.76           | 2875         | 156270      | 54.36           | 1385         | 76418       | 55.16           | 1347         | 98607       | 73.21           | 1276         | 75834       | 59.43           |
| 5    | Saran       | 1832         | 121446      | 66.29           | 1035         | 56270       | 54.38           | 885          | 45507       | 51.40           | 1167         | 85420       | 73.17           | 1324         | 76298       | 57.64           |
| 6    | Vaishali    | 865          | 55212       | 63.84           | 1826         | 118651      | 64.98           | 1228         | 80180       | 65.27           | 1242         | 81881       | 65.93           | 1290         | 84478       | 65.51           |
| 7    | Muzaffarpur | 9238         | 637537      | 69.01           | 8111         | 597275      | 73.64           | 7134         | 466766      | 65.43           | 8169         | 543508      | 66.54           | 9178         | 604881      | 65.91           |
| 8    | Sheohar     | 3937         | 170024      | 43.18           | 3652         | 137970      | 37.78           | 3620         | 213731      | 59.04           | 3587         | 208329      | 58.08           | 3934         | 230182      | 58.51           |

|    |            |       |        |        |       |        |       |       |        |        |       |        |       |       |         |       |
|----|------------|-------|--------|--------|-------|--------|-------|-------|--------|--------|-------|--------|-------|-------|---------|-------|
| 9  | Sitamarhi  | 17371 | 755326 | 43.48  | 14638 | 904493 | 61.79 | 12072 | 748720 | 62.02  | 15453 | 924389 | 59.82 | 18066 | 1092787 | 60.49 |
| 10 | Madhubani  | 5241  | 327034 | 62.40  | 5578  | 373886 | 67.02 | 5139  | 342543 | 66.66  | 4281  | 277505 | 64.83 | 3818  | 226233  | 59.26 |
| 11 | Darbhanga  | 2487  | 155894 | 62.68  | 2491  | 167201 | 67.13 | 2115  | 140655 | 66.50  | 1559  | 101051 | 64.83 | 1361  | 78783   | 57.91 |
| 12 | Samastipur | 6774  | 257637 | 38.03  | 5952  | 375282 | 63.05 | 6346  | 400843 | 63.16  | 6051  | 335112 | 55.38 | 7768  | 468510  | 60.31 |
| 13 | Begusarai  | 6839  | 269577 | 39.42  | 6614  | 399230 | 60.36 | 7465  | 451058 | 60.42  | 5878  | 336798 | 57.30 | 7357  | 478387  | 65.02 |
| 14 | Khagaria   | 323   | 11960  | 37.07  | 355   | 20136  | 56.72 | 1096  | 62822  | 57.31  | 377   | 21928  | 58.16 | 416   | 25996   | 62.49 |
| 15 | Saharsa    | 802   | 42216  | 52.67  | 835   | 44620  | 53.44 | 1290  | 71239  | 55.22  | 1290  | 71239  | 55.22 | 1290  | 74954   | 58.10 |
| 16 | Madhepura  | 4017  | 211592 | 52.67  | 4247  | 229328 | 54.00 | 4675  | 250423 | 53.57  | 4675  | 250423 | 53.57 | 4675  | 266543  | 57.01 |
| 17 | Purnia     | 967   | 56820  | 58.78  | 1069  | 64714  | 60.54 | 900   | 52612  | 58.46  | 900   | 52612  | 58.46 | 900   | 52945   | 58.83 |
| 18 | Araria     | 325   | 17451  | 53.76  | 427   | 24874  | 58.25 | 281   | 15167  | 54.07  | 281   | 15167  | 54.07 | 281   | 15167   | 54.07 |
| 19 | Katihar    | 110   | 7285   | 66.22  | 158   | 11154  | 70.59 | 80    | 5500   | 68.74  | 80    | 5500   | 68.74 | 80    | 5500    | 68.74 |
| 20 | Kisangunj  | 175   | 16003  | 91.24  | 331   | 21502  | 65.02 | 224   | 20500  | 91.51  | 224   | 20500  | 91.51 | 224   | 17891   | 79.86 |
| 21 | Patna      | 473   | 34027  | 71.97  | 492   | 44312  | 90.11 | 383   | 35247  | 92.14  | 383   | 35248  | 92.14 | 351   | 29737   | 84.77 |
| 22 | Nalanda    | 203   | 20834  | 102.50 | 194   | 19008  | 98.23 | 60    | 6106   | 101.03 | 60    | 3859   | 63.84 | 57    | 3408    | 60.00 |
| 23 | Jahanabad  | 82    | 7961   | 97.10  | 88    | 7395   | 84.30 | 102   | 6111   | 59.75  | 102   | 6111   | 59.75 | 92    | 4948    | 53.78 |
| 24 | Arwal      | 45    | 2941   | 65.87  | 40    | 2671   | 66.46 | 9     | 581    | 65.80  | 9     | 581    | 65.80 | 8     | 477     | 59.60 |
| 25 | Gaya       | 382   | 27680  | 72.44  | 358   | 24321  | 67.99 | 151   | 11144  | 73.99  | 151   | 11144  | 73.99 | 139   | 9385    | 67.72 |
| 26 | Nawada     | 401   | 21727  | 54.18  | 381   | 20152  | 52.86 | 214   | 12130  | 56.81  | 214   | 12130  | 56.81 | 194   | 10030   | 51.75 |
| 27 | Aurangabad | 93    | 6827   | 73.65  | 94    | 6860   | 73.35 | 98    | 7215   | 73.98  | 98    | 7215   | 73.98 | 88    | 5852    | 66.59 |
| 28 | Bhojpur    | 475   | 26879  | 56.54  | 425   | 34547  | 81.32 | 391   | 20333  | 52.04  | 332   | 16620  | 50.00 | 355   | 17739   | 50.00 |
| 29 | Rohtash    | 293   | 15298  | 52.19  | 280   | 16053  | 57.31 | 250   | 15612  | 62.42  | 210   | 12600  | 60.01 | 175   | 10000   | 57.05 |
| 30 | Buxer      | 374   | 19257  | 51.50  | 336   | 26216  | 78.04 | 277   | 14415  | 52.00  | 183   | 8939   | 48.83 | 181   | 8492    | 46.85 |
| 31 | Kemur      | 153   | 4648   | 30.38  | 147   | 5770   | 39.31 | 125   | 6819   | 54.53  | 101   | 5249   | 52.22 | 89    | 4980    | 55.87 |
| 32 | Jamui      | 814   | 49190  | 60.44  | 823   | 49380  | 60.00 | 293   | 17394  | 59.27  | 293   | 17394  | 59.27 | 265   | 14109   | 53.32 |
| 33 | Mungher    | 161   | 9654   | 60.00  | 181   | 10860  | 60.00 | 177   | 10797  | 60.86  | 177   | 10797  | 60.86 | 163   | 9137    | 55.99 |
| 34 | Lakhisarai | 25    | 1416   | 57.56  | 31    | 2015   | 65.00 | 20    | 1148   | 56.14  | 20    | 1148   | 56.14 | 19    | 944     | 51.02 |
| 35 | Shekhpura  | 352   | 21119  | 59.95  | 360   | 23400  | 65.00 | 316   | 18589  | 58.86  | 316   | 18589  | 58.86 | 279   | 14510   | 51.92 |
| 36 | Bhagalpur  | 5557  | 377762 | 67.98  | 4521  | 272336 | 60.24 | 4890  | 272964 | 55.82  | 2402  | 129525 | 53.92 | 650   | 29992   | 46.14 |

|    |              |               |                 |              |               |                 |              |               |                 |              |               |                 |              |               |                 |              |
|----|--------------|---------------|-----------------|--------------|---------------|-----------------|--------------|---------------|-----------------|--------------|---------------|-----------------|--------------|---------------|-----------------|--------------|
| 37 | Banka        | 2902          | 194889          | 67.15        | 2587          | 154709          | 59.80        | 3079          | 172210          | 55.93        | 2195          | 123578          | 56.30        | 1045          | 50490           | 48.32        |
|    | <b>Total</b> | <b>314988</b> | <b>21117428</b> | <b>67.04</b> | <b>263530</b> | <b>18175594</b> | <b>68.97</b> | <b>264100</b> | <b>18236898</b> | <b>69.05</b> | <b>268943</b> | <b>17610120</b> | <b>65.48</b> | <b>304180</b> | <b>18297500</b> | <b>60.15</b> |

### C. Gujarat

| S.<br>No | District     | 2014-15       |                    |                 | 2015-16       |                   |                 | 2016-17       |                   |                 | 2017-18       |                   |                 | 2018-19       |                   |                 |
|----------|--------------|---------------|--------------------|-----------------|---------------|-------------------|-----------------|---------------|-------------------|-----------------|---------------|-------------------|-----------------|---------------|-------------------|-----------------|
|          |              | Area<br>(ha)  | Productio<br>n (T) | Yield<br>(T/ha) | Area<br>(ha)  | Production<br>(T) | Yield<br>(T/ha) |
|          |              |               |                    |                 |               |                   |                 |               |                   |                 |               |                   |                 |               |                   |                 |
| 1        | Amreli       | 40            | 2814               | 70              | 57            | 3928              | 69              | 7             | 487               | 70              |               |                   |                 |               |                   |                 |
| 2        | Bharauch     | 36425         | 2396401            | 66              | 21455         | 1424612           | 66              | 24950         | 1647099           | 66              | 32100         | 2120804           | 66              | 28733         | 1897229           | 66              |
| 3        | Bhavnagar    | 41            | 2885               | 70              | 1205          | 83039             | 69              | 10            | 690               | 69              |               |                   |                 |               |                   |                 |
| 4        | Dang         | 163           | 11469              | 70              | 167           | 11508             | 69              | 184           | 12811             | 70              | 200           | 13926             | 70              | 179           | 12429             | 69              |
| 5        | Gir Somnath  | 7670          | 539661             | 70              | 3440          | 271072            | 79              | 2384          | 173968            | 73              | 5600          | 414649            | 74              | 4774          | 349837            | 73              |
| 6        | Jamnagar     | 85            | 5981               | 70              |               |                   |                 |               |                   |                 |               |                   |                 | 21            | 1495              | 71              |
| 7        | Junagadh     |               |                    |                 | 5             | 345               | 69              |               |                   |                 | 100           | 2300              | 23              | 26            | 661               | 25              |
| 8        | Kachchh      | 619           | 43553              | 70              |               |                   |                 |               |                   |                 |               |                   |                 |               |                   |                 |
| 9        | Kheda        | 2             | 141                | 71              | 2             | 138               | 69              |               |                   |                 |               |                   |                 |               |                   |                 |
| 10       | Mahisagar    |               |                    |                 | 30            | 2067              | 69              |               |                   |                 |               |                   |                 |               |                   |                 |
| 11       | Morbi        | 73            | 5136               | 70              | 50            | 3446              | 69              | 80            | 5582              | 70              |               |                   |                 | 51            | 3541              | 69              |
| 12       | Narmada      | 6715          | 514369             | 77              | 6792          | 509400            | 75              | 5645          | 427863            | 76              | 6400          | 485109            | 76              | 6388          | 484185            | 76              |
| 13       | Navsari      | 17922         | 1234557            | 69              | 14498         | 987314            | 68              | 12878         | 882581            | 69              | 16000         | 1096101           | 68              | 15325         | 1050138           | 69              |
| 14       | Rajkot       | 23            | 1618               | 70              | 210           | 14472             | 69              | 50            | 3453              | 69              | 100           | 6944              | 69              | 96            | 6622              | 69              |
| 15       | Surat        | 98025         | 7063191            | 72              | 66310         | 5105538           | 77              | 77031         | 5703991           | 74              | 86500         | 6432659           | 74              | 81967         | 6076345           | 74              |
| 16       | Tapi         | 27088         | 1593668            | 59              | 25619         | 1417755           | 55              | 23670         | 1352385           | 57              | 27200         | 1553192           | 57              | 25894         | 1479250           | 57              |
| 17       | Vadodara     | 6490          | 395890             | 61              | 10010         | 675675            | 68              | 2050          | 133133            | 65              | 4800          | 309509            | 64              | 5838          | 378552            | 65              |
| 18       | Valsad       | 7172          | 530728             | 74              | 7280          | 436800            | 60              | 8978          | 691059            | 77              | 6900          | 462180            | 67              | 7583          | 507692            | 67              |
|          | <b>Total</b> | <b>208553</b> | <b>14339248</b>    | <b>69</b>       | <b>157130</b> | <b>10943181</b>   | <b>70</b>       | <b>157917</b> | <b>11034615</b>   | <b>70</b>       | <b>185900</b> | <b>22761373</b>   | <b>122</b>      | <b>176875</b> | <b>12247976</b>   | <b>69</b>       |

## D. Haryana

| S.<br>No | District     | 2013-14       |                |           | 2014-15      |                |           | 2015-16      |                |           | 2016-17       |                |           | 2017-18       |                |           |
|----------|--------------|---------------|----------------|-----------|--------------|----------------|-----------|--------------|----------------|-----------|---------------|----------------|-----------|---------------|----------------|-----------|
|          |              | Area          | Prod           | Yield     | Area         | Prod           | Yield     | Area         | Prod           | Yield     | Area          | Prod           | Yield     | Area          | Prod           | Yield     |
|          |              | (ha)          | (T)            | (T/ha)    | (ha)         | (T)            | (T/ha)    | (ha)         | (T)            | (T/ha)    | (ha)          | (T)            | (T/ha)    | (ha)          | (T)            | (T/ha)    |
| 1        | Hisar        | 1000          | 65000          | 65        | 1000         | 70000          | 70        | 1000         | 64000          | 64        | 2000          | 134000         | 67        | 2000          | 150000         | 75        |
| 2        | Fatehabab    | 0             | 0              | 0         | 0            | 0              |           | 0            | 0              |           |               |                |           | 1000          | 85000          | 85        |
| 3        | Bhiwani      | 2000          | 128000         | 64        | 2000         | 152000         | 76        | 2000         | 144000         | 72        | 4000          | 250000         | 63        | 3000          | 230000         | 77        |
| 4        | Rohtak       | 8000          | 479000         | 60        | 8000         | 544000         | 68        | 9000         | 604000         | 67        | 10000         | 709000         | 71        | 11000         | 839000         | 76        |
| 5        | Jhajjar      | 3000          | 191000         | 64        | 3000         | 214000         | 72        | 3000         | 229000         | 76        | 3000          | 227000         | 76        | 3000          | 200000         | 67        |
| 6        | Sonipat      | 9000          | 624000         | 69        | 7000         | 556000         | 79        | 7000         | 602000         | 86        | 8000          | 700000         | 88        | 9000          | 850000         | 94        |
| 7        | Faridabad    | 0             | 0              | 0         | 1000         | 76000          | 76        | 1000         | 72000          | 72        |               |                |           |               |                |           |
| 8        | Mewat        | 0             | 0              | 0         | 0            | 0              |           |              |                |           | 1000          | 81000          | 81        |               |                |           |
| 9        | Karnal       | 12000         | 979000         | 82        | 11000        | 935000         | 85        | 11000        | 944000         | 86        | 12000         | 1122000        | 94        | 13000         | 1211000        | 93        |
| 10       | Panipat      | 7000          | 647000         | 92        | 6000         | 501000         | 84        | 5000         | 410000         | 82        | 7000          | 583000         | 83        | 8000          | 681000         | 85        |
| 11       | Kurukshtera  | 11000         | 836000         | 76        | 11000        | 898000         | 82        | 10000        | 809000         | 81        | 10000         | 856000         | 86        | 12000         | 1109000        | 92        |
| 12       | Kaithal      | 4000          | 292000         | 73        | 3000         | 214000         | 71        | 3000         | 275000         | 92        | 4000          | 380000         | 95        | 5000          | 452000         | 90        |
| 13       | Ambala       | 11000         | 855000         | 78        | 10000        | 706000         | 71        | 10000        | 675000         | 68        | 10000         | 781000         | 78        | 12000         | 975000         | 81        |
| 14       | Panchkula    | 1000          | 72000          | 72        | 1000         | 58000          | 58        | 1000         | 64000          | 64        | 1000          | 90000          | 90        | 1000          | 84000          | 84        |
| 15       | Y. Nagar     | 27000         | 2276000        | 84        | 27000        | 1887000        | 70        | 25000        | 1750000        | 70        | 23000         | 1832000        | 80        | 26000         | 2172000        | 84        |
| 16       | Jind         | 4000          | 288000         | 72        | 4000         | 271000         | 68        | 3000         | 214000         | 71        | 5000          | 377000         | 75        | 5000          | 400000         | 80        |
| 17       | Palwal       | 2000          | 130000         | 65        | 2000         | 87000          | 44        | 2000         | 136000         | 68        | 2000          | 101000         | 51        | 2000          | 118000         | 59        |
| 18       | Charkhadri   |               |                |           |              |                |           |              |                |           |               |                |           | 1000          | 77000          | 77        |
|          | <b>Total</b> | <b>102000</b> | <b>7862000</b> | <b>77</b> | <b>97000</b> | <b>7169000</b> | <b>74</b> | <b>93000</b> | <b>6992000</b> | <b>75</b> | <b>102000</b> | <b>8223000</b> | <b>81</b> | <b>114000</b> | <b>9633000</b> | <b>85</b> |

## E. Karnataka

| S.<br>No | District         | 2013-14      |                   |                 | 2014-15      |                   |                 | 2015-16      |                   |                 | 2016-17      |                   |                 | 2017-18      |                   |                 |
|----------|------------------|--------------|-------------------|-----------------|--------------|-------------------|-----------------|--------------|-------------------|-----------------|--------------|-------------------|-----------------|--------------|-------------------|-----------------|
|          |                  | Area<br>(ha) | Production<br>(T) | Yield<br>(T/ha) |
|          |                  |              |                   |                 |              |                   |                 |              |                   |                 |              |                   |                 |              |                   |                 |
| 1        | Bagalkote        | 86942        | 9002844           | 103.55          | 93679        | 10234431          | 109.25          | 94085        | 9027456           | 95.95           | 88266        | 6372805           | 72.20           | 83339        | 6729624           | 80.75           |
| 2        | Bangalore Urban  | 0            | 0                 | 0.00            | 2            | 182               | 91.00           | 0            | 0                 | 0               | 0            | 0                 | 0.00            | 0            | 0                 | 0.00            |
| 3        | Bangalore rural  | 1            | 89                | 89.00           | 0            | 0                 | 0               | 6            | 484               | 80.67           | 0            | 0                 | 0.00            | 0            | 0                 | 0.00            |
| 4        | Belgaum          | 159443       | 14389731          | 90.25           | 180571       | 16296533          | 90.25           | 175778       | 14528052          | 82.65           | 163511       | 10718146          | 65.55           | 208729       | 20622425          | 98.80           |
| 5        | Bellary          | 6004         | 484823            | 80.75           | 3406         | 349456            | 102.60          | 7835         | 803871            | 102.60          | 6994         | 511611            | 73.15           | 4405         | 372443            | 84.55           |
| 6        | Bidar            | 26490        | 1937744           | 73.15           | 28867        | 1892232           | 65.55           | 19418        | 848567            | 43.70           | 17712        | 959105            | 54.15           | 15523        | 1150254           | 74.10           |
| 7        | Bijapur          | 44914        | 3456132           | 76.95           | 49050        | 3914190           | 79.80           | 43846        | 2207646           | 50.35           | 35226        | 2409458           | 68.40           | 20777        | 1835648           | 88.35           |
| 8        | Chamarajanagar   | 3050         | 289750            | 95.00           | 3573         | 298703            | 83.60           | 2899         | 256127            | 88.35           | 1875         | 130031            | 69.35           | 6788         | 748038            | 110.20          |
| 9        | Chikmaglur       | 1546         | 88122             | 57.00           | 1391         | 132145            | 95.00           | 1113         | 69785             | 62.70           | 1040         | 72124             | 69.35           | 937          | 69432             | 74.10           |
| 10       | Chitradurga      | 0            | 0                 | 0.00            | 0            | 0                 | 0               | 2            | 162               | 81.00           | 6            | 416               | 69.33           | 2            | 188               | 94.00           |
| 11       | Dakshina Cannada | 16           | 1444              | 90.25           | 10           | 912               | 91.20           | 10           | 808               | 80.80           | 10           | 694               | 69.40           | 0            | 0                 | 0.00            |
| 12       | Davanagere       | 6900         | 793155            | 114.95          | 9523         | 1221325           | 128.25          | 4444         | 569943            | 128.25          | 3843         | 412546            | 107.35          | 3795         | 410998            | 108.30          |
| 13       | Dharwad          | 3706         | 253490            | 68.40           | 8653         | 641187            | 74.10           | 8450         | 569952            | 67.45           | 7327         | 508127            | 69.35           | 8350         | 658398            | 78.85           |
| 14       | Gadag            | 964          | 89748             | 93.10           | 1870         | 197192            | 105.45          | 4722         | 381302            | 80.75           | 2855         | 160023            | 56.05           | 813          | 55609             | 68.40           |
| 15       | Gulbarga         | 27602        | 1678202           | 60.80           | 45503        | 3025950           | 66.50           | 28601        | 1195522           | 41.80           | 28429        | 1080302           | 38.00           | 1003         | 68605             | 68.40           |
| 16       | Hassan           | 1463         | 122307            | 83.60           | 1568         | 171304            | 109.25          | 689          | 98182             | 142.50          | 835          | 58700             | 70.30           | 2175         | 276878            | 127.30          |
| 17       | Haveri           | 7338         | 871388            | 118.75          | 10376        | 1094149           | 105.45          | 9820         | 960887            | 97.85           | 7632         | 703289            | 92.15           | 13347        | 1153848           | 86.45           |
| 18       | Kodagu           | 0            | 0                 | 0.00            | 0            | 0                 | 0               | 0            | 0.00              | 0               | 0            | 0.00              | 0               | 0            | 0.00              |                 |
| 19       | Kolar            | 0            | 0                 | 0.00            | 0            | 0                 | 0               | 0            | 0.00              | 81              | 5617         | 69.35             | 0               | 0            | 0.00              |                 |
| 20       | Koppal           | 2593         | 231555            | 89.30           | 2383         | 217330            | 91.20           | 1789         | 144462            | 80.75           | 310          | 21498             | 69.35           | 1291         | 121419            | 94.05           |
| 21       | Mandya           | 19462        | 2496002           | 128.25          | 21592        | 2543538           | 117.80          | 27784        | 3061797           | 110.20          | 17628        | 2193805           | 124.45          | 20941        | 2347486           | 112.10          |
| 22       | Mysore           | 7995         | 683572            | 85.50           | 4104         | 374285            | 91.20           | 6261         | 618587            | 98.80           | 3338         | 332966            | 99.75           | 4150         | 508582            | 122.55          |
| 23       | Raichur          | 345          | 30808             | 89.30           | 295          | 26904             | 91.20           | 0            | 0.00              | 0               | 0            | 0.00              | 0               | 0            | 0.00              |                 |

|    |                |               |                 |              |               |                 |              |               |                 |              |               |                 |              |               |                 |              |
|----|----------------|---------------|-----------------|--------------|---------------|-----------------|--------------|---------------|-----------------|--------------|---------------|-----------------|--------------|---------------|-----------------|--------------|
| 24 | Ramanagarm     | 191           | 14697           | 76.95        | 1027          | 67320           | 65.55        | 492           | 45338           | 92.15        | 98            | 10241           | 104.50       | 221           | 17216           | 77.90        |
| 25 | Shimoga        | 4915          | 471594          | 95.95        | 3940          | 393015          | 99.75        | 3981          | 359285          | 90.25        | 2447          | 211543          | 86.45        | 1268          | 112028          | 88.35        |
| 26 | Tumkur         | 1556          | 122691          | 78.85        | 1670          | 174515          | 104.50       | 214           | 22363           | 104.50       | 735           | 66334           | 90.25        | 917           | 86244           | 94.05        |
| 27 | Udupi          | 55            | 4912            | 89.31        | 42            | 3830            | 91.19        | 11            | 888             | 80.73        | 14            | 971             | 69.36        | 11            | 1035            | 94.09        |
| 28 | Uttar Kannada  | 5324          | 419797          | 78.85        | 6207          | 483525          | 77.90        | 6542          | 478547          | 73.15        | 5941          | 372501          | 62.70        | 0             | 0               | 0.00         |
| 29 | Chikkaballapur | 0             | 0               | 0.00         | 58            | 5290            | 91.21        | 0             | 0               | 0.00         | 0             | 0               | 0.00         | 0             | 0               | 0.00         |
| 30 | Yadgir         |               | 107785          | 0.00         | 862           | 78614           | 91.20        | 794           | 64116           | 80.75        | 945           | 65536           | 69.35        | 1216          | 114365          | 94.05        |
|    | <b>TOTAL</b>   | <b>418815</b> | <b>38042382</b> | <b>90.83</b> | <b>480222</b> | <b>43838057</b> | <b>91.29</b> | <b>449586</b> | <b>36314129</b> | <b>80.77</b> | <b>397098</b> | <b>27378389</b> | <b>68.95</b> | <b>399998</b> | <b>37460763</b> | <b>93.65</b> |

## F. Maharashtra

| S.<br>No | District   | 2013-14      |                   |                 | 2014-15      |                   |                 | 2015-16      |                   |                 | 2016-17      |                   |                 | 2017-18      |                   |                 |
|----------|------------|--------------|-------------------|-----------------|--------------|-------------------|-----------------|--------------|-------------------|-----------------|--------------|-------------------|-----------------|--------------|-------------------|-----------------|
|          |            | Area<br>(ha) | Production<br>(T) | Yield<br>(t/ha) |
| 1        | Kolhapur   | 141800       | 13347500          | 94.13           | 146300       | 14876400          | 101.68          | 145286       | 16036480          | 110.38          | 132631       | 11136365          | 83.97           | 143905       | 14779000          | 102.70          |
| 2        | Sangli     | 70300        | 6327000           | 90.00           | 74500        | 8504000           | 114.15          | 83966        | 8799960           | 104.80          | 72358        | 5630038           | 77.81           | 80176        | 8546800           | 106.60          |
| 3        | Satara     | 75800        | 6822000           | 90.00           | 70000        | 8186200           | 116.95          | 65504        | 8576173           | 130.93          | 50329        | 5974272           | 118.70          | 80644        | 7983800           | 99.00           |
| 4        | Pune       | 108600       | 9665400           | 89.00           | 127800       | 13149800          | 102.89          | 118430       | 10936879          | 92.35           | 95903        | 5639975           | 58.81           | 113140       | 13270600          | 117.29          |
| 5        | Solapur    | 144800       | 13466400          | 93.00           | 205500       | 21034400          | 102.36          | 183147       | 12991615          | 70.94           | 64744        | 3955234           | 61.09           | 100505       | 10468150          | 104.16          |
| 6        | Ahemdnagr  | 99300        | 6752400           | 68.00           | 122000       | 13182300          | 108.05          | 112415       | 10217438          | 90.89           | 60972        | 3856128           | 63.24           | 104404       | 11308900          | 108.32          |
| 7        | Nasik      | 21600        | 1512000           | 70.00           | 22000        | 1117400           | 50.79           | 18958        | 1277680           | 67.40           | 11216        | 486762            | 43.40           | 11865        | 988600            | 83.32           |
| 8        | Dhule      | 2700         | 186200            | 68.96           | 3300         | 1117400           | 338.61          | 2060         | 123600            | 60.00           | 4508         | 270480            | 60.00           | 2501         | 199200            | 79.65           |
| 9        | Nandurbar  | 7300         | 605900            | 83.00           | 12200        | 903800            | 74.08           | 14123        | 1051632           | 74.46           | 10952        | 737847            | 67.37           | 14887        | 1266900           | 85.10           |
| 10       | Jalgaon    | 7700         | 539000            | 70.00           | 12300        | 696200            | 56.60           | 9974         | 598865            | 60.04           | 9163         | 268870            | 29.34           | 9330         | 793100            | 85.01           |
| 11       | Aurangabad | 15400        | 924000            | 60.00           | 13900        | 1620000           | 116.55          | 15306        | 1120633           | 73.22           | 14644        | 332758            | 22.72           | 21325        | 1172900           | 55.00           |
| 12       | Jalna      | 11100        | 921300            | 83.00           | 21100        | 1845300           | 87.45           | 26096        | 1387443           | 53.17           | 16430        | 644672            | 39.24           | 23792        | 1417400           | 59.57           |
| 13       | Beed       | 27300        | 1774500           | 65.00           | 37500        | 2874800           | 76.66           | 36073        | 1360875           | 37.73           | 12292        | 416256            | 33.86           | 36050        | 2072850           | 57.50           |
| 14       | Parbhani   | 25600        | 1664000           | 65.00           | 32000        | 1996100           | 62.38           | 28481        | 1177899           | 41.36           | 9000         | 204550            | 22.73           | 25000        | 1375000           | 55.00           |
| 15       | Hingoli    | 18000        | 1080000           | 60.00           | 17100        | 1146400           | 67.04           | 15191        | 930586            | 61.26           | 5000         | 271935            | 54.39           | 9500         | 66500             | 7.00            |

|    |              |               |                 |              |                |                  |              |               |                 |              |               |                 |              |               |                 |              |
|----|--------------|---------------|-----------------|--------------|----------------|------------------|--------------|---------------|-----------------|--------------|---------------|-----------------|--------------|---------------|-----------------|--------------|
| 16 | Nanded       | 28100         | 1686000         | 60.00        | 23500          | 1456400          | 61.97        | 18792         | 1025831         | 54.59        | 14501         | 404472          | 27.89        | 23000         | 1495000         | 65.00        |
| 17 | Osmanabad    | 43600         | 2921200         | 67.00        | 39800          | 4483800          | 112.66       | 22687         | 1558109         | 68.68        | 12000         | 142091          | 11.84        | 35000         | 1575000         | 45.00        |
| 18 | Latur        | 61500         | 3690000         | 60.00        | 46400          | 3685900          | 79.44        | 41478         | 1621503         | 39.09        | 9000          | 147303          | 16.37        | 40000         | 2440000         | 61.00        |
| 19 | Buldhana     | 0             | 0               | 0.00         | 300            | 18300            | 61.00        | 342           | 17100           | 50.00        | 535           | 21400           | 40.00        | 257           | 12900           | 50.19        |
| 20 | Yeotmal      | 7700          | 500500          | 65.00        | 8100           | 534600           | 66.00        | 13589         | 254669          | 18.74        | 12493         | 267817          | 21.44        | 14127         | 593300          | 42.00        |
| 21 | Akola        | 0             | 0               | 0.00         | 100            | 2200             | 22.00        | 100           | 4500            | 45.00        | 65            | 2275            | 35.00        | 45            | 2300            | 51.11        |
| 22 | Washim       | 0             | 0               | 0.00         | 200            | 10600            | 53.00        | 209           | 10450           | 50.00        | 256           | 8960            | 35.00        | 154           | 6900            | 44.81        |
| 23 | Amravati     | 800           | 44000           | 55.00        | 500            | 31500            | 63.00        | 321           | 17013           | 53.00        | 430           | 16340           | 38.00        | 121           | 4800            | 39.67        |
| 24 | Wardha       | 3400          | 176800          | 52.00        | 3100           | 175800           | 56.71        | 3079          | 180883          | 58.75        | 3017          | 122046          | 40.45        | 2168          | 130100          | 60.01        |
| 25 | Nagpur       | 3100          | 170500          | 55.00        | 4200           | 230400           | 54.86        | 4362          | 306522          | 70.27        | 4599          | 228637          | 49.71        | 4268          | 221900          | 51.99        |
| 26 | Bhandara     | 8100          | 445500          | 55.00        | 6700           | 194300           | 29.00        | 4361          | 90000           | 20.64        | 4210          | 101942          | 24.21        | 3574          | 232300          | 65.00        |
| 27 | Gondia       | 2500          | 135000          | 54.00        | 1500           | 91500            | 61.00        | 955           | 33425           | 35.00        | 667           | 22678           | 34.00        | 1129          | 45200           | 40.04        |
|    | <b>Total</b> | <b>936100</b> | <b>75357100</b> | <b>80.50</b> | <b>1051900</b> | <b>103165800</b> | <b>98.08</b> | <b>985285</b> | <b>81707763</b> | <b>82.93</b> | <b>631915</b> | <b>41312103</b> | <b>65.38</b> | <b>900867</b> | <b>82469400</b> | <b>91.54</b> |

## G. Odisha

| S.No. | District     | 2013-14 |        |        | 2014-15 |        |        | 2015-16 |        |        | 2016-17 |        |        | 2017-18 |        |        |
|-------|--------------|---------|--------|--------|---------|--------|--------|---------|--------|--------|---------|--------|--------|---------|--------|--------|
|       |              | Area    | Prod   | Yield  |
|       |              | (ha)    | (T)    | (T/ha) |
| 1     | Balsore      | 250     | 15500  | 62.00  | 120     | 7680   | 64.00  | 120     | 7350   | 61.25  | 130     | 8270   | 63.62  | 180     | 13800  | 76.67  |
| 2     | Bhadrak      | 380     | 26900  | 70.79  | 500     | 35400  | 70.80  | 260     | 18640  | 71.69  | 130     | 9360   | 72.00  | 350     | 26950  | 77.00  |
| 3     | Bolangir     | 2360    | 171000 | 72.46  | 1780    | 131720 | 74.00  | 590     | 42730  | 72.42  | 860     | 62790  | 73.01  | 1350    | 103980 | 77.02  |
| 4     | Subarnapur   | 350     | 24550  | 70.14  | 360     | 25310  | 70.31  | 140     | 9430   | 67.36  | 90      | 6100   | 67.78  | 170     | 13060  | 76.82  |
| 5     | Cuttack      | 2270    | 160030 | 70.50  | 3330    | 240090 | 72.10  | 3080    | 210300 | 68.28  | 2810    | 198640 | 70.69  | 3270    | 256910 | 78.57  |
| 6     | Jagatsingpur | 790     | 56490  | 71.51  | 800     | 57600  | 72.00  | 780     | 53260  | 68.28  | 850     | 59410  | 69.89  | 1250    | 59410  | 47.53  |
| 7     | Jajpur       | 2070    | 144490 | 69.80  | 1810    | 126700 | 70.00  | 1900    | 136520 | 71.85  | 1210    | 88300  | 72.98  | 1090    | 86090  | 78.98  |
| 8     | Kendrapara   | 490     | 34230  | 69.86  | 560     | 39760  | 71.00  | 470     | 29610  | 63.00  | 410     | 28470  | 69.44  | 450     | 35010  | 77.80  |

|    |              |              |                |              |              |                |              |              |                |              |              |                |              |              |                |              |
|----|--------------|--------------|----------------|--------------|--------------|----------------|--------------|--------------|----------------|--------------|--------------|----------------|--------------|--------------|----------------|--------------|
| 9  | Dhenkanal    | 1100         | 79310          | 72.10        | 1060         | 76960          | 72.60        | 730          | 51490          | 70.53        | 710          | 52980          | 74.62        | 1350         | 50980          | 37.76        |
| 10 | Angul        | 70           | 4100           | 58.57        | 140          | 8600           | 61.43        | 160          | 10370          | 64.81        | 30           | 1950           | 65.00        | 70           | 4550           | 65.00        |
| 11 | Ganjam       | 3670         | 265890         | 72.45        | 2940         | 214030         | 72.80        | 1820         | 132030         | 72.54        | 2670         | 194620         | 72.89        | 2100         | 163550         | 77.88        |
| 12 | Gajapati     | 60           | 4250           | 70.83        | 50           | 3550           | 71.00        | 30           | 2050           | 68.33        | 0            | 0              | 0.00         | 0            | 0              | 0.00         |
| 13 | Kalahandi    | 2020         | 135040         | 66.85        | 2160         | 152280         | 70.50        | 1000         | 73430          | 73.43        | 1410         | 103300         | 73.26        | 1270         | 100150         | 78.86        |
| 14 | Nowapara     | 50           | 3100           | 62.00        | 90           | 5670           | 63.00        | 100          | 6480           | 64.80        | 40           | 2550           | 63.75        | 50           | 3560           | 71.20        |
| 15 | Keonjhar     | 50           | 3400           | 68.00        | 100          | 6910           | 69.10        | 90           | 5550           | 61.67        | 90           | 6100           | 67.78        | 180          | 13220          | 73.44        |
| 16 | Koraput      | 9980         | 788200         | 78.98        | 7940         | 631230         | 79.50        | 7990         | 636480         | 79.66        | 7720         | 602850         | 78.09        | 6250         | 470650         | 75.30        |
| 17 | Malkangiri   | 10           | 500            | 50.00        | 10           | 540            | 54.00        | 10           | 600            | 60.00        | 10           | 620            | 62.00        | 30           | 2340           | 78.00        |
| 18 | Nabarangpur  | 4260         | 268640         | 63.06        | 4790         | 313510         | 65.45        | 4890         | 344750         | 70.50        | 4960         | 356570         | 71.89        | 3820         | 295190         | 77.27        |
| 19 | Rayagada     | 240          | 15500          | 64.58        | 240          | 15600          | 65.00        | 90           | 5810           | 64.56        | 220          | 14510          | 65.95        | 390          | 29970          | 76.85        |
| 20 | Mayurbhanj   | 0            | 0              | 0.00         | 0            | 0              | 0.00         | 0            | 0              | 0.00         | 0            | 0              | 0.00         | 0            | 0              | 0.00         |
| 21 | Phulbani     | 0            | 0              | 0.00         | 0            | 0              | 0.00         | 0            | 0              | 0.00         | 0            | 0              | 0.00         | 0            | 0              | 0.00         |
| 22 | Boudh        | 40           | 2910           | 72.75        | 60           | 4380           | 73.00        | 10           | 770            | 77.00        | 30           | 2200           | 73.33        | 50           | 3660           | 73.20        |
| 23 | Puri         | 180          | 12250          | 68.06        | 200          | 14000          | 70.00        | 220          | 13660          | 62.09        | 260          | 16880          | 64.92        | 350          | 26570          | 75.91        |
| 24 | Khordha      | 980          | 65420          | 66.76        | 850          | 58230          | 68.51        | 900          | 63290          | 70.32        | 180          | 12560          | 69.78        | 350          | 26890          | 76.83        |
| 25 | Nayagarh     | 2500         | 178100         | 71.24        | 3240         | 231660         | 71.50        | 2320         | 162020         | 69.84        | 1650         | 117360         | 71.13        | 1390         | 106040         | 76.29        |
| 26 | Sambalpur    | 50           | 3330           | 66.60        | 50           | 3350           | 67.00        | 40           | 2460           | 61.50        | 40           | 2610           | 65.25        | 50           | 3270           | 65.40        |
| 27 | Bargarh      | 640          | 47100          | 73.59        | 430          | 31630          | 73.56        | 750          | 53350          | 71.13        | 440          | 32010          | 72.75        | 480          | 36840          | 76.75        |
| 28 | Deogarh      | 140          | 8450           | 60.36        | 160          | 9680           | 60.50        | 170          | 10070          | 59.24        | 180          | 11310          | 62.83        | 180          | 13320          | 74.00        |
| 29 | Jharsuguda   | 240          | 18250          | 76.04        | 240          | 18260          | 76.08        | 240          | 18700          | 77.92        | 240          | 17820          | 74.25        | 350          | 27040          | 77.26        |
| 30 | Sundargarh   | 90           | 6340           | 70.44        | 70           | 4940           | 70.57        | 80           | 6140           | 76.75        | 70           | 5120           | 73.14        | 180          | 13260          | 73.67        |
|    | <b>Total</b> | <b>35330</b> | <b>2543270</b> | <b>71.99</b> | <b>34080</b> | <b>2469270</b> | <b>72.46</b> | <b>28980</b> | <b>2107340</b> | <b>72.72</b> | <b>27440</b> | <b>2015260</b> | <b>73.44</b> | <b>27000</b> | <b>1986260</b> | <b>73.57</b> |

## H. Punjab

| S.<br>No | District    | 2013-14      |                   |                 | 2014-15      |                   |                 | 2015-16      |                   |                 | 2016-17      |                   |                 | 2017-18      |                   |                 |
|----------|-------------|--------------|-------------------|-----------------|--------------|-------------------|-----------------|--------------|-------------------|-----------------|--------------|-------------------|-----------------|--------------|-------------------|-----------------|
|          |             | Area<br>(ha) | Production<br>(T) | Yield<br>(T/ha) |
|          |             |              |                   |                 |              |                   |                 |              |                   |                 |              |                   |                 |              |                   |                 |
| 1        | Amritsar    | 5000         | 401000            | 80.20           | 4000         | 301000            | 75.25           | 4000         | 303000            | 75.75           | 4000         | 308000            | 77.00           | 6000         | 501000            | 83.50           |
| 2        | F.G.Sahib   | 3000         | 243000            | 81.00           | 3000         | 264000            | 88.00           | 3000         | 262000            | 87.33           | 3000         | 216000            | 72.00           | 3000         | 250000            | 83.33           |
| 3        | Firozpur    | 2000         | 170000            | 85.00           | 2000         | 150000            | 75.00           | 0            | 0                 | 0.00            | 0            | 0                 | 0.00            | 0            | 0                 | 0.00            |
| 4        | Gurdaspur   | 21000        | 1560000           | 74.29           | 24000        | 1840000           | 76.67           | 21000        | 1512000           | 72.00           | 21000        | 1682000           | 80.10           | 22000        | 1895000           | 86.14           |
| 5        | Hoshiarpur  | 21000        | 1481000           | 70.52           | 22000        | 1515000           | 68.86           | 22000        | 1622000           | 73.73           | 22000        | 1682000           | 76.45           | 23000        | 1830000           | 79.57           |
| 6        | Jalandhar   | 10000        | 764000            | 76.40           | 11000        | 825000            | 75.00           | 11000        | 656000            | 59.64           | 10000        | 854000            | 85.40           | 11000        | 958000            | 87.09           |
| 7        | Kapoorthala | 4000         | 328000            | 82.00           | 4000         | 312000            | 78.00           | 5000         | 380000            | 76.00           | 4000         | 328000            | 82.00           | 4000         | 335000            | 83.75           |
| 8        | Ludhiana    | 2000         | 170000            | 85.00           | 3000         | 258000            | 86.00           | 2000         | 171000            | 85.50           | 2000         | 186000            | 93.00           | 3000         | 273000            | 91.00           |
| 9        | SBS Nagar   | 6000         | 401000            | 66.83           | 6000         | 395000            | 65.83           | 0            | 0                 | 0.00            | 0            | 0                 | 0.00            | 0            | 0                 | 0.00            |
| 10       | Patiala     | 3000         | 281000            | 93.67           | 3000         | 272000            | 90.67           | 2000         | 176000            | 88.00           | 2000         | 185000            | 92.50           | 2000         | 204000            | 102.00          |
| 11       | Ropad       | 2000         | 152000            | 76.00           | 3000         | 238000            | 79.33           | 3000         | 221000            | 73.67           | 3000         | 244000            | 81.33           | 0            | 0                 | 0.00            |
| 12       | Sangrur     | 3000         | 264000            | 88.00           | 3000         | 265000            | 88.33           | 3000         | 260000            | 86.67           | 3000         | 267000            | 89.00           | 4000         | 369000            | 92.25           |
| 13       | Tarantaran  | 1000         | 75000             | 75.00           | 0            | 0                 | 0.00            | 0            | 0                 | 0.00            | 0            | 0                 | 0.00            | 1000         | 95000             | 95.00           |
| 14       | Mohali      | 1000         | 61000             | 61.00           | 1000         | 64000             | 64.00           | 1000         | 59000             | 59.00           | 1000         | 68000             | 68.00           | 0            | 0                 | 0.00            |
| 15       | Baranala    | 1000         | 90000             | 90.00           | 1000         | 87000             | 87.00           | 1000         | 88000             | 88.00           | 1000         | 103000            | 103.00          | 1000         | 85000             | 85.00           |
| 16       | Pathankot   | 4000         | 234000            | 58.50           | 4000         | 253000            | 63.25           | 4000         | 266000            | 66.50           | 4000         | 298000            | 74.50           | 4000         | 292000            | 73.00           |
| 17       | Fazilka     | 0            | 0                 | 0.00            | 0            | 0                 | 0.00            | 2000         | 178000            | 89.00           | 2000         | 181000            | 90.50           | 2000         | 147000            | 73.50           |
|          | STATE TOTAL | 89000        | 6675000           | 75.00           | 94000        | 7039000           | 74.88           | 84000        | 6154000           | 73.26           | 82000        | 6602000           | 80.51           | 86000        | 7234000           | 84.12           |

## I. Tamil Nadu

| S.<br>No | District        | 2013-14      |              |                 | 2014-15      |              |                 | 2015-16      |              |                 | 2016-17      |              |                 | 2017-18      |              |                 |
|----------|-----------------|--------------|--------------|-----------------|--------------|--------------|-----------------|--------------|--------------|-----------------|--------------|--------------|-----------------|--------------|--------------|-----------------|
|          |                 | Area<br>(ha) | Prod.<br>(T) | Yield<br>(t/ha) |
|          |                 |              |              |                 |              |              |                 |              |              |                 |              |              |                 |              |              |                 |
| 1        | Kancheepuram    | 1731         | 180000       | 103.99          | 1846         | 197100       | 106.77          | 1889         | 190800       | 101.01          | 2100         | 178300       | 84.90           | 1661         | 166100       | 100.00          |
| 2        | Thiruvallur     | 7352         | 698400       | 94.99           | 7215         | 711600       | 98.63           | 6114         | 611400       | 100.00          | 5400         | 512700       | 94.94           | 5734         | 550464       | 96.00           |
| 3        | Cuddalore       | 30304        | 3272800      | 108.00          | 27531        | 3307100      | 120.12          | 24443        | 2322100      | 95.00           | 21600        | 2090500      | 96.78           | 18747        | 2099664      | 112.00          |
| 4        | Villupuram      | 88786        | 10565500     | 119.00          | 79709        | 9368200      | 117.53          | 73243        | 8130000      | 111.00          | 60300        | 6353700      | 105.37          | 49644        | 5262264      | 106.00          |
| 5        | Vellore         | 11591        | 1089600      | 94.00           | 8789         | 736000       | 83.74           | 7296         | 583700       | 80.00           | 5900         | 561800       | 95.22           | 5201         | 462889       | 89.00           |
| 6        | Thiruvannamalai | 37783        | 3098200      | 82.00           | 24992        | 2071600      | 82.89           | 25394        | 2183900      | 86.00           | 25400        | 1992300      | 78.44           | 20070        | 2067210      | 103.00          |
| 7        | Salem           | 12652        | 1214600      | 96.00           | 9433         | 927800       | 98.36           | 8255         | 701700       | 85.00           | 6000         | 427200       | 71.20           | 5755         | 558235       | 97.00           |
| 8        | Namakkal        | 16544        | 1968700      | 119.00          | 18849        | 2124100      | 112.69          | 14268        | 1555200      | 109.00          | 11800        | 1269400      | 107.58          | 10152        | 1025352      | 101.00          |
| 9        | Dharmapuri      | 8433         | 615600       | 73.00           | 5854         | 494600       | 84.49           | 7905         | 624500       | 79.00           | 8200         | 527800       | 64.37           | 8114         | 592322       | 73.00           |
| 10       | Krishnagiri     | 840          | 81500        | 97.02           | 483          | 46100        | 95.45           | 581          | 58700        | 101.03          | 900          | 75000        | 83.33           | 540          | 54000        | 100.00          |
| 11       | Coimbatore      | 1170         | 121700       | 104.02          | 1128         | 120500       | 106.83          | 926          | 93500        | 100.97          | 800          | 68900        | 86.13           | 401          | 40100        | 100.00          |
| 12       | Tiruppur        | 4713         | 461900       | 98.01           | 2933         | 308600       | 105.22          | 5593         | 687900       | 122.99          | 4900         | 258400       | 52.73           | 1390         | 155680       | 112.00          |
| 13       | Erode           | 23539        | 2565800      | 109.00          | 21198        | 2336700      | 110.23          | 22332        | 2501200      | 112.00          | 19400        | 1262400      | 65.07           | 8742         | 1057782      | 121.00          |
| 14       | Trichy          | 4034         | 447800       | 111.01          | 2999         | 254800       | 84.96           | 2699         | 248900       | 92.22           | 2400         | 223100       | 92.96           | 0            | 0            | 0.00            |
| 15       | Karur           | 3372         | 340600       | 101.01          | 2520         | 253800       | 100.71          | 2723         | 345800       | 126.99          | 2300         | 188400       | 81.91           | 915          | 77775        | 85.00           |
| 16       | Perambalur      | 5241         | 482200       | 92.01           | 6039         | 557600       | 92.33           | 8112         | 827400       | 102.00          | 5300         | 433100       | 81.72           | 4452         | 347256       | 78.00           |
| 17       | Ariyalur        | 9875         | 1115900      | 113.00          | 7493         | 784100       | 104.64          | 6147         | 571700       | 93.00           | 5800         | 534900       | 92.22           | 5108         | 429072       | 84.00           |
| 18       | Pudukottai      | 6826         | 471000       | 69.00           | 5062         | 542700       | 107.21          | 4417         | 472600       | 107.00          | 3500         | 306400       | 87.54           | 3388         | 257488       | 76.00           |
| 19       | Thanjavur       | 8580         | 1012400      | 118.00          | 9317         | 1008900      | 108.29          | 7690         | 661300       | 85.99           | 5700         | 500700       | 87.84           | 4754         | 480154       | 101.00          |
| 20       | Thiruvarur      | 503          | 52300        | 103.98          | 581          | 62000        | 106.71          | 375          | 37900        | 101.07          | 400          | 31100        | 77.75           | 168          | 16800        | 100.00          |
| 21       | Nagapattinam    | 2962         | 278400       | 93.99           | 2576         | 225500       | 87.54           | 1899         | 121500       | 63.98           | 1100         | 60400        | 54.91           | 596          | 59600        | 100.00          |
| 22       | Madurai         | 4075         | 399400       | 98.01           | 2769         | 222300       | 80.28           | 2936         | 258400       | 88.01           | 2700         | 175900       | 65.15           | 2374         | 199416       | 84.00           |
| 23       | Theni           | 6425         | 674600       | 105.00          | 4767         | 457000       | 95.87           | 5287         | 586900       | 111.01          | 4800         | 394600       | 82.21           | 2939         | 311534       | 106.00          |
| 24       | Dindigul        | 3838         | 310900       | 81.01           | 1824         | 158900       | 87.12           | 2504         | 252900       | 101.00          | 2400         | 59800        | 24.92           | 1661         | 137863       | 83.00           |
| 25       | Ramanathapuram  | 422          | 43900        | 104.03          | 244          | 26100        | 106.97          | 317          | 32000        | 100.95          | 300          | 27800        | 92.67           | 213          | 21300        | 100.00          |
| 26       | Virudhunagar    | 2917         | 294600       | 100.99          | 2350         | 229500       | 97.66           | 2260         | 178500       | 78.98           | 2200         | 145900       | 66.32           | 1547         | 133042       | 86.00           |

|                    |              |               |                 |               |               |                 |               |               |                 |               |               |                 |              |               |                 |              |
|--------------------|--------------|---------------|-----------------|---------------|---------------|-----------------|---------------|---------------|-----------------|---------------|---------------|-----------------|--------------|---------------|-----------------|--------------|
| 27                 | Sivagangai   | 5257          | 331200          | 63.00         | 3783          | 339600          | 89.77         | 4084          | 396100          | 96.99         | 4300          | 214600          | 49.91        | 3268          | 186276          | 57.00        |
| 28                 | Tirunelveli  | 3369          | 215600          | 64.00         | 2680          | 209200          | 78.06         | 2398          | 254200          | 106.01        | 2400          | 98000           | 40.83        | 2529          | 252900          | 100.00       |
| 29                 | Thoothukudi  | 204           | 21200           | 103.92        | 98            | 10500           | 107.14        | 181           | 18300           | 101.10        | 200           | 14200           | 71.00        | 39            | 3900            | 100.00       |
| 30                 | The Nilgiris | 3             | 300             | 100.00        | 4             | 400             | 100.00        | 4             | 400             | 100.00        | 0             | 0               | 0            | 5             | 500             | 100.00       |
| 31                 | Kanyakumari  | 2             | 200             | 100.00        | 0             | 0               | 0.00          | 0             | 0               | 0             | 0             | 0               | 0            | 0             | 0               | 0            |
| <b>TOTAL STATE</b> |              | <b>313343</b> | <b>32426800</b> | <b>103.49</b> | <b>265066</b> | <b>28092900</b> | <b>105.98</b> | <b>252272</b> | <b>25509400</b> | <b>101.12</b> | <b>218500</b> | <b>18987300</b> | <b>86.90</b> | <b>170107</b> | <b>17006938</b> | <b>99.98</b> |

## J. Telangana

| S.No             | District         | 2017-18      |                |                 | 2018-19      |                |                 |
|------------------|------------------|--------------|----------------|-----------------|--------------|----------------|-----------------|
|                  |                  | Area<br>(ha) | Prod<br>(T)    | Yield<br>(T/ha) | Area<br>(ha) | Prod<br>(T)    | Yield<br>(T/ha) |
|                  |                  |              |                |                 |              |                |                 |
| 1                | Kamareddy        | 0            | 0              | 0               | 5838         | 373632         | 64              |
| 2                | Sangareddy       | 0            | 0              | 0               | 18421        | 1344733        | 73              |
| 3                | Medak            | 12957        | 839814         | 65              | 1342         | 93808          | 70              |
| 4                | Vikarabad        | 0            | 0              | 0               | 6304         | 472800         | 75              |
| 5                | Khammam          | 4859         | 318545         | 66              | 4059         | 283731         | 70              |
| 6                | Bhadradri        | 0            | 0              | 0               | 711          | 53136          | 75              |
| 7                | Suryapeta        | 0            | 0              | 0               | 950          | 63447          | 67              |
| 8                | Mahabubabad      | 0            | 0              | 0               | 15           | 1036           | 69              |
| 9                | Wanaparthy       | 0            | 0              | 0               | 1956         | 154027         | 79              |
| 10               | Jogulamba gadwal | 0            | 0              | 0               | 1959         | 157163         | 80              |
| 11               | Mahabubnagar     | 4430         | 347907         | 79              | 464          | 37826          | 82              |
| 12               | Nagarkurnool     | 0            | 0              | 0               | 104          | 8405           | 81              |
| 13               | Ranga Reddy      | 1824         | 127680         | 70              | 0            | 0              | 0               |
| 14               | Nizamabad        | 9383         | 700400         | 75              | 427          | 27328          | 64              |
| 15               | Nalgonda         | 1947         | 149121         | 77              | 0            | 0              | 0               |
| 16               | Jagityal         | 0            | 0              | 0               | 388          | 24832          | 64              |
| 17               | Sidipet          | 0            | 0              | 0               | 343          | 21952          | 64              |
| <b>T O T A L</b> |                  | <b>35400</b> | <b>2483467</b> | <b>70</b>       | <b>43281</b> | <b>3117856</b> | <b>72</b>       |

## K.Uttar Pradesh

| Sl.<br>No. | Name of<br>District | 2014-15      |              |                 | 2015-16      |              |                 | 2016-17      |              |                 | 2017-18      |              |                 | 2018-19      |              |                 |
|------------|---------------------|--------------|--------------|-----------------|--------------|--------------|-----------------|--------------|--------------|-----------------|--------------|--------------|-----------------|--------------|--------------|-----------------|
|            |                     | Area<br>(ha) | Prod.<br>(T) | Yield<br>(T/ha) |
|            |                     |              |              |                 |              |              |                 |              |              |                 |              |              |                 |              |              |                 |
| 1          | Saharanpur          | 124052       | 8169569      | 65.86           | 110566       | 7380059      | 66.75           | 137258       | 9634414      | 70.19           | 142742       | 10453853     | 73.24           | 137598       | 10659442     | 77.47           |
| 2          | Muzaffarnagar       | 164216       | 11803189     | 71.88           | 167212       | 12698079     | 75.94           | 172230       | 14270289     | 82.86           | 173431       | 15028143     | 86.65           | 176683       | 15266825     | 86.41           |
| 3          | Meerut              | 121109       | 9506088      | 78.49           | 118837       | 9443739      | 79.47           | 131419       | 10937741     | 83.23           | 131645       | 12556827     | 95.38           | 131936       | 12232050     | 92.71           |
| 4          | Bagpat              | 77107        | 5671682      | 73.56           | 71901        | 5538678      | 77.03           | 74144        | 5718875      | 77.13           | 75037        | 6369741      | 84.89           | 74227        | 6431027      | 86.64           |
| 5          | Buland Shahar       | 48031        | 3028451      | 63.05           | 45836        | 3033060      | 66.17           | 45789        | 3528134      | 77.05           | 48470        | 4054612      | 83.65           | 52806        | 4733107      | 89.63           |
| 6          | Ghaziabad           | 11136        | 750076       | 67.36           | 20412        | 1548863      | 75.88           | 20204        | 1584963      | 78.45           | 23499        | 2087087      | 88.82           | 23136        | 1971372      | 85.21           |
| 7          | G.Buddha Nagar      | 1798         | 131612       | 73.20           | 1007         | 75667        | 75.14           | 1882         | 150422       | 79.93           | 1812         | 161446       | 89.10           | 2050         | 182869       | 89.20           |
| 8          | Aligarh             | 6478         | 387877       | 59.88           | 5119         | 315556       | 61.64           | 3938         | 264728       | 67.22           | 7305         | 543375       | 74.38           | 8630         | 685498       | 79.43           |
| 9          | Hathras             | 262          | 15038        | 57.40           | 220          | 13483        | 61.29           | 122          | 7950         | 65.16           | 566          | 42034        | 74.27           | 861          | 68250        | 79.27           |
| 10         | Mathura             | 990          | 41691        | 42.11           | 742          | 34654        | 46.70           | 295          | 15812        | 53.60           | 523          | 29646        | 56.68           | 183          | 10040        | 54.86           |
| 11         | Agra                | 145          | 6106         | 42.11           | 224          | 10462        | 46.71           | 153          | 8201         | 53.60           | 256          | 14511        | 56.68           | 205          | 11247        | 54.86           |
| 12         | Firozabad           | 117          | 4927         | 42.11           | 119          | 5558         | 46.71           | 46           | 2465         | 53.59           | 112          | 6348         | 56.68           | 137          | 7516         | 54.86           |
| 13         | Mainpuri            | 338          | 14234        | 42.11           | 355          | 16580        | 46.70           | 463          | 24817        | 53.60           | 441          | 24998        | 56.68           | 452          | 24799        | 54.87           |
| 14         | Etah                | 353          | 20262        | 57.40           | 218          | 13361        | 61.29           | 240          | 15640        | 65.17           | 251          | 17761        | 70.76           | 193          | 13885        | 71.94           |
| 15         | Bareilly            | 99211        | 6120128      | 61.69           | 84849        | 5309850      | 62.58           | 94895        | 6561799      | 69.15           | 96963        | 7765961      | 80.09           | 97049        | 7253442      | 74.74           |
| 16         | Badaun              | 29629        | 1748230      | 59.00           | 21811        | 1447291      | 66.36           | 27612        | 1915941      | 69.39           | 32295        | 2358698      | 73.04           | 26891        | 1947661      | 72.43           |
| 17         | Shahjahanpur        | 42195        | 2850863      | 67.56           | 59226        | 3975486      | 67.12           | 39819        | 2970179      | 74.59           | 45738        | 3710815      | 81.13           | 39835        | 3188234      | 80.04           |
| 18         | Pilipit             | 93620        | 6500973      | 69.44           | 68532        | 4397013      | 64.16           | 67848        | 4757841      | 70.13           | 79277        | 6433804      | 81.16           | 70522        | 5456146      | 77.37           |
| 19         | Bijnor              | 212471       | 13968693     | 65.74           | 203202       | 13951037     | 68.66           | 205353       | 16100497     | 78.40           | 201630       | 16815135     | 83.40           | 204482       | 17575637     | 85.95           |
| 20         | Moradabad           | 44938        | 2900119      | 64.54           | 51649        | 3332187      | 64.52           | 46820        | 3257174      | 69.57           | 43759        | 3416878      | 78.08           | 50744        | 3875827      | 76.38           |
| 21         | Amroha              | 75824        | 5348322      | 70.54           | 76299        | 5419671      | 71.03           | 77651        | 5748038      | 74.02           | 78921        | 6729120      | 85.26           | 73607        | 6201537      | 84.25           |
| 22         | Rampur              | 28625        | 1784483      | 62.34           | 25080        | 1584554      | 63.18           | 20574        | 1432773      | 69.64           | 21849        | 1639374      | 75.03           | 27642        | 2186482      | 79.10           |
| 23         | Farrukhabad         | 7198         | 436861       | 60.69           | 7710         | 466517       | 60.51           | 8086         | 503111       | 62.22           | 8165         | 533762       | 65.37           | 8116         | 538837       | 66.39           |
| 24         | Kannauj             | 130          | 7490         | 57.62           | 154          | 8906         | 57.83           | 208          | 12557        | 60.37           | 194          | 12551        | 64.70           | 173          | 11334        | 65.51           |
| 25         | Etawah              | 408          | 23506        | 57.61           | 228          | 13187        | 57.84           | 429          | 25898        | 60.37           | 423          | 27367        | 64.70           | 337          | 22077        | 65.51           |
| 26         | Auraiya             | 920          | 53004        | 57.61           | 503          | 29092        | 57.84           | 596          | 35979        | 60.37           | 669          | 43282        | 64.70           | 852          | 55816        | 65.51           |

|    |                  |       |         |       |       |         |       |       |         |       |       |         |       |       |         |       |
|----|------------------|-------|---------|-------|-------|---------|-------|-------|---------|-------|-------|---------|-------|-------|---------|-------|
| 27 | Kanpur City      | 2819  | 140262  | 49.76 | 2746  | 138201  | 50.33 | 3128  | 173842  | 55.58 | 1863  | 115007  | 61.73 | 3095  | 195604  | 63.20 |
| 28 | Kanpur Dehat     | 2304  | 132740  | 57.61 | 2077  | 120127  | 57.84 | 2203  | 132990  | 60.37 | 2243  | 145115  | 64.70 | 2119  | 138820  | 65.51 |
| 29 | Fatehpur         | 7882  | 518486  | 65.78 | 7255  | 486318  | 67.03 | 6310  | 458529  | 72.67 | 6377  | 234214  | 36.73 | 6447  | 247578  | 38.40 |
| 30 | Prayagraj        | 700   | 46046   | 65.78 | 754   | 50542   | 67.03 | 675   | 49050   | 72.67 | 1124  | 41283   | 36.73 | 652   | 25038   | 38.40 |
| 31 | Kaushambi        | 1439  | 94659   | 65.78 | 663   | 44442   | 67.03 | 1424  | 103478  | 72.67 | 1736  | 63760   | 36.73 | 1526  | 58602   | 38.40 |
| 32 | Pratapharh       | 846   | 55651   | 65.78 | 844   | 56575   | 67.03 | 984   | 71504   | 72.67 | 830   | 30484   | 36.73 | 961   | 36904   | 38.40 |
| 33 | Jhansi           | 165   | 6671    | 40.43 | 153   | 5267    | 34.42 | 57    | 2168    | 38.04 | 154   | 6074    | 39.44 | 138   | 5125    | 37.14 |
| 34 | Lalitpur         | 52    | 2102    | 40.42 | 38    | 1308    | 34.42 | 41    | 1560    | 38.05 | 24    | 946     | 39.42 | 87    | 3231    | 37.14 |
| 35 | Jalaun           | 1344  | 54341   | 40.43 | 1435  | 49402   | 34.43 | 1223  | 46525   | 38.04 | 1041  | 41056   | 39.44 | 1541  | 57226   | 37.14 |
| 36 | Hamirpur         | 5381  | 217635  | 40.45 | 5695  | 208921  | 36.68 | 2842  | 122072  | 42.95 | 6308  | 241798  | 38.33 | 4162  | 162322  | 39.00 |
| 37 | Mahoba           | 2545  | 102932  | 40.44 | 2998  | 109982  | 36.69 | 3297  | 141616  | 42.95 | 2424  | 92917   | 38.33 | 2240  | 87362   | 39.00 |
| 38 | Banda            | 398   | 16097   | 40.44 | 414   | 15187   | 36.68 | 529   | 22722   | 42.95 | 395   | 15141   | 38.33 | 522   | 20359   | 39.00 |
| 39 | Chitrakut        | 340   | 13751   | 40.44 | 144   | 5283    | 36.69 | 239   | 10266   | 42.95 | 256   | 9813    | 38.33 | 202   | 7878    | 39.00 |
| 40 | Varanasi         | 3996  | 252707  | 63.24 | 3716  | 235639  | 63.41 | 4130  | 272365  | 65.95 | 2532  | 169310  | 66.87 | 4083  | 273953  | 67.10 |
| 41 | Chandauli        | 618   | 35548   | 57.52 | 706   | 41299   | 58.50 | 576   | 35397   | 61.45 | 684   | 44133   | 64.52 | 654   | 43153   | 65.98 |
| 42 | Ghazipur         | 7239  | 396118  | 54.72 | 5559  | 316441  | 56.92 | 7496  | 427842  | 57.08 | 7309  | 452544  | 61.92 | 7268  | 446488  | 61.43 |
| 43 | Jaunpur          | 9870  | 565156  | 57.26 | 8315  | 476882  | 57.35 | 8734  | 551290  | 63.12 | 9516  | 626838  | 65.87 | 8201  | 569477  | 69.44 |
| 44 | Mirzapur         | 1596  | 104987  | 65.78 | 1642  | 110066  | 67.03 | 1842  | 133853  | 72.67 | 1705  | 135112  | 79.24 | 1881  | 151998  | 80.81 |
| 45 | Sonbhadra        | 219   | 14406   | 65.78 | 217   | 14546   | 67.03 | 160   | 11626   | 72.66 | 64    | 5072    | 79.25 | 200   | 16161   | 80.81 |
| 46 | S. Ravidas nagar | 1100  | 72359   | 65.78 | 1094  | 73333   | 67.03 | 935   | 67944   | 72.67 | 1147  | 90894   | 79.24 | 1024  | 82747   | 80.81 |
| 47 | Azamgarh         | 20282 | 1249533 | 61.61 | 20720 | 1232094 | 59.46 | 19251 | 1168074 | 60.68 | 19032 | 1160267 | 60.96 | 18898 | 1185963 | 62.76 |
| 48 | Mau              | 6411  | 332115  | 51.80 | 6146  | 324558  | 52.81 | 6423  | 373639  | 58.17 | 6532  | 395839  | 60.60 | 6631  | 420405  | 63.40 |
| 49 | Ballia           | 4096  | 213254  | 52.06 | 4021  | 232591  | 57.84 | 6312  | 415380  | 65.81 | 6481  | 356248  | 54.97 | 6457  | 345630  | 53.53 |
| 50 | Gorakhpur        | 2948  | 181208  | 61.47 | 2616  | 138941  | 53.11 | 2601  | 158994  | 61.13 | 2340  | 152222  | 65.05 | 2993  | 215005  | 71.84 |
| 51 | Maharajgarnj     | 15932 | 952033  | 59.76 | 15205 | 914307  | 60.13 | 17489 | 1122724 | 64.20 | 17644 | 1161540 | 65.83 | 21279 | 1442716 | 67.80 |
| 52 | Deoria           | 8996  | 567792  | 63.12 | 7700  | 468961  | 60.90 | 8801  | 550943  | 62.60 | 8885  | 574184  | 64.62 | 8832  | 650636  | 73.67 |
| 53 | Kushinagar       | 70102 | 4217897 | 60.17 | 67839 | 4251063 | 62.66 | 70100 | 4689970 | 66.90 | 70227 | 5164494 | 73.54 | 70215 | 5450088 | 77.62 |
| 54 | Basti            | 36515 | 2290221 | 62.72 | 41263 | 2527936 | 61.26 | 35114 | 2294630 | 65.35 | 40246 | 2659134 | 66.07 | 40546 | 2804648 | 69.17 |
| 55 | Siddharthnagar   | 2377  | 149086  | 62.72 | 2467  | 151139  | 61.26 | 2129  | 139126  | 65.35 | 2013  | 133003  | 66.07 | 2058  | 142356  | 69.17 |
| 56 | Sant Kabir Nagar | 3606  | 226168  | 62.72 | 2273  | 139253  | 61.26 | 3876  | 253288  | 65.35 | 3706  | 244862  | 66.07 | 3750  | 259395  | 69.17 |

|                    |                |                |                  |              |                |                  |              |                |                  |              |                |                  |              |                |                  |              |
|--------------------|----------------|----------------|------------------|--------------|----------------|------------------|--------------|----------------|------------------|--------------|----------------|------------------|--------------|----------------|------------------|--------------|
| 57                 | Lucknow        | 195            | 12853            | 65.91        | 203            | 13393            | 65.98        | 217            | 15484            | 71.35        | 267            | 20849            | 78.09        | 193            | 15857            | 82.16        |
| 58                 | Unnao          | 695            | 45809            | 65.91        | 618            | 40774            | 65.98        | 782            | 55799            | 71.35        | 612            | 47790            | 78.09        | 640            | 52582            | 82.16        |
| 59                 | Raebareli      | 2306           | 125317           | 54.34        | 1704           | 91518            | 53.71        | 3408           | 191189           | 56.10        | 2417           | 124563           | 51.54        | 2384           | 139168           | 58.38        |
| 60                 | Sitapur        | 148655         | 9903396          | 66.62        | 146006         | 9716991          | 66.55        | 138028         | 9790050          | 70.93        | 153458         | 11589148         | 75.52        | 150682         | 11533803         | 76.54        |
| 61                 | Hardoi         | 37032          | 2226216          | 60.12        | 36893          | 2304189          | 62.46        | 34227          | 2361663          | 69.00        | 37344          | 2820667          | 75.53        | 44585          | 3491897          | 78.32        |
| 62                 | Kheri          | 268653         | 17757963         | 66.10        | 277299         | 18418200         | 66.42        | 245844         | 17697818         | 71.99        | 248135         | 20026480         | 80.71        | 239675         | 20693540         | 86.34        |
| 63                 | Ayodhya        | 20004          | 1328266          | 66.40        | 16610          | 1094732          | 65.91        | 21721          | 1526204          | 70.26        | 19950          | 1535272          | 76.96        | 21885          | 1670526          | 76.33        |
| 64                 | Ambedkar Nagar | 11458          | 715575           | 62.45        | 8707           | 534112           | 61.34        | 11722          | 804439           | 68.63        | 11987          | 890188           | 74.26        | 11929          | 914693           | 76.68        |
| 65                 | Sultanpur      | 10951          | 648825           | 59.25        | 9363           | 509010           | 54.36        | 9848           | 625033           | 63.47        | 9412           | 596947           | 63.42        | 9125           | 654920           | 71.77        |
| 66                 | Barabanki      | 9736           | 564143           | 57.94        | 9128           | 549506           | 60.20        | 8763           | 616635           | 70.37        | 9254           | 735471           | 79.48        | 9849           | 807539           | 81.99        |
| 67                 | Gonda          | 1602           | 100048           | 62.45        | 1477           | 90603            | 61.34        | 77658          | 4693960          | 60.44        | 79629          | 5576260          | 70.03        | 79434          | 5946747          | 74.86        |
| 68                 | Balrampur      | 79442          | 4088721          | 51.47        | 72834          | 3968579          | 54.49        | 43934          | 2379817          | 54.17        | 44074          | 2902890          | 65.86        | 43524          | 2933518          | 67.40        |
| 69                 | Bahraich       | 43539          | 2227978          | 51.17        | 44049          | 2368603          | 53.77        | 22134          | 1451105          | 65.56        | 22397          | 1597264          | 71.32        | 23282          | 1723613          | 74.03        |
| 70                 | Shravasti      | 38237          | 2205969          | 57.69        | 50171          | 2953266          | 58.86        | 7842           | 465071           | 59.31        | 8201           | 565572           | 68.96        | 8230           | 596742           | 72.51        |
| 71                 | Kashganj       | 7331           | 404876           | 55.23        | 6516           | 397554           | 61.01        | 7013           | 448916           | 64.01        | 6946           | 515840           | 74.26        | 7173           | 568588           | 79.27        |
| 72                 | Amethi         | 7179           | 379471           | 52.86        | 5732           | 318700           | 55.60        | 1744           | 119684           | 68.63        | 1666           | 123722           | 74.26        | 1591           | 121995           | 76.68        |
| 73                 | Shamli         | 62990          | 4966384          | 78.84        | 58917          | 4759080          | 80.78        | 63440          | 5350530          | 84.34        | 65748          | 6109567          | 92.92        | 65349          | 6287358          | 96.21        |
| 74                 | Hapur          | 35923          | 2526393          | 70.33        | 35721          | 2416740          | 67.66        | 36365          | 2856980          | 78.56        | 39774          | 3313651          | 83.31        | 37241          | 3114241          | 83.62        |
| 75                 | Sambal         | 28914          | 1833148          | 63.40        | 28214          | 1836054          | 65.08        | 28156          | 2008649          | 71.34        | 32200          | 2523836          | 78.38        | 29025          | 2273006          | 78.31        |
| <b>Total State</b> |                | <b>2228261</b> | <b>146576786</b> | <b>65.78</b> | <b>2168888</b> | <b>145384798</b> | <b>67.03</b> | <b>2159841</b> | <b>156948671</b> | <b>72.67</b> | <b>2234282</b> | <b>177056410</b> | <b>79.25</b> | <b>2223805</b> | <b>179698158</b> | <b>80.81</b> |

## L. Uttarakhand

| Sl.<br>No. | Districts    | 2014-15      |                |                 | 2015-16      |                |                 | 2016-17      |                |                 | 2017-18      |                |                 | 2018-19      |                |                 |
|------------|--------------|--------------|----------------|-----------------|--------------|----------------|-----------------|--------------|----------------|-----------------|--------------|----------------|-----------------|--------------|----------------|-----------------|
|            |              | Area<br>(ha) | Prod<br>(T)    | Yield<br>(T/ha) |
|            |              |              |                |                 |              |                |                 |              |                |                 |              |                |                 |              |                |                 |
| 1          | US Nagar     | 38217        | 2450000        | 64              | 35118        | 2290000        | 65              | 27394        | 1786000        | 65              | 15696        | 1083024        | 69              | 31989        | 2351000        | 73              |
| 2          | Nainital     | 4474         | 287000         | 64              | 4215         | 275000         | 65              | 3856         | 250000         | 65              | 3268         | 225492         | 69              | 3333         | 244000         | 73              |
| 3          | Haridwar     | 50473        | 2988000        | 59              | 48258        | 2756000        | 57              | 48607        | 2776000        | 57              | 67583        | 4730810        | 70              | 55700        | 3793000        | 68              |
| 4          | Dehradun     | 5630         | 370000         | 66              | 5475         | 355000         | 65              | 5099         | 330000         | 65              | 3916         | 264330         | 68              | 5249         | 403000         | 77              |
|            | <b>Total</b> | <b>98794</b> | <b>6095000</b> | <b>62</b>       | <b>93066</b> | <b>5676000</b> | <b>61</b>       | <b>84956</b> | <b>5142000</b> | <b>61</b>       | <b>90463</b> | <b>6303656</b> | <b>70</b>       | <b>96271</b> | <b>6791000</b> | <b>71</b>       |

**Varieties of sugarcane released and notified from 2000 to 2019 and their salient characteristics.**

**Annexure-III**

| S. N.                  | Name of Variety     | Year of release & Notification | Gazette notification no. | State (s) for which recommended                    | Key characteristics (like duration, yield level, Quality characteristics etc.) |                   |             |  |
|------------------------|---------------------|--------------------------------|--------------------------|--|--|-------------------|-------------|--|
|                        |                     |                                |                          |  | Maturity   | Cane yield (t/ha) | sucrose (%) | Salient features   |
| <b>Peninsular Zone</b> |                     |                                |                          |  |  |                   |             |  |
| 1                      | Co 85004 (Prabha)   | 2000                           | S.O. 821 (E)             | Guj., MS, KN, Kerala, Interior of TN & AP, MP & CG | Early  | 90.5              | 19.5        | MR to smut, good ratooners   |
| 2                      | Co 86032 (Nayana)   | 2000                           | S.O. 821 (E)             | -do-   | Mid-late   | 102.0             | 20.1        | R to smut, field tolerant to red rot, MR to wilt, tolerant to drought  |
| 3                      | Co 87025 (Kalyani)  | 2000                           | S.O. 821 (E)             | -do-   | Mid-late   | 78.2              | 18.3        | R to smut, field tolerant to red rot, tolerant to drought & water logging                                    |
| 4                      | Co 87044 (Uttara)   | 2000                           | S.O. 821 (E)             | -do-   | Mid-late   | 101.0             | 18.3        | MR to smut, MS to red rot, R to rust, MR to drought.   |
| 5                      | Co 8371 (Bhima)     | 2000                           | S.O. 821 (E)             | -do-   | Mid-late   | 117.7             | 18.6        | R to smut, tolerant to drought & water logging   |
| 6                      | CoM 88121 (Krishna) | 2000                           | S.O. 821 (E)             | -do-   | Mid-late   | 88.7              | 18.6        | Susceptible to early shoot borer and scale insect, R to smut, tolerant to drought, excellent jaggery quality |
| 7                      | Co 91010 (Dhanush)  | 2000                           | S.O. 821 (E)             | -do-   | Mid-late   | 116.0             | 19.1        | R to smut, tolerant to drought   |
| 8                      | Co 94008 (Shyama)   | 2004                           | S.O. 161(E)              | -do-   | Early  | 120.0             | 18.0        | MR to red rot, R to smut, tolerant to drought & salinity, good jaggery quality                               |
| 9                      | Co 99004 (Damodar)  | 2007                           | S.O. 122 (E)             | -do-   | Mid-late   | 116.7             | 18.8        | MR to red rot & wilt, tolerant to drought & salinity, tolerant to internode borer, good jaggery quality      |
| 10                     | Co 2001-13 (Sulabh) | 2009                           | S.O. 454 (E)             | -do-   | Mid-late   | 108.6             | 19.03       | MR to red rot & smut, tolerant to drought & salinity, good ratooners, good jaggery quality                   |
| 11                     | Co 2001-15 (Mangal) | 2009                           | S.O. 454 (E)             | -do-   | Mid-late   | 113.0             | 19.37       | MR to red rot & smut, tolerant to drought & salinity, good ratooners, good jaggery quality                   |
| 12                     | Co 0218 (Shreyas)   | 2010                           | S.O. 2137 (E)            | -do-   | Mid-late   | 103.77            | 20.79       | MR to red rot, R to smut, tolerant to drought & salinity, good ratooners, good jaggery quality               |
| 13                     | Co 0403 (Samriddhi) | 2012                           | S.O. 2125 (E)            | -do-   | Early  | 101.6             | 18.16       | MR to red rot, R to smut, tolerant to drought & salinity, good ratooners, good jaggery quality               |

| S. N.               | Name of Variety                  | Year of release & Notification | Gazette notification no- | State (s) for which recommended                    | Key characteristics (like duration, yield level, Quality characteristics etc.) |                   |             |   |
|---------------------|----------------------------------|--------------------------------|--------------------------|--|--|-------------------|-------------|---|
|                     |                                  |                                |                          |  | Maturity   | Cane yield (t/ha) | sucrose (%) | Salient features  |
| 14                  | Co 06027                         | 2013                           | S.O. 2817 (E)            | Guj., MS, KN, Kerala, Interior of TN & AP, MP & CG | Mid-late   | 110.56            | 19.18       | MR to red rot, tolerant to drought & salinity   |
| 15                  | Co Snk 05103                     | 2014                           | S.O. 1919 (E)            | -do-   | Early  | 105.50            | 17.21       | MR to red rot, smut & wilt, Resistant to sugarcane wooly aphid and tolerant to moisture stress & excellent ratooning ability  |
| 16                  | Co Snk 05104                     | 2014                           | S.O. 1919 (E)            | -do-   | Mid-late   | 106.86            | 17.52       | MR to red rot, smut. Tolerant to sugarcane wooly aphid, tolerant to salinity, water logging & moisture stress   |
| 17                  | Co N 05071 (Gujarat Sugarcane 5) | 2016                           | S.O. 3540 (E)            | -do-   | Early  | 152               | 18.76       | MR to wilt & red rot, tolerant to shoot borer & top borer, susceptible to red rot & scale insect  |
| 18                  | Co N 05072                       | 2016                           | S.O. 3540 (E)            | -do-   | Mid-late   | 143               | 17.78       | For south Gujarat   |
| 19                  | Co 09004 (Amritha)               | 2017                           | S.O. 2805 (E)            | -do-   | Early  | 109.85            | 18.94       | MR to red rot, R to smut & YLD, tolerant to drought and salinity  |
| <b>Coastal Zone</b> |                                  |                                |                          |  |  |                   |             |   |
| 20                  | Co 86249 (Bhavani)               | 2000                           | S.O. 821 (E)             | Coastal TN & AP and Odisha                         | Mid-late   | 104.2             | 18.7        | MR to red rot, smut, tolerant to water logging, good ratooner   |
| 21                  | CoC 01061 (CoC (56) 23)          | 2006                           | S.O. 1572 (E)            | -do-   | Early  | 110.0             | 17.4        | MR to red rot & tolerant to drought   |
| 22                  | CoOr 03151 (Sabita)              | 2011                           | S.O. 2326 (E)            | -do-   | Early  | 105.28            | 15.53       | R to red rot & wilt, tolerant to internode, top & early shoot borers and scale insect, tolerant to drought & water logging  |
| 23                  | Co 06030                         | 2013                           | S.O. 2817 (E)            | -do-   | Mid-late   | 103.33            | 16.60       | MR to red rot   |
| 24                  | Co A 05323 (Revathi)             | 2017                           | S.O. 1007 (E)            | -do-   | Mid-late   | 103.18            | 16.74       | MR to red rot & MS to smut, tolerant to moisture stress suitable for normal irrigated, limited irrigated & Rainfed condition, very good ratoon in AP, non-lodging canes |
| 25                  | Co A 08323                       | 2017                           | S.O. 1007 (E)            | -do-   | Early  | 106.30            | 16.41       | R to red rot & HS to smut   |

| S. N.                     | Name of Variety             | Year of release & Notification | Gazette notification no- | State (s) for which recommended               | Key characteristics (like duration, yield level, Quality characteristics etc.) |                   |             |  |
|---------------------------|-----------------------------|--------------------------------|--------------------------|---|--|-------------------|-------------|--|
|                           |                             |                                |                          |   | Maturity   | Cane yield (t/ha) | sucrose (%) | Salient features   |
| <b>North Central Zone</b> |                             |                                |                          |   |  |                   |             |  |
| 26                        | CoS 91230 (Raseeli)         | 2000                           | S.O. 821 (E)             | Pun. Har. Raj., Central & Western U.P. and UK | Mid-late   | 68.2              | 18.8        | MR to red rot, tolerant to top, shoot & stalk borers   |
| 27                        | Co Pant 90223               | 2000                           | S.O. 821 (E)             | -do-  | Mid-late   | 73.3              | 18.5        | MR to red rot, tolerant to water logging   |
| 28                        | CoH 92201 (Haryana 92)      | 2001                           | S.O. 92 (E)              | -do-  | Early  | 70.0              | 18.2        | MR to red rot, tolerant to GSD & smut, tolerant to drought condition   |
| 29                        | CoS 95255 (Rachna)          | 2004                           | S.O. 642 (E)             | -do-  | Early  | 70.5              | 17.5        | MR to red rot, excellent ratooner  |
| 30                        | CoS 94270 (Sweta)           | 2005                           | S.O. 122 (E)             | -do-  | Mid-late   | 81.0              | 17.2        | MR to red rot, excellent ratooner  |
| 31                        | CoH 119 (Haryana Ganna 119) | 2007                           | S.O. 1566 (E)            | -do-  | Mid-late   | 82.8              | 17.5        | MR to red rot and tolerant to moisture stress, sodicity. Resistance to GSD, smut & tolerant to top borer, moderately tol. to shoot borer |
| 32                        | Co 98014 (Karan 1)          | 2007                           | S.O. 122 (E)             | -do-  | Early  | 76.3              | 17.6        | MR to red rot, tolerant to drought & water logging, suitable for co-generation   |
| 33                        | CoS 96268 (Mithas)          | 2007                           | S.O. 1178 (E)            | -do-  | Early  | 91.90             | 17.9        | MR to red rot, good ratooner   |
| 34                        | CoPant 97222                | 2007                           | S.O. 122 (E)             | -do-  | Mid-late   | 88.2              | 18.2        | MR to red rot, tolerant to drought, water logging & salinity   |
| 35                        | CoJ 89 (CoJ 20193)          | 2007                           | S.O. 1178 (E)            | -do-  | Mid-late   | 75.9              | 17.9        | MR to red rot, suitable for late crushing and co-generation, good jaggery quality  |
| 36                        | CoS 96275 (Sweety)          | 2007                           | S.O. 1178 (E)            | -do-  | Mid-late   | 80.8              | 17.3        | MR to red rot, good ratooner   |
| 37                        | Co 0118 (Karan 2)           | 2009                           | S.O. 449 (E)             | -do-  | Early  | 78.2              | 18.45       | MR to red rot, tolerant to water stress & water logging  |
| 38                        | Co 0238 (Karan 4)           | 2009                           | S.O. 454 (E)             | -do-  | Early  | 81.08             | 17.99       | MR to red rot, good ratoonability in winters, tolerant to water stress & water logging   |
| 39                        | Co 124 (Karan 5)            | 2010                           | S.O. 2137 (E)            | -do-  | Mid-late   | 75.71             | 18.22       | MR to red rot, tolerant to water stress & water logging  |

| S. N. | Name of Variety             | Year of release & Notification | Gazette notification no- | State (s) for which recommended               | Key characteristics (like duration, yield level, Quality characteristics etc.) |                   |             |  |
|-------|-----------------------------|--------------------------------|--------------------------|---|--|-------------------|-------------|--|
|       |                             |                                |                          |   | Maturity   | Cane yield (t/ha) | sucrose (%) | Salient features   |
| 40    | Co 0239 (Karan 6)           | 2010                           | S.O. 2137 (E)            | Pun. Har. Raj., Central & Western U.P. and UK | Early  | 79.23             | 18.58       | MR to red rot, tolerant to water stress & water logging                                      |
| 41    | CoH 128                     | 2012                           | S.O. 456 (E)             | -do-  | Mid-late   | 76.23             | 17.70       | MR to red rot, tolerant to top & early shoot borers  |
| 42    | Co 0237 (Karan 8)           | 2012                           | S.O. 2125 (E)            | -do-  | Early  | 71.33             | 18.78       | MR to red rot, tolerant to water logging, good ratooner                                      |
| 43    | Co 05011 (Karan 9)          | 2012                           | S.O. 1708 (E)            | -do-  | Mid-late   | 82.47             | 18.00       | MR to red rot & wilt, suitable for harvesting in winter                                      |
| 44    | CoPK 05191 (Pratap Ganna 1) | 2013                           | S.O. 312 (E)             | -do-  | Early  | 81.12             | 17.06       | MR to red rot, tolerant to drought & water logging, good ratooner                            |
| 45    | Co 05009                    | 2013                           | S.O. 2817 (E)            | -do-  | Early  | 75.89             | 17.44       | MR to red rot, tolerant to water logging and low temperature                                 |
| 46    | Co 09022 (Karan 12)         | 2017                           | S.O. 2805 (E)            | -do-  | Mid-late   | 83.56             | 17.49       | MR to red rot, suitable for water logging condition  |
| 47    | CoLk 9204 (Ikshu 3)         | 2017                           | S.O. 1379 (E)            | -do-  | Mid-late   | 82.80             | 17.00       | R-MR to red rot & smut and LS to major insect-pests, excellent under water logging condition |
| 48    | CoLK 09204 (Ikshu- 3)       | 2018                           | S.O. 1379 (E)            | -do-  | Mid-late   | 82.8              | 17.00       |  |

| S. N.                     | Name of Variety       | Year of release & Notification | Gazette notification no. | State (s) for which recommended    | Key characteristics (like duration, yield level, Quality characteristics etc.) |                   |             |   |
|---------------------------|-----------------------|--------------------------------|--------------------------|------------------------------------|--|-------------------|-------------|---|
|                           |                       |                                |                          |                                    | Maturity   | Cane yield (t/ha) | sucrose (%) | Salient features  |
| <b>North Eastern Zone</b> |                       |                                |                          |                                    |  |                   |             |   |
| 50                        | Co 87263 (Sarayu)     | 2000                           | S.O. 821 (E)             | Eastern U.P., Bihar, W.B., Jha.    | Early  | 66.3              | 17.4        | MR to red rot, smut, tolerant to shoot borer, drought & water logging                           |
| 51                        | Co 87268 (Moti)       | 2000                           | S.O. 821 (E)             | -do-                               | Early  | 85.0              | 17.5        | MR to red rot, R to smut, tolerant to Suitable for drought & water logging condition            |
| 52                        | Co 89029 (Gandak)     | 2001                           | S.O. 1134 (E)            | -do-                               | Early  | 70.6              | 16.3        | MR to red rot, smut, tolerant to top borer and shoot borer, tolerant to drought & water logging |
| 53                        | BO 128 (Pramod)       | 2001                           | S.O. 92 (E)              | -do-                               | Mid-late   | 69.6              | 17.6        | MR to red rot, wilt & smut, tolerant to water logging & salinity                                |
| 54                        | CoSe 95422 (Rasbhari) | 2001                           | S.O. 1134 (E)            | -do-                               | Early  | 67.8              | 17.7        | MR to red rot, Suitable for normal irrigated condition  |
| 55                        | CoSe 92423 (Rajbhog)  | 2001                           | S.O. 1134 (E)            | -do-                               | Mid-late   | 70.1              | 17.5        | MR to red rot, excellent ratooner   |
| 56                        | CoSe 96234 (Rashmi)   | 2004                           | S.O. 624 (E)             | -do-                               | Early  | 64.1              | 17.9        | MR to red rot, non-loding, suitable for autumn, spring, early and late sown condition           |
| 57                        | CoSe 96436 (Jalpari)  | 2004                           | S.O. 624 (E)             | -do-                               | Mid-late   | 67.1              | 17.7        | MR to red rot, tolerant to water logging  |
| 58                        | CoLk 94184 (Birendra) | 2008                           | S.O. 2458 (E)            | -do-                               | Early  | 76.0              | 18.0        | MR to red rot, tolerant to drought & water logging  |
| 59                        | Co 0232 (Kamal)       | 2009                           | S.O. 454 (E)             | -do-                               | Early  | 67.82             | 16.51       | MR to red rot, tolerant to top borer, water logging & early drought                             |
| 60                        | Co 0233 (Kosi)        | 2009                           | S.O. 454 (E)             | -do-                               | Mid-late   | 67.77             | 17.54       | MR to red rot, tolerant to top borer, water logging & early drought                             |
| 61                        | CoSe 01421 (Imarti)   | 2013                           | S.O. 2817 (E)            | -do-                               | Early  | 65.87             | 17.36       | MR to red rot, smut & wilt, good ratooner   |
| 62                        | CoP 06436 (CoP 2061)  | 2015                           | S.O. 268 (E)             | -do-                               | Mid-late   | 74.25             | 17.35       | MR to red rot, smut & wilt good ratooner & tolerant to lodging                                  |
| 63                        | CoLk 12207 Ikshu 6    | 2019                           | S.O. 3220 (E)            | UP, Bihar, W.B., Jharkhand & Assam | Mid-late   | 91.50             | 16.90       | R to MR reaction to red rot & smut. Good performance under moisture stress condition.           |
| 64                        | CoLk 12209 Ikshu 7    | 2019                           | -do-                     | -do-                               | Mid-late   | 81.97             | 18.41       | R to MR reaction to red rot & smut. Good performance under moisture stress condition.           |

| S. N. | Name of Variety          | Year of release & Notification | Gazette notification no. | State(s) for which recommended | Key characteristics (like duration, yield level, Quality characteristics etc.) |  |             |   |
|-------|--------------------------|--------------------------------|--------------------------|--------------------------------|--|--|-------------|---|
|       |                          |                                |                          |                                | Maturity   | Cane yield (t/ha)                                    | sucrose (%) | Salient features  |
| 63    | Co 0232                  | 2009                           | S.O. 454 (E)             | Assam                          | Early  | 67.82  | 16.51       | MR to red rot, tolerant to top borer, water logging & early drought                       |
| 64    | Co 0233                  | 2009                           | S.O. 454 (E)             | -do-                           | Mid-late   | 67.77  | 17.54       | MR to red rot, tolerant to top borer, water logging & early drought                       |
| 65    | Co P 06436 (Co P 2061)   | 2015                           | S.O. 268 (E)             | -do-                           | Mid-late   | 74.25  | 17.35       | MR to red rot, smut & wilt  |
| 66    | Co Pb 09181 (CoPb 91)    | 2016                           | S.O. 3540 (E)            | Punjab                         |  | 102  | 17.00       | Tolerant to red rot, good ratooner  |
| 67    | Co N 03131               | 2016                           | S.O. 3540 (E)            | Gujarat                        | Early  | 147  | 18.50       | For south Gujarat   |
| 68    | Co N 04131               | 2016                           | S.O. 3540 (E)            | -do-                           |  | 135  | 18.13       | MR to Red rot & less susceptible to smut  |
| 69    | Co N 07072               | 2016                           | S.O. 3540 (E)            | -do-                           |  | 136  | 18.50       | MR to Red rot & less susceptible to smut  |
| 70    | Co N 09072               | 2017                           | S.O. 2805 (E)            | Gujarat                        | Early  | 129  | 18.00       | MR to Red rot & wilt, non lodging   |
| 71    | Co C 25                  | 2018                           | S.O. 399 (E)             | TN                             | Early  | 145  |             | MR to Red rot & less susceptible to shoot borer, good ratooner                            |
| 72    | Co VC 99463              | 2018                           | S.O. 1379 (E)            | Karnataka                      | Mid-late   | 170  |             | Drought tolerant, good rationing ability  |
| 73    | VSI 12121 (VSI 08005)    | 2019                           | SO. 3220                 | Maharashtra                    | Mid-late   | Adsali- 162.16<br>Pre-season- 148.49<br>Suru- 133.19 |             | Tolerant to drought, good ratooner, moderate resistant to red-rot and wilt diseases.      |
| 74    | Ranga (CoV 15356)        | 2019                           | -do-                     | Andhra Pradesh                 | Early  | 120-130  |             | moderately resistant to red rot and smut  |
| 75    | Swarna mukhi (CoT 10367) | 2019                           | -do-                     | -do                            | Early  | 110  |             | Good ratooner. Resistant to Red rot, wilt, smut and Pokkah boieng. Susceptible to Borers. |

**MR – Moderate Resistant, R- Resistant**

### Sugarcane varieties tolerant to drought, water logging and salinity Developed in India

|          |   |  |
|----------|---|--|
| Drought  | Punjab, Haryana, Rajasthan, Central & Western Uttar Pradesh and Uttarakhand   | CoPk 05191, Co 0239, Co 0239, Co Pant 90223, Co 98014, Co Pant 97222   |
|          | Eastern U.P., Bihar and West Bengal   | CoLK 94184, Co 87268, Co 87263, Co 89029, Co 0232, Co 0233   |
|          | Coastal Tamil Nadu & Andhra Pradesh and Odisha  | CoOr 03151   |
|          | Gujarat, Maharashtra, Karnataka, Kerala, Interior of Tamil Nadu & Andhra Pradesh, Madhya Pradesh and Chhattisgarh                                     | Co 86032, Co 87025, Co 8371, Co 91010, Co 94008, Co 99004, Co 2001-13, Co 2001-15, Co 0218, Co 0403 and Co 88121 |
| Salinity | BO 91, BO 99, BO 102, BO 104, BO 128, BO 109, CoS 767, Co 1148, Co 8347, Co 8371, CoC 671, Co 89010, Co 94008, Co 94012, Co 97008, Co 99004, CoM 0265 |  |

### Sugarcane varieties tolerant to water logging:

| Zone               | Early varieties                                    | Midlate varieties   |
|--------------------|--|---|
| North West Zone    | Co 98014, Co 0118, Co 0239, Co 0237 and CoPk 05191 | Co Pant 90223, CoPant 97222 and Co 0124, Co 87263, Co 87268, BO 128, CoSe 96436 |
| North Central Zone | Co 89029 and CoLk 94184                            | Co 0232 and Co 0233   |
| East Coast Zone    | CoOr 03151   | Co 86249  |
| Peninsular Zone    | -  | Co 87025 Co 8371 and CoSnk 05104  |

### Promising sugarcane varieties for Jaggery (Gur) making:

| Zone               | Sugarcane varieties                                     |
|--------------------|---|
| North West Zone    | CoJ 64, CoS 767, Co 6304 & Co 7717                      |
| North Central Zone | CoS 767 & BO 91   |
| East Coast Zone    | CoC 671, Co 7219 & Co 6304                              |
| Peninsular Zone    | Co 62175, Co 7219, Co 86032, Co 8021, Co 6304 & Co 6907 |

## Annexure IV

### Variety wise Area under sugarcane

#### A. Andhra Pradesh

| Sl.No. | Name of Variety | Year of release | 2016-17      | 2017-18      | 2018-19      | (Area in ha) |
|--------|-----------------|-----------------|--------------|--------------|--------------|--------------|
| 1      | 81V48           |                 | 316          | 420          | 42           |              |
| 2      | Co 7805         |                 | 3350         | 3164         | 1305         |              |
| 3      | Co 86032        | 2000            | 305          | 321          | 223          |              |
| 4      | 91V83           |                 | 1101         | 708          | 340          |              |
| 5      | 2003V46         |                 | 28284        | 29359        | 31649        |              |
| 6      | 87A380          |                 | 672          | 742          | 237          |              |
| 7      | 86V96           |                 | 2877         | 2587         | 1377         |              |
| 8      | 87A298          |                 | 31801        | 27951        | 28040        |              |
| 9      | S 16            |                 | 865          | 602          | 267          |              |
| 10     | Co8014          |                 | 230          | 588          | 263          |              |
| 11     | Others          |                 | 6148         | 8328         | 5707         |              |
|        |                 | <b>Total</b>    | <b>75949</b> | <b>74771</b> | <b>69450</b> |              |

#### B. Assam

| Sl.No. | Name of Variety | Year of release | 2016-17      | 2017-18      | 2018-19      | (Area in ha) |
|--------|-----------------|-----------------|--------------|--------------|--------------|--------------|
| 1      | Adhagathiya     |                 | 2589         | 2593         | 2923         |              |
| 2      | Khaberi joba    |                 | 865          | 887          | 915          |              |
| 3      | Kolong          |                 | 3245         | 3267         | 3498         |              |
| 4      | Seni Joba       |                 | 967          | 983          | 1125         |              |
| 5      | Borak           |                 | 3879         | 3885         | 4224         |              |
| 6      | Co 313          | 1932            | 1688         | 1735         | 1912         |              |
| 7      | Co 997          | 1967            | 1953         | 1992         | 2175         |              |
| 8      | Dhanshiri       |                 | 3834         | 3864         | 4123         |              |
| 9      | Co JOR 2        |                 | 939          | 965          | 1269         |              |
| 10     | CoBln 02173     |                 | 1187         | 1197         | 1496         |              |
| 11     | CoBln 94063     |                 | 3952         | 3981         | 4546         |              |
| 12     | CoBln 9006      |                 | 3553         | 3567         | 3597         |              |
| 13     | Kopilipar       |                 | 2732         | 2782         | 3197         |              |
|        |                 | <b>Total</b>    | <b>31383</b> | <b>31698</b> | <b>35000</b> |              |

## C. Bihar

(Area in ha)

| Sl.No. | Name of Variety | Year of release | 2015-16 | 2016-17 | 2017-18 |
|--------|-----------------|-----------------|---------|---------|---------|
| 1      | BO130           | 1997            | 431     | 0       | 3       |
| 2      | BO 139          | 2005            | 746     | 573     | 527     |
| 3      | BO 141          | 2006            | 2045    | 2588    | 2187    |
| 4      | BO 144          |                 | 326     | 375     | 79      |
| 5      | BO 146          | 2009            | 0       | 0       | 79      |
| 6      | CoP 9301        | 1196            | 7232    | 6378    | 6672    |
| 7      | CoSe 95436      | 1998            | 0       | 0       | 128     |
| 8      | CoSe 98231      | 1999            | 1035    | 966     | 689     |
| 9      | CoS 8436        | 1987            | 2541    | 3241    | 2918    |
| 10     | CoS 88230       | 1991            | 128     | 246     | 87      |
| 11     | CoS 96268       | 1999            | 0       | 0       | 36      |
| 12     | BO 138          | 2003            | 84      | 1       | 16      |
| 13     | BO 110          | 1988            | 36949   | 30723   | 27766   |
| 14     | BO 128          | 1993            | 75      | 8       | 18      |
| 15     | BO 136          | 2002            | 17      | 0       | 14      |
| 16     | BO 137          | 2002            | 1640    | 1220    | 385     |
| 17     | BO 147          | 2005            | 10666   | 9635    | 7815    |
| 18     | CoP 9206        | 1994            | 3086    | 2097    | 2758    |
| 19     | CoP 9302        | 1996            | 408     | 751     | 1443    |
| 20     | CoS 767         | 1982            | 7398    | 6034    | 4364    |
| 21     | CoSe 95422      | 2001            | 677     | 535     | 603     |
| 22     | CoS 8432        | 1987            | 933     | 933     | 839     |
| 23     | CoLk 8102       | 1990            | 34      | 24      | 27      |
| 24     | CoSe 92423      | 1993            | 11465   | 11165   | 6074    |
| 25     | Co 97264        | 1999            | 27      | 0       | 25      |
| 26     | CoS 91269       | 1992            | 5976    | 4540    | 2316    |
| 27     | CoJ 88          |                 | 764     | 767     | 646     |
| 28     | CoJ 85          |                 | 265     | 484     | 366     |
| 29     | BO 91           | 1983            | 29431   | 20920   | 20565   |
| 30     | BO 150          |                 | 3891    | 4822    | 6252    |
| 31     | BO 153          | 2011            | 148     | 194     | 263     |
| 32     | Co 0232         | 2009            | 3602    | 5159    | 5410    |
| 33     | Co 0233         | 2009            | 16413   | 21805   | 33067   |
| 34     | Co 0235         |                 | 12813   | 6049    | 5367    |
| 35     | Co 0238         | 2009            | 19279   | 33593   | 57961   |
| 36     | Co0239          | 2010            | 792     | 759     | 227     |
| 37     | Co 0118         | 2009            | 2820    | 4425    | 2877    |
| 38     | Co 98014        | 2007            | 759     | 539     | 861     |
| 39     | Co 94211        |                 | 485     | 700     | 842     |
| 40     | CoP 2061        | 2011            | 624     | 1444    | 4963    |
| 41     | CoP 84212       |                 | 3       | 3       | 2       |
| 42     | CoLk 94184      | 2008            | 1330    | 4213    | 2846    |
| 43     | Others          |                 | 19824   | 22365   | 19449   |
|        |                 | Total           | 207164  | 210274  | 229830  |

#### D. Chhattisgarh

(Area in ha)

| Sl.No. | Name of Variety | Year of release | 2016-17      | 2017-18      | 2018-19      |
|--------|-----------------|-----------------|--------------|--------------|--------------|
| 1      | Co 8201         |                 | 169          | 121          | 108          |
| 2      | Co 62171        |                 | 2770         | 3134         | 1916         |
| 3      | Co 62175        |                 | 3748         | 3334         | 3849         |
| 4      | Co 86032        | 2000            | 12149        | 12827        | 12969        |
| 7      | Co 419          |                 | 128          | 148          | 167          |
| 8      | Co 205          |                 | 11           | 9            | 12           |
| 10     | Co 271          |                 | 0            | 35           | 135          |
| 11     | CoJ 85          |                 | 939          | 1343         | 1126         |
| 12     | Co 527          |                 | 540          | 565          | 565          |
| 13     | Co 8036         |                 | 3651         | 3082         | 5900         |
| 14     | CoM 265         | 2009            | 6451         | 7790         | 7231         |
| 15     | Others          |                 | 4042         | 3769         | 5709         |
| 16     | <b>Total</b>    |                 | <b>34598</b> | <b>36157</b> | <b>39687</b> |

#### E. Gujarat

(Area in ha)

| Sl.No. | Name of Variety   | Year of release | 2015-16       | 2016-17       | 2017-18       |
|--------|-------------------|-----------------|---------------|---------------|---------------|
| 1      | CoC 671           | 1982            | 1646          | 2055          | 2225          |
| 2      | Co 86032          | 2000            | 23489         | 30839         | 17720         |
| 3      | CoSi 95071        |                 | 6482          | 11091         | 8331          |
| 4      | Co 97009 (MC 707) |                 | 9548          | 9271          | 7675          |
| 5      | Co 86002          |                 | 18876         | 26976         | 12322         |
| 6      | Co 8338           | 1198            | 0             | 157           | 124           |
| 7      | Co 86249          |                 | 2230          | 1674          | 812           |
| 8      | Co 99004          | 2007            | 914           | 523           | 462           |
| 9      | CoN 91132         | 1996            | 592           | 250           | 162           |
| 10     | CoN 05071         | 2012            | 21933         | 21128         | 7734          |
| 11     | CoN 05072         | 2007            | 777           | 1496          | 2102          |
| 12     | CoN 04131         | 2011            | 150           | 207           | 72            |
| 13     | CoN 07072         | 2013            | 3147          | 15443         | 3433          |
| 14     | CoM 0265          | 2009            | 22229         | 42445         | 42830         |
| 15     | CoN 13073         | 2016            | 0             | 371           | 624           |
| 16     | Co 0238           | 2009            | 0             | 339           | 1110          |
| 17     | Co 985117         |                 | 0             | 7035          | 14395         |
| 18     | MS 10001          |                 | 0             | 3181          | 5243          |
| 19     | Others            |                 | 50            | 11275         | 10918         |
|        |                   | <b>Total</b>    | <b>112063</b> | <b>185756</b> | <b>138294</b> |

## F. Haryana

(Area in ha)

| Sl.No.             | Name of Variety | Year of release | 2016-17       | 2017-18       | 2018-19       |
|--------------------|-----------------|-----------------|---------------|---------------|---------------|
| <b>Early Group</b> |                 |                 |               |               |               |
| 1                  | CoJ 64          | 1982            | 150           | 101           | 6             |
| 2                  | CoJ 85          |                 | 10621         | 8232          | 24791         |
| 3                  | CoJ 83          |                 | 0             | 8             | 0             |
| 4                  | CoS 92          |                 | 11            | 4             | 101           |
| 5                  | CoS 56          |                 | 400           | 626           | 395           |
| 6                  | Co 89003        |                 | 16280         | 16102         | 16680         |
| 7                  | CoS 92268       |                 | 69            | 28            | 2258          |
| 8                  | Others          |                 |               | 38            | 76            |
| <b>New variety</b> |                 |                 |               |               |               |
| 9                  | Co 0238         | 2009            | 43734         | 61730         | 60825         |
| 10                 | Co 0239         | 2010            | 5792          | 3774          | 10648         |
| 11                 | Co 0118         | 2009            | 3684          | 4645          | 3475          |
| 12                 | CoH 160         |                 | 1523          | 3621          | 7470          |
| <b>Mid Group</b>   |                 |                 |               |               |               |
| 13                 | Co 7717         |                 | 153           | 97            | 186           |
| 14                 | CoH 99          |                 | 33            | 1             | 35            |
| 15                 | CoS 8436        | 1987            | 4178          | 1334          | 511           |
| 16                 | CoS 88230       | 1991            | 0             | 0             | 9             |
| 17                 | CoH 119         | 2007            | 21489         | 11962         | 6967          |
| 18                 | Others          |                 |               | 907           | 1069          |
| <b>New variety</b> |                 |                 |               |               |               |
| 19                 | CoJ 88          |                 | 380           | 102           | 52            |
| 20                 | CoH 152         |                 | 341           | 86            | 8             |
| 21                 | CoH 136         |                 | 0             | 5             | 0             |
| 22                 | CoH 133         |                 | 0             | 48            | 33            |
| <b>Late Group</b>  |                 |                 |               |               |               |
| 23                 | CoS 767         | 1982            | 839           | 333           | 245           |
| 24                 | Co 1148         | 1962            | 27            | 15            | 4             |
| 25                 | CoH 110         |                 | 30            | 0             | 0             |
| 26                 | CoS 8432        | 1987            | 16            | 4             | 11            |
| 27                 | CoP 84212       | 1998            | 330           | 115           | 35            |
| 28                 | Others          |                 | 920           | 82            | 110           |
|                    |                 | <b>Total</b>    | <b>110080</b> | <b>114000</b> | <b>136000</b> |

## G. Maharashtra

(Area in ha)

| Sl.No. | Name of Variety | Year of release | 2015-16 | 2016-17 | 2017-18 |
|--------|-----------------|-----------------|---------|---------|---------|
| 1      | Co 8014         |                 | 296     | 317     | 271     |
| 2      | CoC 671         | 1982            | 46380   | 14377   | 19122   |
| 3      | Co 86032        | 2000            | 521724  | 339615  | 474813  |
| 4      | VSI 434         |                 | 4539    | 2533    | 2616    |
| 5      | CoM 265         | 2007            | 297818  | 201856  | 292338  |

|   |             |              |               |               |               |
|---|-------------|--------------|---------------|---------------|---------------|
| 6 | Co VSI 9805 |              | 8684          | 5004          | 5863          |
| 7 | Co 92005    |              | 61774         | 48263         | 62418         |
| 8 | Others      |              | 45590         | 21408         | 44559         |
|   |             | <b>Total</b> | <b>986805</b> | <b>633373</b> | <b>902000</b> |

## H. Nagaland

(Area in ha)

| Sl.No. | Name of Variety | Year of release | 2017-18     | 2018-19     |
|--------|-----------------|-----------------|-------------|-------------|
| 1      | Co 170          |                 | 310         | 300         |
| 2      | CoA 71-1        |                 | 450         | 460         |
| 3      | CoA 7602        |                 | 350         | 360         |
| 4      | Co 9104         |                 | 180         | 200         |
| 5      | Co 997          | 1967            | 190         | 170         |
| 6      | Co Bln 9605     | 1997            | 120         | 110         |
| 7      | Co 909          |                 | 200         | 180         |
| 8      | Co 9103         |                 | 97          | 98          |
| 9      | Co 9101         |                 | 380         | 280         |
| 10     | LOCAL           |                 | 1280        | 2340        |
|        |                 | <b>Total</b>    | <b>3560</b> | <b>4500</b> |

## I. Punjab

(Area in ha)

| Sl.No.                 | Name of Variety    | Year of release | 2014-15      | 2015-16       | 2016-17      |
|------------------------|--------------------|-----------------|--------------|---------------|--------------|
| <b>Early Varieties</b> |                    |                 |              |               |              |
| 1                      | CoJ 64             | 1982            | 302          | 355           | 359          |
| 2                      | CoJ 83             |                 | 701          | 3693          | 268          |
| 3                      | CoJ 85             |                 | 13643        | 12034         | 9872         |
|                        |                    | <b>Total</b>    | <b>14647</b> | <b>16082</b>  | <b>10499</b> |
| <b>Mid Varieties</b>   |                    |                 |              |               |              |
| 4                      | CoJ 88             |                 | 9395         | 7377          | 5095         |
| 5                      | CoS 8436           | 1987            | 6494         | 1694          | 175          |
| 6                      | CoH 119            |                 | 139          | 169           | 23           |
|                        |                    | <b>Total</b>    | <b>16029</b> | <b>9239</b>   | <b>5293</b>  |
| <b>Late Varieties</b>  |                    |                 |              |               |              |
| 9                      | Co 89              |                 | 75           | 0             | 26           |
| 10                     | Co 1148            | 1962            | 25           | 0             | 37           |
| 11                     | Co 89003           |                 | 11691        | 8761          | 12171        |
| 12                     | Co 0238            | 2009            | 49038        | 60018         | 59611        |
|                        |                    | <b>Total</b>    | <b>60828</b> | <b>68779</b>  | <b>71844</b> |
| 13                     | <b>Others</b>      |                 | <b>2868</b>  | <b>5899</b>   | <b>851</b>   |
|                        | <b>Grand Total</b> |                 | <b>94372</b> | <b>100000</b> | <b>88487</b> |

## J. Telangana

(Area in ha)

| Sl.No. | Name of Variety | Year of release | 2017-18      | 2018-19      |
|--------|-----------------|-----------------|--------------|--------------|
| 1      | 83A30           |                 | 238          | 34           |
| 2      | Co 8014         |                 | 2            | 355          |
| 3      | Co 86032        | 2000            | 18333        | 21996        |
| 4      | 2002V48         |                 | 54           | 46           |
| 5      | 87A298          |                 | 1383         | 1777         |
| 6      | 83R23           |                 | 27           | 123          |
| 7      | 87A380          |                 | 58           | 0            |
| 8      | 86V96           |                 | 0            | 59           |
| 9      | 93V297          |                 | 6289         | 8937         |
| 10     | 2003V46         |                 | 2359         | 4265         |
| 11     | 83V68           |                 | 148          | 0            |
| 12     | VSI 3102        |                 | 0            | 82           |
| 13     | 95020           |                 | 0            | 41           |
| 14     | 86V96           |                 | 89           | 0            |
| 15     | Others          |                 | 6420         | 1467         |
|        |                 | Total           | <b>35400</b> | <b>39182</b> |

## K. Uttar Pradesh

(Area in ha)

| Sl.No. | Name of Variety        | Year of release | 2016-17 | 2017-18 | 2018-19 |
|--------|------------------------|-----------------|---------|---------|---------|
| A      | <b>Early Varieties</b> |                 |         |         |         |
| 1      | CoJ 64                 | 1982            | 6573    | 3909    | 4262    |
| 2      | Co 0118                | 2009            | 18134   | 41244   | 69245   |
| 3      | Co 0232                | 2009            | 72      | 282     | 700     |
| 4      | Co 0237                | 2012            | 189     | 28      | 14424   |
| 5      | Co 0238                | 2009            | 728604  | 1208081 | 1928451 |
| 6      | Co 0239                | 2010            | 35616   | 44346   | 48801   |
| 7      | CoSe 01235             | 2003            | 1716    | 951     | 1735    |
| 8      | CoSe 03234             | 2008            | 5188    | 3914    | 2676    |
| 9      | CoS 03251              |                 | 243     | 331     | 336     |
| 10     | UP 05125               |                 | 1637    | 2889    | 3541    |
| 11     | CoS 08272              |                 | 1225    | 2341    | 5328    |
| 12     | CoLk 94184             | 2008            | 88174   | 144198  | 188306  |
| 13     | CoSe 95422             | 2000            | 5420    | 4528    | 4267    |
| 14     | Co 98014               | 2007            | 60178   | 64585   | 53911   |
| 15     | CoS 8436               | 1987            | 55672   | 34129   | 23051   |
| 16     | CoS 88230              | 1991            | 15424   | 9476    | 5265    |
| 17     | CoS 95255              | 2004            | 2433    | 1206    | 591     |
| 18     | CoS 96268              | 2007            | 3350    | 2581    | 1282    |
| 19     | CoS 98231              | 1999            | 17548   | 10431   | 5582    |
| 20     | CoSe 01421             | 2013            | 0       | 30      | 252     |
| 21     | Co 05009               | 2013            | 0       | 33      | 70      |
| 22     | CoPk 05191             | 2013            | 0       | 2549    | 8410    |

|          |                               |                           |                |                |                |
|----------|-------------------------------|---------------------------|----------------|----------------|----------------|
| 23       | CoLk 9709                     |                           | 27             | 107            | 34             |
| 24       | CoS 13231                     |                           | 0              | 0              | 31             |
| 25       | Co 89029                      | 2001                      | 1              | 0              | 715            |
| 26       | Others                        |                           | 37621          | 37703          | 27823          |
|          |                               | <b>Total</b>              | <b>1085045</b> | <b>1619872</b> | <b>2399089</b> |
| <b>B</b> | <b>Mid and Late varieties</b> |                           |                |                |                |
|          | <b>Suitable</b>               |                           |                |                |                |
| 1        | UP 39                         |                           | 5680           | 3595           | 1432           |
| 2        | UP 0097                       | 2003                      | 11700          | 6787           | 2107           |
| 3        | CoH 119                       | 2005                      | 1830           | 1233           | 602            |
| 4        | Co 0124                       | 2010                      | 3146           | 25             | 23             |
| 5        | Co 0233                       | 2009                      | 31074          | 21816          | 9732           |
| 6        | CoS 767                       | 1982                      | 231574         | 115653         | 42373          |
| 7        | CoSe 01434                    | 2009                      | 112742         | 106645         | 69617          |
| 8        | Co 05011                      | 2012                      | 1649           | 3143           | 4756           |
| 9        | CoS 07250                     | 2009                      | 22583          | 13970          | 6468           |
| 10       | CoS 8432                      | 1987                      | 31601          | 13825          | 6009           |
| 11       | CoP 84212                     |                           | 17376          | 4593           | 1168           |
| 12       | CoS 94257                     | 1995                      | 3869           | 2258           | 925            |
| 13       | CoS 96269                     | 2004                      | 4073           | 3052           | 1921           |
| 14       | CoS 96275                     | 2003                      | 6236           | 5803           | 4235           |
| 15       | CoPant 97222                  | 2007                      | 2002           | 1578           | 760            |
| 16       | CoS 97261                     | 2003                      | 28204          | 24059          | 12797          |
| 17       | CoS 97264                     | 1999                      | 62417          | 40711          | 19985          |
| 18       | CoS 98259                     | 2008                      | 1971           | 1130           | 4253           |
| 19       | CoS 99259                     | 2005                      | 14396          | 14613          | 9881           |
| 20       | Others                        |                           | 154230         | 155316         | 118291         |
|          |                               | <b>Total</b>              | <b>748353</b>  | <b>539805</b>  | <b>317335</b>  |
| <b>C</b> | <b>Water Logging</b>          |                           |                |                |                |
| 1        | UP 9530                       | 1996                      | 12412          | 8677           | 5514           |
| 2        | CoSe 96436                    | 2004                      | 6118           | 4635           | 3783           |
|          |                               | <b>Total</b>              | <b>18530</b>   | <b>13312</b>   | <b>9297</b>    |
|          | <b>Total Suitable</b>         |                           | <b>766883</b>  | <b>553117</b>  | <b>18594</b>   |
| <b>D</b> | <b>Unsuitable</b>             |                           |                |                |                |
| 1        | CoLk 8102                     | 1996                      | 681            | 433            | 103            |
| 2        | CoS 90260                     |                           | 202            | 362            | 1046           |
| 3        | BO 91                         | 1983                      | 1265           | 810            | 296            |
| 4        | CoS 1148                      |                           | 7186           | 4632           | 956            |
| 5        | CoS 91269                     | 1992                      | 59877          | 39174          | 15010          |
| 6        | CoS 92423                     | 1993                      | 102294         | 40754          | 12705          |
| 7        | CoSe 01424                    | 2008                      | 0              | 2753           | 1923           |
| 8        | Others                        |                           | 28237          | 29364          | 18143          |
|          |                               | <b>Total (Unsuitable)</b> | <b>199742</b>  | <b>118282</b>  | <b>50182</b>   |
|          | <b>Total (Mid late)</b>       |                           | <b>966625</b>  | <b>671399</b>  | <b>2785200</b> |
|          | <b>Grand Total</b>            |                           | <b>1194604</b> | <b>819045</b>  | <b>2835382</b> |

## L. Uttarakhand

(Area in ha)

| Sl.No.   | Name of Variety         | Year of release       | 2016-17      | 2017-18      | 2018-19      |
|----------|-------------------------|-----------------------|--------------|--------------|--------------|
| <b>A</b> | <b>Early Varieties</b>  |                       |              |              |              |
| 1        | CoS 8436                | 19987                 | 7724         | 4050         | 2035         |
| 2        | CoS 88230               | 1991                  | 5385         | 4534         | 3689         |
| 3        | CoS 96258               | 1998                  | 1            | 113          | 0            |
| 4        | CoS 96268               | 2007                  | 1340         | 1175         | 38           |
| 5        | Co 98014                | 2007                  |              | 1700         | 1792         |
| 6        | CoS 98247               |                       | 495          | 939          | 6            |
| 7        | CoPant 94211            |                       |              |              |              |
| 8        | CoJ 85                  |                       | 1719         | 1997         | 2253         |
| 9        | Co 0238                 | 2009                  | 14451        | 27708        | 55642        |
| 10       | CoPant 3220             |                       | 2550         | 1885         | 1461         |
| 11       | Co 0118                 | 2009                  | 282          | 752          | 1554         |
| 12       | Co 0239                 | 2010                  | 298          | 597          | 1096         |
| 13       | Co 119                  |                       | 0            | 19           | 11           |
| 14       | Other                   |                       | 1345         | 398          | 671          |
|          |                         | <b>Total</b>          | <b>35590</b> | <b>45867</b> | <b>70248</b> |
| <b>B</b> | <b>Mid Late variety</b> |                       |              |              |              |
| 1        | CoS 767                 | 1979                  | 21408        | 15594        | 6798         |
| 2        | CoPant 84212            | 1998                  | 534          | 314          | 184          |
| 3        | CoPant 90223            | 2000                  | 1915         | 1529         | 1002         |
| 4        | CoS 97264               | 1999                  | 6804         | 5200         | 3016         |
| 5        | CoSe 92423              | 2001                  | 371          | 280          | 147          |
| 6        | CoS 8432                | 1987                  | 1668         | 724          | 244          |
| 7        | CoS 94257               | 1995                  | 539          | 96           | 93           |
| 8        | CoPant 96219            |                       | 14           | 24           | 12           |
| 9        | UP 9530                 | 1996                  | 0            | 293          | 0            |
| 10       | CoSe 96436              | 2004                  | 297          | 72           | 6            |
| 11       | CoPant 97222            | 2007                  | 3243         | 2122         | 990          |
| 12       | CoPant 99214            |                       | 2862         | 1777         | 654          |
| 13       | CoJ 88                  |                       | 4737         | 8615         | 8129         |
| 14       | Co 0097                 |                       | 153          | 38           | 3            |
| 15       | HR 0150                 |                       |              | 1654         | 65           |
| 16       | Co Pant 5224            | 2012                  | 287          | 339          | 218          |
| 17       | Others Mid Late         |                       | 3450         | 1451         | 984          |
|          |                         | <b>Total Mid late</b> | <b>48282</b> | <b>40122</b> | <b>22545</b> |
| 18       | Rejected Varieties      |                       | 1030         | 0            | 0            |
|          | <b>Total</b>            |                       | <b>84902</b> | <b>85989</b> | <b>92793</b> |

**Annexure-V**

**Important growing / Planting and harvesting time of sugarcane in different States of India**

| Sl.<br>No. | State          | Time of sowing |                                      | Harvesting time                      |
|------------|----------------|----------------|--------------------------------------|--------------------------------------|
|            |                | <i>Adsali</i>  | <i>Eksali</i>                        |                                      |
| 1          | Andhra Pradesh | <i>Adsali</i>  | Aug.-Sept                            | March-April                          |
|            |                | <i>Eksali</i>  | Jan-Mar                              | December-April                       |
| 2          | Assam          | <i>Eksali</i>  | Jan-Mar                              | November-March                       |
| 3          | Bihar          | <i>Eksali</i>  | -Oct<br>-Feb-Mar                     | November-February<br>Nov. – April    |
| 4          | Gujarat        | <i>Eksali</i>  | -Jan-Feb<br>-Oct-Nov                 | Nov.-Dec.<br>Nov.-Dec.               |
| 5          | Haryana        | <i>Eksali</i>  | -Oct<br>-Feb-Mar                     | Nov. – Dec.<br>Dec. – April          |
| 6          | Karnataka      | <i>Adsali</i>  | Jul-Aug                              | Dec. – Jan.                          |
|            |                | <i>Eksali</i>  | -Oct-Nov<br>-Jan-Feb                 | April-May<br>Jan. – March            |
| 7          | Kerala         | <i>Eksali</i>  | Oct-Dec                              | August – March                       |
| 8          | Madhya Pradesh | <i>Eksali</i>  | -Oct-Nov<br>-Jan-Feb                 | Dec. – April<br>Jan- Feb.            |
| 9          | Maharashtra    | <i>Adsali</i>  | June-July                            | Nov. – Dec.                          |
|            |                | <i>Eksali</i>  | -Oct-Nov<br>-Jan-Feb                 | Jan. – Feb.<br>Feb.-March            |
| 10         | Orissa         | <i>Eksali</i>  | Jan-Mar                              | Dec.- May                            |
| 11         | Punjab         | <i>Eksali</i>  | Feb-Mar                              | Nov.-March                           |
| 12         | Rajasthan      | <i>Eksali</i>  | -Oct<br>-Feb-Mar                     | Nov.-March                           |
| 13         | Tamil Nadu     | <i>Eksali</i>  | -July-Sept<br>-Feb to March<br>& May | July-Sept.<br>-Feb to<br>March & May |
| 14         | Uttar Pradesh  | <i>Eksali</i>  | -End Sept-Oct<br>-Feb-Apr            | December<br>Dec. – May               |
| 15         | West Bengal    | <i>Eksali</i>  | Feb-Apr                              | Feb-Apr                              |

## SUGARCANE, SUGAR AND MOLASSES PRODUCTION AT A GLANCE

**STATEMENT SHOWING AREA, PRODUCTION AND YIELD OF SUGARCANE, FACTORIES IN OPERATION, DURATION, CAPACITY,  
CANE CRUSHED, SUGAR AND MOLASSES PRODUCTION & THEIR RECOVERY % CANE**

| Year    | Area under Sugarcane (000 ha.) | Production of sugarcane (000 tonnes) | Yield of cane per ha. (tones) | No. of factories in operation | Average duration days | Average capacity (tones/day) | Total cane crushed (000 tonnes) | Total Sugar produced (000 tonnes) | Recovery of sugar (% cane) | Molasses production (000 tonnes) | Molasses (% cane) |
|---------|--------------------------------|--------------------------------------|-------------------------------|-------------------------------|-----------------------|------------------------------|---------------------------------|-----------------------------------|----------------------------|----------------------------------|-------------------|
| 1930-31 | 1176                           | 36354                                | 30.90                         | 29                            | -                     | -                            | 1339                            | 120                               | 8.96                       | -                                | -                 |
| 1940-41 | 1617                           | 51978                                | 32.10                         | 148                           | 113                   | 750                          | 11492                           | 1113                              | 9.70                       | 431                              | 3.76              |
| 1950-51 | 1707                           | 54823                                | 32.10                         | 139                           | 101                   | 882                          | 11348                           | 1100                              | 9.99                       | 387                              | 3.60              |
| 1960-61 | 2415                           | 110001                               | 45.50                         | 174                           | 166                   | 1172                         | 31021                           | 3021                              | 9.74                       | 1210                             | 3.99              |
| 1970-71 | 2615                           | 126368                               | 48.30                         | 215                           | 139                   | 1394                         | 38205                           | 3740                              | 9.79                       | 1611                             | 4.22              |
| 1980-81 | 2667                           | 154248                               | 57.80                         | 315                           | 104                   | 1718                         | 51584                           | 5150                              | 9.98                       | 2126                             | 4.12              |
| 1990-91 | 3686                           | 241045                               | 65.40                         | 385                           | 166                   | 2088                         | 122338                          | 12047                             | 9.84                       | 5454                             | 4.45              |
| 2000-01 | 4316                           | 295956                               | 68.60                         | 436                           | 138                   | 3203                         | 176660                          | 18511                             | 10.48                      | 7820                             | 4.43              |
| 2001-02 | 4411                           | 297208                               | 67.40                         | 434                           | 138                   | 3285                         | 180346                          | 18528                             | 10.27                      | 8073                             | 4.48              |
| 2002-03 | 4520                           | 287383                               | 63.60                         | 453                           | 140                   | 3343                         | 194365                          | 20145                             | 10.36                      | 8879                             | 4.57              |
| 2003-04 | 3938                           | 233862                               | 59.40                         | 422                           | 99                    | 3493                         | 132511                          | 13546                             | 10.22                      | 5905                             | 4.46              |
| 2004-05 | 3662                           | 237088                               | 64.80                         | 400                           | 97                    | 3508                         | 124772                          | 12690                             | 10.17                      | 5513                             | 4.42              |
| 2005-06 | 4201                           | 281172                               | 66.90                         | 455                           | 125                   | 3619                         | 188672                          | 19267                             | 10.21                      | 8549                             | 4.53              |
| 2006-07 | 5151                           | 355520                               | 69.00                         | 504                           | 173                   | 3494                         | 279295                          | 28367                             | 10.16                      | 13111                            | 4.69              |
| 2007-08 | 5055                           | 348188                               | 68.90                         | 516                           | 149                   | 3546                         | 249906                          | 26357                             | 10.55                      | 11313                            | 4.53              |
| 2008-09 | 4415                           | 285029                               | 64.60                         | 489                           | 87                    | 3718                         | 144983                          | 14539                             | 10.03                      | 6546                             | 4.51              |
| 2009-10 | 4175                           | 292302                               | 70.00                         | 490                           | 109                   | 3790                         | 185548                          | 18912                             | 10.19                      | 8400                             | 4.53              |
| 2010-11 | 4886                           | 342382                               | 70.10                         | 527                           | 135                   | 3677                         | 239807                          | 24394                             | 10.17                      | 10970                            | 4.57              |
| 2011-12 | 5038                           | 361037                               | 71.70                         | 529                           | 137                   | 3868                         | 256975                          | 26343                             | 10.25                      | 11824                            | 4.60              |
| 2012-13 | 4998                           | 341198                               | 68.30                         | 526                           | 127                   | 4092                         | 250598                          | 25141                             | 10.03                      | 11745                            | 4.69              |
| 2013-14 | 4993                           | 352141                               | 70.50                         | 513                           | 115                   | 4404                         | 238176                          | 24360                             | 10.23                      | 10850                            | 4.56              |
| 2014-15 | 5067                           | 362333                               | 71.50                         | 538                           | 133                   | 4163                         | 273073                          | 28313                             | 10.37                      | 12479                            | 4.57              |
| 2015-16 | 4927                           | 348448                               | 70.70                         | 526                           | 117                   | 4192                         | 236498                          | 25125                             | 10.62                      | 10885                            | 4.60              |
| 2016-17 | 4436                           | 306070                               | 69.00                         | 489                           | 100                   | 4315                         | 193434                          | 20262                             | 10.48                      | 9002                             | 4.65              |
| 2017-18 | 4732                           | 376905                               | 79.60                         | 525                           | 141                   | 4439                         | 301198                          | 32328                             | 10.73                      | 13980                            | 4.64              |

Source: Cooperative Sugar, Vol-51, No.6, February, 2020.

**Annexure-VII**

**STATEMENT SHOWING FACTORIES IN OPERATION, OPENING STOCKS, PRODUCTION,  
IMPORTS, CONSUMPTION AND EXPORTS OF SUGAR (Lakh Tonnes) DURING LAST 10 YEARS**

| <b>Season</b> | <b>No. of factories in operation</b> | <b>Carryover of sugar in the beginning of the season</b> | <b>Production during the year</b> | <b>Imports</b> | <b>Total available supply</b> | <b>Consumption</b> | <b>Exports</b> | <b>Closing stock of Sugar</b> |
|---------------|--------------------------------------|--|-----------------------------------|----------------|-------------------------------|--------------------|----------------|-------------------------------|
| 2008-09       | 489                                  | 94.10  | 145.39                            | 24.03          | 263.52                        | 229.12             | 1.65           | 32.75                         |
| 2009-10       | 490                                  | 32.75  | 189.12                            | 40.80          | 262.67                        | 213.28             | 2.35           | 47.04                         |
| 2010-11       | 527                                  | 47.04  | 243.94                            | -              | 290.98                        | 207.69             | 26.00          | 57.29                         |
| 2011-12       | 529                                  | 57.29  | 263.43                            | -              | 320.72                        | 220.00             | 33.90          | 66.82                         |
| 2012-13       | 526                                  | 66.82  | 251.41                            | 7.25           | 325.48                        | 230.00             | 3.48           | 92.00                         |
| 2013-14       | 513                                  | 92.00  | 243.60                            | 11.77          | 347.37                        | 244.27             | 27.82          | 75.28                         |
| 2014-15       | 538                                  | 75.28  | 283.13                            | 12.36          | 370.77                        | 256.55             | 23.02          | 91.20                         |
| 2015-16       | 526                                  | 91.20  | 251.25                            | -              | 342.45                        | 248.50             | 16.70          | 77.25                         |
| 2016-17       | 489                                  | 77.25  | 202.62                            | 4.48           | 284.35                        | 244.48             | 0.46           | 39.41                         |
| 2017-18       | 525                                  | 39.41  | 323.28                            | 2.24           | 364.93                        | 254.50             | 6.32           | 104.11                        |

**Source:** Source: Cooperative Sugar, Vol-51, No.6, February, 2020.

**Annexure-VIII**

**UTILIZATION OF SUGARCANE FOR DIFFERENT PURPOSES**

| <b>Year</b> | <b>Production of Sugarcane (000 tonnes)</b> | <b>Cane used for (000 tonnes)</b> |                                      |                          | <b>Percentage of sugarcane production utilized for</b> |                                      |                          |
|-------------|---|-----------------------------------|--------------------------------------|--------------------------|--|--------------------------------------|--------------------------|
|             |   | <b>Production of white sugar</b>  | <b>Seed, feed &amp; chewing etc.</b> | <b>Gur and Khandsari</b> | <b>Production of white sugar</b>                       | <b>Seed, feed &amp; chewing etc.</b> | <b>Gur and Khandsari</b> |
| 2000-01     | 295956                                      | 176660                            | 33930                                | 85366                    | 59.69  | 11.46                                | 28.84                    |
| 2001-02     | 297208                                      | 180346                            | 34724                                | 82138                    | 60.68  | 11.68                                | 27.64                    |
| 2002-03     | 287383                                      | 194365                            | 33524                                | 59494                    | 67.63  | 11.67                                | 20.70                    |
| 2003-04     | 233862                                      | 132511                            | 27830                                | 73521                    | 56.66  | 11.90                                | 31.44                    |
| 2004-05     | 237088                                      | 124772                            | 28213                                | 84103                    | 52.63  | 11.90                                | 35.47                    |
| 2005-06     | 281172                                      | 188672                            | 33459                                | 59041                    | 67.10  | 11.90                                | 21.00                    |
| 2006-07     | 355520                                      | 279295                            | 42307                                | 33918                    | 78.56  | 11.90                                | 09.54                    |
| 2007-08     | 348188                                      | 249906                            | 40525                                | 57757                    | 71.77  | 11.64                                | 16.59                    |
| 2008-09     | 285029                                      | 144983                            | 33833                                | 106213                   | 50.87  | 11.87                                | 37.26                    |
| 2009-10     | 292302                                      | 185548                            | 34784                                | 71970                    | 63.48  | 11.90                                | 24.62                    |
| 2010-11     | 342382                                      | 239807                            | 40743                                | 61832                    | 70.04  | 11.90                                | 18.06                    |
| 2011-12     | 361037                                      | 256975                            | 42928                                | 61134                    | 71.18  | 11.89                                | 16.93                    |
| 2012-13     | 341198                                      | 250598                            | 40337                                | 50263                    | 73.45  | 11.82                                | 14.73                    |
| 2013-14     | 352141                                      | 238176                            | 39299                                | 74666                    | 67.64  | 11.16                                | 21.20                    |
| 2014-15     | 362333                                      | 273073                            | 41500                                | 47760                    | 75.37  | 11.45                                | 13.18                    |
| 2015-16     | 348448                                      | 236498                            | 40500                                | 71450                    | 67.87  | 11.62                                | 20.51                    |
| 2016-17     | 306070                                      | 193434                            | 35886                                | 76750                    | 63.20  | 11.70                                | 25.07                    |
| 2017-18(P)  | 376905                                      | 301198                            | 33189                                | 42518                    | 79.91  | 08.80                                | 11.29                    |

**Source:** Source: Cooperative Sugar, Vol-51, No.6, February, 2020.

**Annexure-IX**

**STATE WISE UTILIZATION (%) OF SUGARCANE FOR SUGAR PRODUCTION IN MAJOR STATES**

| S. N. | State            | 2012-13      | 2013-14      | 2014-15      | 2015-16      | 2016-17      | 2017-18      |
|-------|------------------|--------------|--------------|--------------|--------------|--------------|--------------|
| 1     | Andhra Pradesh   | 65.68        | 65.59        | 45.73        | 63.02        | 52.41        | 62.80        |
| 2     | Bihar            | 38.78        | 54.16        | 40.64        | 40.71        | 37.05        | 53.37        |
| 3     | Gujarat          | 78.60        | 84.49        | 79.28        | 101.12       | 70.02        | 86.92        |
| 4     | Haryana          | 70.53        | 76.25        | 75.74        | 76.51        | 74.69        | 84.33        |
| 5     | Karnataka        | 93.25        | 99.40        | 106.56       | 99.68        | 88.85        | 121.61       |
| 6     | Madhya Pradesh   | 77.27        | 96.19        | 83.89        | 65.61        | 74.37        | 88.00        |
| 7     | Maharashtra      | 112.66       | 86.39        | 113.74       | 100.95       | 73.80        | 114.50       |
| 8     | Orissa           | 75.53        | 72.57        | 62.86        | 89.74        | 49.70        | 156.99       |
| 9     | Punjab           | 98.08        | 74.49        | 80.91        | 100.97       | 93.21        | 104.95       |
| 10    | Tamil Nadu       | 60.98        | 52.36        | 57.44        | 61.14        | 68.12        | 48.64        |
| 11    | Telangana        | @            | @            | @            | 106.36       | 51.79        | 97.09        |
| 12    | Uttar Pradesh    | 60.44        | 52.06        | 53.77        | 44.35        | 57.13        | 62.78        |
| 13    | Uttarakhand      | 54.97        | 54.24        | 57.42        | 48.20        | 54.13        | 64.90        |
|       | <b>All India</b> | <b>73.45</b> | <b>67.64</b> | <b>76.00</b> | <b>67.87</b> | <b>63.07</b> | <b>79.91</b> |

Source: Cooperative Sugar, Vol-51, No.5, January, 2020.

**Annexure-X**

**STATE WISE CANE CRUSHED (in '000 tonnes) BY SUGAR FACTORIES IN INDIA**

| S. N. | State            | 2008-09       | 2009-10       | 2010-11       | 2011-12       | 2012-13       | 2013-14       | 2014-15       | 2015-16       | 2016-17       | 2017-18       |
|-------|------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| 1.    | AP               | 5993          | 5547          | 10317         | 11588         | 10299         | 10091         | 6014          | 5894          | 4117          | 4992          |
| 2.    | Bihar            | 2370          | 2724          | 4141          | 4761          | 5716          | 6976          | 5743          | 5150          | 5711          | 7462          |
| 3.    | CG               | 150           | 110           | 267           | 435           | 517           | 771           | 787           | 608           | 502           | 1080          |
| 4.    | Goa              | 108           | 100           | 146           | 116           | 108           | 127           | 125           | 101           | 47            | 74            |
| 5.    | Gujarat          | 9445          | 11295         | 12360         | 9432          | 10493         | 10603         | 11148         | 11245         | 8368          | 10476         |
| 6.    | Haryana          | 2528          | 2648          | 4346          | 5430          | 5245          | 5718          | 5794          | 5120          | 6453          | 8124          |
| 7.    | Karnataka        | 16065         | 23977         | 33765         | 34753         | 33320         | 37679         | 44742         | 37714         | 20917         | 34370         |
| 8.    | MP               | 625           | 853           | 1700          | 1639          | 1944          | 3052          | 3968          | 3465          | 3518          | 4778          |
| 9.    | MS               | 40023         | 61390         | 80223         | 77063         | 70047         | 66434         | 93116         | 74383         | 37377         | 95189         |
| 10.   | Orissa           | 327           | 251           | 519           | 731           | 719           | 680           | 454           | 518           | 405           | 377           |
| 11.   | Pondicherry      | 166           | 224           | 546           | 720           | 632           | 608           | 359           | 68            | 66            | -             |
| 12.   | Punjab           | 2603          | 2112          | 3433          | 4271          | 4796          | 4972          | 5695          | 6671          | 6759          | 8421          |
| 13.   | Rajasthan        | 42            | 48            | 49            | 29            | 52            | 67            | 78            | 89            | 119           | 77            |
| 14.   | TN               | 16606         | 14328         | 20310         | 25455         | 21457         | 16992         | 14050         | 15586         | 11729         | 8043          |
| 15.   | UP               | 45482         | 56734         | 64381         | 76855         | 81506         | 70113         | 74454         | 64483         | 82717         | 111154        |
| 16.   | UK               | 2421          | 3174          | 3235          | 3641          | 3693          | 3222          | 3523          | 2837          | 3506          | 4091          |
| 17.   | WB               | 29            | 29            | 69            | 56            | 54            | 71            | 59            | 8             | 7             | 7             |
| 18.   | Telangana        | @             | @             | @             | @             | @             | @             | 3064          | 2558          | 1116          | 2483          |
|       | <b>All India</b> | <b>144983</b> | <b>185548</b> | <b>239807</b> | <b>256975</b> | <b>250598</b> | <b>238176</b> | <b>273173</b> | <b>236498</b> | <b>193434</b> | <b>301198</b> |

@ Included in Andhra Pradesh

Source: Cooperative Sugar, Vol-51, No.6, February, 2020.

## PER CAPITA CONSUMPTION OF SUGAR, GUR &amp; KHANDSARI

| Year    | Population in Million<br>(As on 1 <sup>st</sup> March) | Consumption<br>(lakh tonnes) |                     | Per capita<br>consumption<br>(kg/annum) |                     | Total per capita<br>consumption of<br>sugar, gur &<br>khandsari<br>(kg/ annum) |
|---------|--|------------------------------|---------------------|---|---------------------|--|
|         |  | Sugar                        | Gur &<br>Khandsari* | Sugar                                   | Gur &<br>Khandsari* |  |
| 1960-61 | 439  | 21.13                        | 66.87               | 4.8                                     | 15.2                | 20.0   |
| 1970-71 | 546  | 40.25                        | 74.37               | 7.4                                     | 13.6                | 21.0   |
| 1980-81 | 684  | 49.80                        | 85.22               | 7.3                                     | 12.5                | 19.8   |
| 1990-91 | 846  | 107.15                       | 90.71               | 12.7                                    | 10.7                | 23.4   |
| 2000-01 | 1029   | 162.00                       | 86.09               | 15.7                                    | 8.4                 | 24.1   |
| 2001-02 | 1043   | 167.81                       | 83.11               | 16.1                                    | 8.0                 | 24.1   |
| 2002-03 | 1060   | 183.84                       | 56.94               | 17.3                                    | 5.4                 | 22.7   |
| 2003-04 | 1077   | 172.85                       | 71.46               | 16.0                                    | 6.6                 | 22.6   |
| 2004-05 | 1093   | 185.00                       | 81.75               | 16.9                                    | 7.5                 | 24.4   |
| 2005-06 | 1106   | 185.00                       | 57.39               | 16.7                                    | 5.2                 | 21.9   |
| 2006-07 | 1122   | 199.00                       | 33.38               | 17.7                                    | 3.0                 | 20.7   |
| 2007-08 | 1138   | 219.00                       | 50.93               | 19.3                                    | 4.5                 | 23.7   |
| 2008-09 | 1154   | 229.12                       | 107.92              | 19.9                                    | 9.3                 | 29.2   |
| 2009-10 | 1170   | 213.28                       | 73.12               | 18.2                                    | 6.2                 | 24.4   |
| 2010-11 | 1186   | 207.69                       | 59.94               | 17.5                                    | 5.1                 | 22.6   |
| 2011-12 | 1202   | 220.00                       | 56.71               | 18.3                                    | 4.7                 | 23.0   |
| 2012-13 | 1218   | 230.00                       | 44.67               | 18.9                                    | 3.7                 | 22.6   |
| 2013-14 | 1238   | 244.27                       | 66.45               | 20.1                                    | 5.7                 | 25.8   |
| 2014-15 | 1254   | 256.55                       | 40.86               | 20.5                                    | 3.3                 | 23.8   |
| 2015-16 | 1270   | 248.50                       | 40.00               | 19.6                                    | 3.1                 | 22.7   |
| 2016-17 | 1301   | 244.48                       | 53.35               | 18.8                                    | 4.1                 | 22.9   |
| 2017-18 | 1317   | 254.50                       | 53.99               | 19.3                                    | 4.1                 | 23.4   |

\*The entire production is taken to be consumed internally

**Source:** Cooperative Sugar, Vol-51, No.6, February, 2020.

**Annexure XII**

**State wise number of sugar factories in operation in India**

| <b>Sl.<br/>No.</b> | <b>State</b>          | <b>2012-13</b> | <b>2013-14</b> | <b>2014-15</b> | <b>2015-16</b> | <b>2016-17</b> | <b>2017-18</b> |
|--------------------|-----------------------|----------------|----------------|----------------|----------------|----------------|----------------|
| 1.                 | Andhra Pradesh        | 36             | 34             | 22             | 19             | 18             | 18             |
| 2.                 | Assam                 | -              | -              | -              | -              | -              | -              |
| 3.                 | Bihar                 | 11             | 11             | 11             | 11             | 11             | 11             |
| 4.                 | Chhattisgarh          | 3              | 3              | 3              | 3              | 4              | 4              |
| 5.                 | Dadra Nagar<br>Haveli | -              | -              | -              | 1              | -              | -              |
| 6.                 | Goa                   | 1              | 1              | 1              | 1              | 1              | 1              |
| 7.                 | Gujarat               | 18             | 19             | 19             | 21             | 20             | 17             |
| 8.                 | Haryana               | 14             | 14             | 14             | 14             | 14             | 14             |
| 9.                 | Karnataka             | 60             | 61             | 65             | 64             | 61             | 65             |
| 10.                | Kerala                | -              | -              | -              | -              | -              | -              |
| 11.                | Madhya Pradesh        | 12             | 15             | 15             | 17             | 16             | 19             |
| 12.                | Maharashtra           | 172            | 159            | 184            | 180            | 152            | 186            |
| 13.                | Nagaland              | -              | 1              | -              | -              | -              | -              |
| 14.                | Orissa                | 5              | 5              | 3              | 3              | 3              | 2              |
| 15.                | Pondicherry           | 2              | 2              | 2              | 1              | 1              | -              |
| 16.                | Punjab                | 16             | 16             | 16             | 16             | 16             | 16             |
| 17.                | Rajasthan             | 1              | 1              | 1              | 1              | 1              | 1              |
| 18.                | Tamil Nadu            | 43             | 42             | 44             | 42             | 39             | 37             |
| 19.                | Telangana             | @              | @              | 10             | 7              | 7              | 7              |
| 20.                | Uttar Pradesh         | 122            | 119            | 118            | 117            | 116            | 119            |
| 21.                | Uttarakhand           | 9              | 9              | 9              | 8              | 8              | 7              |
| 22.                | West Bengal           | 1              | -              | 1              | 1              | 1              | 1              |
|                    | <b>All India</b>      | <b>529</b>     | <b>513</b>     | <b>538</b>     | <b>526</b>     | <b>489</b>     | <b>525</b>     |

@ Included in Andhra Pradesh

**Source:** Cooperative Sugar, Vol-51, No.6, February, 2020.

**Annexure XIII**

**State wise duration (in days) of crushing season for sugarcane in India**

| Sl. No. | State            | 2012-13    | 2013-14    | 2014-15    | 2015-16    | 2016-17    | 2017-18    |
|---------|------------------|------------|------------|------------|------------|------------|------------|
| 1       | Andhra Pradesh   | 101        | 101        | 93         | 104        | 81         | 101        |
| 2       | Bihar            | 117        | 126        | 100        | 95         | 106        | 129        |
| 3       | Chhattisgarh     | 85         | 120        | 119        | 90         | 60         | 122        |
| 4       | Goa              | 81         | 94         | 98         | 78         | 43         | 60         |
| 5       | Gujarat          | 145        | 147        | 154        | 139        | 103        | 151        |
| 6       | Haryana          | 136        | 152        | 143        | 136        | 168        | 205        |
| 7       | Karnataka        | 133        | 138        | 149        | 121        | 78         | 114        |
| 8       | Madhya Pradesh   | 89         | 122        | 119        | 92         | 100        | 114        |
| 9       | Maharashtra      | 123        | 126        | 145        | 114        | 70         | 139        |
| 10      | Odisha           | 80         | 80         | 74         | 77         | 70         | 86         |
| 11      | Pondicherry      | 185        | 177        | 103        | 56         | 54         | -          |
| 12      | Punjab           | 112        | 116        | 128        | 136        | 133        | 156        |
| 13      | Rajasthan        | 63         | 78         | 92         | 91         | 99         | 58         |
| 14      | Tamil Nadu       | 174        | 103        | 125        | 147        | 119        | 94         |
| 15      | Telangana        | @          | @          | 105        | 114        | 60         | 122        |
| 16      | Uttar Pradesh    | 129        | 121        | 125        | 111        | 139        | 179        |
| 17      | Uttarakhand      | 113        | 102        | 115        | 107        | 117        | 146        |
| 18      | West Bengal      | 53         | 74         | 71         | 9          | 19         | 8          |
|         | <b>All India</b> | <b>127</b> | <b>115</b> | <b>133</b> | <b>117</b> | <b>100</b> | <b>141</b> |

**Annexure XIV**

**STATE WISE AVERAGE SUGAR RECOVERY PERCENT CANE IN INDIA**

| Sl. No. | State            | 2013-14      | 2014-15      | 2015-16      | 2016-17      | 2017-18      | 2018-19      |
|---------|------------------|--------------|--------------|--------------|--------------|--------------|--------------|
| 1       | Andhra Pradesh   | 9.98         | 9.38         | 9.35         | 9.37         | 9.50         | 9.28         |
| 2       | Assam            | -            | -            | -            | -            | -            |              |
| 3       | Bihar            | 8.47         | 9.16         | 9.77         | 9.21         | 9.59         | 10.37        |
| 4       | Chhattisgarh     | 8.82         | 8.26         | 9.38         | 10.35        | 8.81         | 9.74         |
| 5       | Goa              | 9.45         | 8.80         | 9.90         | 8.38         | 7.92         | 7.50         |
| 6       | Gujarat          | 11.10        | 10.35        | 10.39        | 10.58        | 10.19        | 10.74        |
| 7       | Haryana          | 9.44         | 9.94         | 10.53        | 10.35        | 10.39        | 10.31        |
| 8       | Karnataka        | 11.09        | 11.03        | 10.74        | 10.25        | 10.64        | 10.79        |
| 9       | Madhya Pradesh   | 10.65        | 9.73         | 9.84         | 9.76         | 9.82         | 9.91         |
| 10      | Maharashtra      | 11.57        | 11.28        | 11.33        | 11.34        | 11.25        | 10.05        |
| 11      | Orissa           | 8.82         | 9.47         | 9.27         | 9.40         | 9.34         | 9.70         |
| 12      | Pondicherry      | 8.55         | 8.91         | 7.35         | 8.37         | -            | -            |
| 13      | Punjab           | 9.43         | 9.43         | 10.06        | 9.78         | 9.78         | 10.14        |
| 14      | Rajasthan        | 7.46         | 7.69         | 5.62         | 8.55         | 9.02         | 8.63         |
| 15      | Tamil Nadu       | 8.32         | 8.67         | 8.74         | 9.05         | 8.61         | 10.21        |
| 16      | Telengana        | @            | 10.51        | 10.85        | 10.38        | 10.84        | 8.67         |
| 17      | Uttar Pradesh    | 9.25         | 9.54         | 10.61        | 10.61        | 10.84        | 11.48        |
| 18.     | Uttarakhand      | 8.91         | 9.20         | 9.62         | 9.85         | 10.24        | 10.74        |
| 19.     | West Bengal      | 7.04         | 8.36         | 6.63         | 7.18         | 5.21         | -            |
|         | <b>All India</b> | <b>10.23</b> | <b>10.37</b> | <b>10.62</b> | <b>10.48</b> | <b>10.73</b> | <b>10.68</b> |

@ Included in Andhra Pradesh

Source: Cooperative Sugar, Vol-51, No.6, February, 2020.

**Annexure XV**

**STATE WISE & SECTOR WISE INSTALLED ANNUAL SUGAR PRODUCTION CAPACITY AND UTILISATION OF CAPACITY DURING LAST FIVE YEARS**

| Sl.<br>No. | State                 | 2013-14                        |                                      | 2014-15                        |                                   | 2015-16                        |                                      | 2016-17                        |  | 2017-18                        |                                   |
|------------|-----------------------|--------------------------------|--------------------------------------|--------------------------------|-----------------------------------|--------------------------------|--------------------------------------|--------------------------------|--|--------------------------------|-----------------------------------|
|            |                       | Capacity<br>(In lakh<br>tones) | Utilisation<br>of<br>capacity<br>(%) | Capacity<br>(In lakh<br>tones) | Utilisation<br>of capacity<br>(%) | Capacity<br>(In lakh<br>tones) | Utilisation<br>of<br>capacity<br>(%) | Capacity<br>(In lakh<br>tones) | Utilisati<br>on of<br>capaci<br>ty (%) | Capacity<br>(In lakh<br>tones) | Utilisation<br>of capacity<br>(%) |
| 1.         | Andhra<br>Pradesh     | 14.861                         | 67.76                                | 11.068                         | 51.00                             | 11.068                         | 49.80                                | 11.068                         | 34.78                                  | 11.068                         | 42.84                             |
| 2.         | Assam                 | -                              | -                                    | -                              | -                                 | -                              | -                                    | -                              | -                                      | -                              | -                                 |
| 3.         | Bihar                 | 6.171                          | 95.77                                | 6.171                          | 85.20                             | 6.171                          | 81.50                                | 6.171                          | 85.24                                  | 6.171                          | 115.99                            |
| 4.         | Chhattisgarh          | 0.687                          | 98.98                                | 0.687                          | 93.90                             | 0.687                          | 83.50                                | 0.687                          | 76.69                                  | 0.908                          | 104.84                            |
| 5.         | Dadra Nagar<br>Haveli | -                              | -                                    | -                              | -                                 | -                              | -                                    | -                              | -                                      | -                              | -                                 |
| 6.         | Goa                   | 0.118                          | 101.69                               | 0.118                          | 97.20                             | 0.118                          | 82.20                                | 0.118                          | 33.90                                  | 0.118                          | 49.44                             |
| 7.         | Gujrat                | 14.519                         | 81.07                                | 14.702                         | 78.50                             | 15.160                         | 77.00                                | 15.160                         | 58.38                                  | 15.160                         | 70.40                             |
| 8.         | Haryana               | 5.594                          | 96.53                                | 5.594                          | 102.90                            | 5.594                          | 96.30                                | 5.594                          | 119.4                                  | 5.594                          | 150.85                            |
| 9.         | Karnataka             | 41.458                         | 100.75                               | 42.404                         | 116.40                            | 42.956                         | 94.30                                | 44.848                         | 47.81                                  | 46.740                         | 78.26                             |
| 10.        | Kerala                | -                              | -                                    | -                              | -                                 | -                              | -                                    | -                              | -                                      | -                              | -                                 |
| 11.        | M.P                   | 3.505                          | 92.72                                | 3.505                          | 110.20                            | 3.505                          | 97.30                                | 3.747                          | 91.54                                  | 4.011                          | 116.94                            |
| 12.        | Maharashtra           | 100.774                        | 76.26                                | 105.837                        | 99.30                             | 109.655                        | 76.80                                | 111.979                        | 37.85                                  | 113.307                        | 94.48                             |
| 13.        | Orissa                | 0.903                          | 66.45                                | 0.903                          | 47.20                             | 0.903                          | 53.20                                | 0.903                          | 42.08                                  | 0.903                          | 38.99                             |
| 14.        | Pondicherry           | 0.464                          | 112.07                               | 0.464                          | 68.80                             | 0.464                          | 11.20                                | 0.464                          | 12.93                                  | 0.464                          | -                                 |
| 15.        | Punjab                | 5.734                          | 81.79                                | 5.734                          | 93.60                             | 5.734                          | 117.10                               | 5.734                          | 115.2                                  | 5.734                          | 143.65                            |
| 16.        | Rajasthan             | 0.233                          | 21.46                                | 0.233                          | 27.90                             | 0.233                          | 22.40                                | 0.233                          | 42.92                                  | 0.233                          | 29.95                             |
| 17.        | Tamil Nadu            | 28.610                         | 49.39                                | 28.610                         | 42.60                             | 28.610                         | 47.60                                | 28.610                         | 37.12                                  | 28.610                         | 24.20                             |
| 18.        | Telangana             | @                              | @                                    | 3.793                          | 84.90                             | 3.793                          | 73.20                                | 3.793                          | 30.58                                  | 3.793                          | 71.00                             |
| 19.        | Uttar Pradesh         | 94.688                         | 68.51                                | 94.688                         | 75.00                             | 94.688                         | 72.20                                | 94.688                         | 92.70                                  | 94.688                         | 127.22                            |
| 20.        | Uttarakhand           | 4.61                           | 62.26                                | 4.610                          | 70.40                             | 4.610                          | 59.10                                | 4.610                          | 74.84                                  | 4.610                          | 90.88                             |
| 21.        | West Bengal           | 0.187                          | 26.74                                | 0.187                          | 26.50                             | 0.187                          | 2.70                                 | 0.187                          | 5.35                                   | 0.187                          | 1.94                              |
|            | All India             | <b>323.116</b>                 | <b>75.39</b>                         | <b>329.306</b>                 | <b>86.00</b>                      | <b>334.134</b>                 | <b>75.20</b>                         | <b>338.594</b>                 | <b>59.84</b>                           | <b>342.299</b>                 | <b>94.44</b>                      |

**①** Included in Andhra Pradesh

Source: Cooperative Sugar, Vol-51, No.6, February, 2020.

**Annexure XVI**

**STATE WISE SUGAR PRODUCTION ('000 ton) DURING LAST 10 YEARS**

| <b>Sl.<br/>No</b> | <b>State</b>     | <b>2009-10</b> | <b>2010-11</b> | <b>2011-12</b> | <b>2012-13</b> | <b>2013-14</b> | <b>2014-15</b> | <b>2015-16</b> | <b>2016-17</b> | <b>2017-18</b> | <b>2018-19</b> |
|-------------------|------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| 1                 | AP               | 515            | 1006           | 1135           | 993            | 1007           | 564            | 551            | 385            | 474            | 490            |
| 2                 | Assam            | -              | -              | -              | -              | -              | -              | -              | -              | -              |                |
| 3                 | Bihar            | 258            | 385            | 450            | 506            | 591            | 526            | 503            | 526            | 716            | 840            |
| 4                 | Chhattisgarh     | 9              | 23             | 36             | 49             | 68             | 65             | 57             | 52             | 95             | 110            |
| 5                 | Goa              | 8              | 13             | 10             | 10             | 12             | 11             | 10             | 4              | 6              |                |
| 6                 | Gujarat          | 1189           | 1235           | 1000           | 1130           | 1177           | 1154           | 1168           | 885            | 1067           | 1370           |
| 7                 | Haryana          | 248            | 392            | 494            | 512            | 540            | 576            | 539            | 668            | 844            | 680            |
| 8                 | Karnataka        | 2558           | 3683           | 3872           | 3467           | 4177           | 4935           | 4049           | 2144           | 3658           | 4430           |
| 9                 | Kerala           | -              | -              | -              | -              | -              | -              | -              | -              | -              |                |
| 10                | MP               | 80             | 165            | 159            | 190            | 325            | 386            | 341            | 343            | 469            | 420            |
| 11                | Maharashtra      | 7067           | 9054           | 8977           | 7994           | 7685           | 10507          | 8424           | 4238           | 10705          | 10720          |
| 12                | Orissa           | 23             | 45             | 65             | 62             | 60             | 43             | 48             | 38             | 35             | 40             |
| 13                | Pondicherry      | 19             | 47             | 64             | 53             | 52             | 32             | 5              | 6              | -              |                |
| 14                | Punjab           | 181            | 302            | 390            | 438            | 469            | 537            | 671            | 661            | 824            | 790            |
| 15                | Rajasthan        | 4              | 4              | 2              | 4              | 5              | 6              | 5              | 10             | 7              | 10             |
| 16                | Tamilnadu        | 1280           | 1846           | 2379           | 1906           | 1413           | 1218           | 1362           | 1062           | 692            | 720            |
| 17                | Telangana        | @              | @              | @              | @              | @              | 322            | 277            | 116            | 269            | 260            |
| 18                | Uttar<br>Pradesh | 5179           | 5887           | 6974           | 7485           | 6487           | 7102           | 6841           | 8778           | 12046          | 11860          |
| 19                | Uttarakhand      | 292            | 302            | 331            | 337            | 287            | 324            | 273            | 345            | 419            | 390            |
| 20                | West Bengal      | 2              | 5              | 5              | 5              | 5              | 5              | 1              | 1              | -              |                |
|                   | <b>All India</b> | <b>18912</b>   | <b>24394</b>   | <b>26343</b>   | <b>25141</b>   | <b>24360</b>   | <b>28313</b>   | <b>25125</b>   | <b>20262</b>   | <b>32328</b>   | <b>33130</b>   |

@ Included in Andhra Pradesh

Source: Cooperative Sugar, Vol-51, No.6, February, 2020.

**Annexure-XVII**

**EXPORT- IMPORT OF SUGAR ON FINANCIAL YEAR BASIS FROM 2000-01 ONWARDS**

| <b>Financial year<br/>(April to March)</b> | <b>EXPORT</b>                |                                | <b>IMPORT</b>                |                               |
|--|------------------------------|--------------------------------|------------------------------|-------------------------------|
|  | <b>Quantity<br/>(Tonnes)</b> | <b>Value<br/>(Rs./ Crores)</b> | <b>Quantity<br/>(Tonnes)</b> | <b>Value<br/>(Rs./Crores)</b> |
| 2000-01                                    | 338691                       | 430.98                         | 30404                        | 31.11                         |
| 2001-02                                    | 1456448                      | 1728.29                        | 26578                        | 32.60                         |
| 2002-03                                    | 1662370                      | 1769.49                        | 41430                        | 32.83                         |
| 2003-04                                    | 1200600                      | 1216.59                        | 74400                        | 62.70                         |
| 2004-05                                    | 108690                       | 149.53                         | 932740                       | 976.18                        |
| 2005-06                                    | 321204                       | 569.11                         | 558769                       | 651.59                        |
| 2006-07                                    | 1643403                      | 3127.47                        | 1052                         | 3.49                          |
| 2007-08                                    | 4684554                      | 5412.16                        | 496                          | 2.24                          |
| 2008-09                                    | 3331997                      | 4448.74                        | 386099                       | 583.11                        |
| 2009-10                                    | 44045                        | 110.23                         | 2424045                      | 5961.24                       |
| 2010-11                                    | 3249300                      | 10352.27                       | 1004100                      | 2723.21                       |
| 2011-12                                    | 4074900                      | 12973.73                       | 119661                       | 374.67                        |
| 2012-13                                    | 2784489                      | 8576.83                        | 1122259                      | 3094.38                       |
| 2013-14                                    | 2473483                      | 7152.17                        | 880519                       | 2279.21                       |
| 2014-15                                    | 1950931                      | 5296.53                        | 1537830                      | 3645.15                       |
| 2015-16                                    | 3128275                      | 9787.95                        | 1600027                      | 4011.03                       |
| 2016-17                                    | 2538230                      | 8621.61                        | 2144429                      | 6849.63                       |
| 2017-18                                    | 1750724                      | 5180.54                        | 2401484                      | 6017.22                       |
| 2018-19                                    | 3977639                      | 9451.57                        | 1487677                      | 3147.50                       |
| 2019-20<br>(April to November)             | 3016127                      | 7025.86                        | 842160                       | 1827.17                       |

**Source:** Cooperative Sugar, Vol-51, No.6, February, 2020.

**Annexure-XVIII**

**COUNTRY WISE EXPORT OF SUGAR (TONNES) FROM INDIA DURING 2012 TO 2017**

| S.No. | Country of Destination | Year     |               |               |               |               |
|-------|------------------------|----------|---------------|---------------|---------------|---------------|
|       |                        | 2012     | 2013          | 2014          | 2015          | 2016          |
| A.    | <b>Raw Sugar</b>       |          |               |               |               |               |
| 1.    | Bangladesh             | 0        | 27000         | 48750         | 81250         | 0             |
| 2.    | EU                     | 0        | 10015         | 3309          | 18747         | 18374         |
| 3.    | Iran                   | 0        | 39790         | 335416        | 7722          | 0             |
| 4.    | Iraq                   | 0        | 0             | 12454         | 25000         | 25000         |
| 5.    | Kenya                  | 0        | 11137         | 9900          | 56183         | 25295         |
| 6.    | Libyan Arab J.         | 0        | 0             | 30000         | 0             | 0             |
| 7.    | Malaysia               | 0        | 0             | 57127         | 1690          | 287           |
| 8.    | Mozambique             | 0        | 0             | 12224         | 7620          | 0             |
| 9.    | Nepal                  | 0        | 0             | 8517          | 0             | 0             |
| 10.   | Persian Gulf           | 0        | 0             | 28928         | 0             | 0             |
| 11.   | Saudi Arabia           | 0        | 0             | 10311         | 0             | 0             |
| 12.   | Somalia                |          | 650           | 85394         | 37390         | 69140         |
| 13.   | Sri Lanka              | 0        | 12480         | 31246         | 57016         | 37493         |
| 14.   | Sudan                  | 0        | 0             | 71871         | 0             | 0             |
| 15.   | Tanzania               | 0        | 84255         | 73915         | 123238        | 33944         |
| 16.   | Uganda                 | 0        | 572           | 3702          | 10920         | 1118          |
| 17.   | UAE                    | 0        | 49825         | 63126         | 33356         | 0             |
| 18.   | USA                    | 0        | 620           | 2304          | 11131         | 9113          |
|       | Others                 | 0        | 9565          | 38400         | 15036         | 3705          |
|       | Total                  | <b>0</b> | <b>245909</b> | <b>926894</b> | <b>486299</b> | <b>223469</b> |
|       |                        |          |               |               |               | <b>99198</b>  |

**Source:** Cooperative Sugar, Vol-51, No.6, February, 2020.

| S.No.                 | Country of Destination | Year           |                |                |                |                |                |
|-----------------------|------------------------|----------------|----------------|----------------|----------------|----------------|----------------|
|                       |                        | 2012           | 2013           | 2014           | 2015           | 2016           | 2017           |
| <b>B. White Sugar</b> |                        |                |                |                |                |                |                |
| 1.                    | Afghanistan            | 0              | 1040           | 0              | 150701         | 114823         | 785            |
| 2.                    | Bangladesh             | 469476         | 142            | 28213          | 276            | 3468           | 57026          |
| 3.                    | China                  | 10199          | 7410           | 2826           | 971            | 17760          | 22017          |
| 4.                    | Djibouti               | 87411          | 19970          | 63224          | 55916          | 52728          | 42906          |
| 5.                    | Eritrea                | 16360          | 0              | 0              | 0              | 0              | 10             |
| 6.                    | Ethiopia               | 13599          | 20416          | 1809           | 75000          | 190000         | 0              |
| 7.                    | EU                     | 33966          | 715            | 32397          | 6380           | 12900          | 13303          |
| 8.                    | Iran                   | 180196         | 19592          | 71233          | 48455          | 1776           | 11725          |
| 9.                    | Iraq                   | 237106         | 48940          | 51086          | 14438          | 270            | 0              |
| 10.                   | Jordan                 | 55562          | 59266          | 71717          | 48246          | 46954          | 20047          |
| 11.                   | Kenya                  | 41882          | 3104           | 18503          | 48285          | 78527          | 63127          |
| 12.                   | Kuwait                 | 12037          | 13982          | 19757          | 23851          | 26163          | 26283          |
| 13.                   | Lebanon                | 12050          | 2280           | 875            | 935            | 130            | 0              |
| 14.                   | Libyan Arab J.         | 0              | 260            | 0              | 0              | 22500          | 0              |
| 15.                   | Madagascar             | 26716          | 2380           | 3822           | 6044           | 13263          | 12485          |
| 16.                   | Malaysia               | 179241         | 2860           | 613            | 5957           | 4562           | 60             |
| 17.                   | Myanmar                | 533            | 16874          | 5086           | 534632         | 1155642        | 419973         |
| 18.                   | Nepal                  | 10766          | 16330          | 1673           | 3853           | 32781          | 35876          |
| 19.                   | Persian Gulf           | 39044          | 23175          | 27573          | 33637          | 28497          | 57967          |
| 20.                   | Russian Fd.            | 19317          | 520            | 848            | 0              | 0              | 0              |
| 21.                   | Saudi Arabia           | 96644          | 89718          | 91607          | 81174          | 85985          | 71241          |
| 22.                   | Singapore              | 26232          | 15210          | 5940           | 15229          | 1898           | 820            |
| 23.                   | Somalia                | 194501         | 125502         | 243383         | 339315         | 417314         | 236433         |
| 24.                   | Sri Lanka              | 328066         | 135112         | 154954         | 200262         | 136743         | 39825          |
| 25.                   | Sudan                  | 387117         | 282838         | 399548         | 555508         | 443782         | 406301         |
| 26.                   | Switzerland            | 58             | 0              | 13917          | 0              | 0              | 1              |
| 27.                   | Syrian Arab Rep.       | 17531          | 36797          | 0              | 25520          | 0              | 0              |
| 28.                   | Tanzania               | 129611         | 7124           | 31150          | 20357          | 41998          | 33249          |
| 29.                   | Thailand               | 14506          | 0              | 0              | 0              | 0              | 0              |
| 30.                   | Tuisia                 | 104765         | 0              | 1640           | 494            | 13300          | 0              |
| 31.                   | Turkey                 | 1870           | 6630           | 21819          | 34433          | 13343          | 0              |
| 32.                   | UAE                    | 448827         | 90415          | 180115         | 129190         | 80702          | 195474         |
| 33.                   | USA                    | 28655          | 960            | 6140           | 3920           | 1163           | 342            |
| 34.                   | Vie Nam                | 11356          | 5954           | 543            | 8918           | 19637          | 10259          |
| 35.                   | Yemen Rep.             | 152001         | 16042          | 14338          | 5400           | 33523          | 12700          |
| 36.                   | Others                 | 101578         | 15696          | 34196          | 21786          | 13260          | 65815          |
|                       | <b>Total</b>           | <b>3488721</b> | <b>1087254</b> | <b>1600545</b> | <b>2499083</b> | <b>3105392</b> | <b>1855950</b> |
|                       | <b>Grand Total</b>     | <b>3488721</b> | <b>1333163</b> | <b>2527439</b> | <b>2985382</b> | <b>3328861</b> | <b>1955148</b> |

Source: Cooperative Sugar, Vol-51, No.6, February, 2020.

**Annexure-XIX****CANE GROWERS COOPERATIVE SOCIETIES/CANE DEVOPMENT COMMISSIONS IN VARIOUS STATES (RS. PER QTL.)**

| Sr.No. | State          |                      |
|--------|----------------|----------------------|
| 1.     | Andhra Pradesh | 0.20                 |
| 2.     | Bihar          | 1% on value of cane  |
| 3.     | Haryana        | 0.50                 |
| 4.     | Madhya Pradesh | 0.08                 |
| 5.     | Punjab         | 0.50                 |
| 6.     | Uttar Pradesh  | 3% ad valorem on FRP |

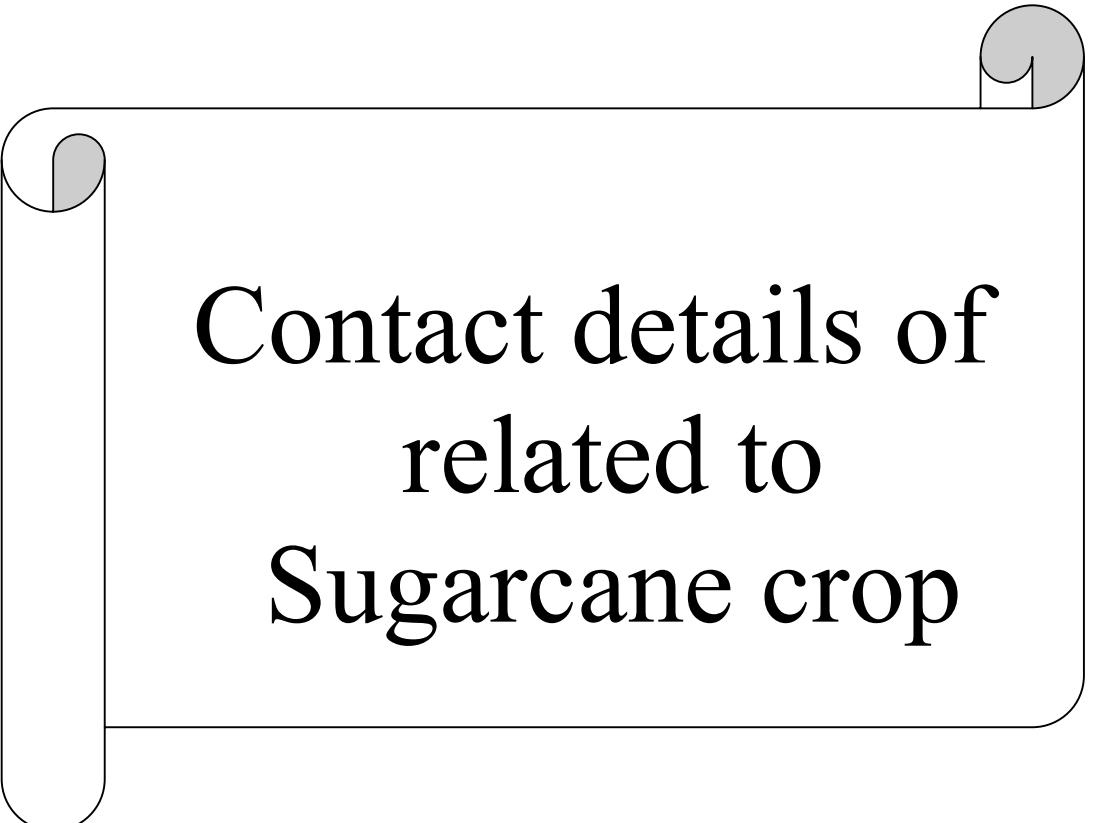
Source: Cooperative Sugar, Vol-51, No.6, February, 2020.

**Annexure-XX****STATE WISE RATE OF CESS/ PURCHASE TAX ON SUGARCANE PAID BY SUGAR FACTORIES**

| S. No. | State          | Cess/ Purchase tax in Rupees per tonne cane   |
|--------|----------------|---|
| 1.     | Andhra Pradesh | 60.00   |
| 2.     | Bihar          | 17.50   |
| 3.     | Gujarat        | 2 % on cane price paid  |
| 4.     | Haryana        | 15.00   |
| 5.     | Karnataka      | 65.00 for factories with 10.50 % and above recovery + 10 road cess.<br>50.00 for factories with recovery below & upto 10.50 % + 10 road cess. |
| 6.     | Kerala         | 4.6 % on value of cane  |
| 7.     | Madhya Pradesh | 4.5 % + 1 % Mandi tax   |
| 8.     | Maharashtra    | 5 % ad valorem on cane-exempted for 2015-16   |
| 9.     | Punjab         | 5.00 cess on cane - exempted for 2015-16  |
| 10.    | Rajasthan      | 2 % ad valorem on cane  |
| 11.    | Tamil Nadu     | 5.00 cess   |
| 12.    | Uttar Pradesh  | 20.00 exempted for 2015-16  |
| 13.    | Uttarakhand    | 20.00 exempted for 2015-16  |

Sugarcane is exempted from Goods & Service Tax (GST) and all states levy like cess, purchase tax in sugarcane has been subsumed in GST w.e.f. 01.07.2017.

Source: Cooperative Sugar, Vol-51, No.6, February, 2020.



# Contact details of related to Sugarcane crop

## Contact details of related to Sugarcane crop

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|--|--|---|-------------------|--|

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| 4       | Haryana        | NFSM-Sugarcane & NFSM- Intercropping | Shri Jagdish Brar, Addln Cane Commisioner<br>Smt. Manju Yadav                 | 09876043992<br>08360192274 | <a href="mailto:agriharyana2009@gmail.com">agriharyana2009@gmail.com</a><br><a href="mailto:agriculture@hry.nic.in">agriculture@hry.nic.in</a>             |
| 5       | Karnataka      | NFSM-Sugarcane &                     | Smt. Rupa, DDA  | 08277929825                | <a href="mailto:nfsm.karnataka@redifmail.com">nfsm.karnataka@redifmail.com</a> ,<br><a href="mailto:agridir@kar.nic.in">agridir@kar.nic.in</a>             |
|         |                | NFSM- Intercropping                  | S. Shanthakumari, AD  | 08277929839                | <a href="mailto:nfsm.karnataka2018@gmail.com">nfsm.karnataka2018@gmail.com</a>   |
| 6       | Madhya Pradesh | NFSM-Sugarcane & NFSM- Intercropping | Shri G S Chauhan, JDA   | 09425135912                | <a href="mailto:diragri@mp.gov.in">diragri@mp.gov.in</a> ,<br><a href="mailto:dagnfsm@mp.gov.in">dagnfsm@mp.gov.in</a>                                     |
| 7       | Maharashtra    | NFSM-Sugarcane & NFSM- Intercropping | Shri P.D. Sigedar, DDA (Cash crops)   | 09404953832                | ddacashcrop@gmail.com  |
| 8       | Odisha         | NFSM-Sugarcane & NFSM- Intercropping | Mr. Bhabani Mahapatra Joint Director(Plan & CC)<br>Shri Nilamadhab Chand, DDA | 07008854575<br>09938680045 | <a href="mailto:nfsmorissa@yahoo.co.in">nfsmorissa@yahoo.co.in</a> ,<br><a href="mailto:diragri.or@nic.in">diragri.or@nic.in</a>                           |
| 9       | Punjab         | NFSM-Sugarcane & NFSM- Intercropping | Dr Karvender Singh, Cane Commissioner   | 09464111352                | <a href="mailto:brar22z@gmail.com">brar22z@gmail.com</a> ,<br><a href="mailto:directoragriculturepunjab@gmail.com">directoragriculturepunjab@gmail.com</a> |
| 10      | Tamil Nadu     | NFSM-Sugarcane & NFSM- Intercropping | Venkatachalapathy, DDA  | 09444005219                | <a href="mailto:diragri@tn.nic.in">diragri@tn.nic.in</a> ,   |
| 11      | Telangana      | NFSM-Sugarcane & NFSM- Intercropping | Smt. Madhavi  | 07288894801                | agriculture.telangana@gmail.com  |

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| 12 | Uttar Pradesh | NFSM-Sugarcane                       | Dr. R.P. Yadav, Addln. Cane Commissioner      | 09412604510 | canecommup@gmail.com                                       |
|    |               | NFSM- Intercropping                  | Dr. S.B. Singh, Addln Director of Agriculture | 09415084351 | <a href="mailto:nfsmagri@gmail.com">nfsmagri@gmail.com</a> |
| 13 | Uttarakhand   | NFSM-Sugarcane & NFSM- Intercropping | Shri Imlal, Joint Cane Commissioner           | 09412923103 | kcpathak1965@gmail.com                                     |

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### A. International

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| 1       | South African Sugarcane Research Institute<br>170 Flanders Drive, Mount Edgecombe<br>Private Bag X02, Mount Edgecombe, 4300                              | +31-5087400<br>Fax -0315087597                                  | <a href="mailto:sasri@sugar.org.za">sasri@sugar.org.za</a> |
| 2       | Bangladesh Sugarcane Research Institute<br>Ministry of Agriculture, Government of the People's Republic Of Bangladesh<br>Ishurdi06620, Pabna, Bangladesh | +88 07326 63628 (DG)<br>+88 07326 63414<br>Fax- +88 07326 63888 | <a href="mailto:bsri@bsri.gov.bd">bsri@bsri.gov.bd</a>     |

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| 1       | Dr. A. D. Pathak,<br>Director                   | Indian Institute of Sugarcane Research (IISR),<br>Raibareli Road, P.O. Dilkusha,<br>Lucknow - 226 002                    | Ph.: 0522-2480726<br>Fax: 0522-2480738<br>Mob.- 9450373565                      | <a href="mailto:iisrlko@sancharnet.in">iisrlko@sancharnet.in</a> ,<br><a href="mailto:director.sugarcane@icar.gov.in">director.sugarcane@icar.gov.in</a> |
| 2       | Dr. Bakshi Ram,<br>Director                     | Sugarcane Breeding Institute,<br>Coimbatore,<br>Tamilnadu - 641007   | Ph.: 0422-2476261,<br>0422-2472986<br>Fax: 0422-2472923<br>Mob.- 09894044711    | <a href="mailto:director@sugarcane.res.in">director@sugarcane.res.in</a> ,<br><a href="mailto:bakshi.ram@icar.gov.in">bakshi.ram@icar.gov.in</a>         |
| 3       | Dr. J. Singh,<br>Director                       | UP Council of Sugarcane Research,<br>Gandhiganj, Shahjahanpur - 242001   | Ph.: 05842-222102<br>Fax: 05842-222509<br>Mob.- 09455038993<br>CUG: 06389025301 | <a href="mailto:dirupcsr@gmail.com">dirupcsr@gmail.com</a>   |
| 4       | Sri Shivajirao C.Deshmukh ,<br>Director General | Vasantdada Sugar Institute<br>Manjari Budruk, Tal.: Haveli,<br>Dist.: Pune,<br>Maharashtra State, India,<br>Pin – 412307 | Ph.: 020-26902100<br>Fax: 020-26902244  | <a href="mailto:vsilib@vsnl.com">vsilib@vsnl.com</a>   |

## Allied Institutes/Organization:

| S. N. | Name   | Office /Address   | Phone/Mobile /Fax   | E-Mail   |
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| 1     | Indian Sugar Mills Association<br><br>Dr. Narendra Singh | Ansal Plaza, 'C' Block, 2nd Floor, August Kranti Marg, Andrews Ganj, New Delhi-110049 (INDIA) | Ph.: +91-11-26262294<br>Fax: +91-11-2626 3231<br><br>Ph.: 011-26262204<br>Mob.- 09999942613 | <a href="mailto:isma@indiansugar.com">isma@indiansugar.com</a><br><a href="mailto:isma@airtelmail.in">isma@airtelmail.in</a> |

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| 2 | <b>The Managing Director</b><br>National Federation of Cooperative Sugar Factories Ltd (NFCSF) | Ansal Plaza, Block-C, 2nd Floor, August Kranti Marg, New Delhi. | Ph.: 011-26263425/26<br>Fax: 011-26263658 | <a href="mailto:nfcsl@spectranet.com">nfcsl@spectranet.com</a>                     |
| 3 | All India Distillers Association (AIDA)  | 805, Siddharth, 96, Nehru Place, New Delhi 110 019.             |   | <a href="mailto:distiler@vsnl.net.in">distiler@vsnl.net.in</a>                     |
| 4 | The Sugar Technologies Association of India (STA)  | 21, Community Centre, East of Kailash, New Delhi 110 065.       |   | <a href="mailto:staidel@vsnl.net.in">staidel@vsnl.net.in</a>                       |

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|---------------------------|----------------|--|--|---|--|
| <b>A. North West Zone</b> |                |  |  |   |  |
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| 5                         | Pantnagar      | Prof. S.P. Singh, Deptt. of Genetics & Plant Breeding, | G.B. Pant University of Agriculture & Technology, Pantnagar – 263 145, Distt. U.S. Nagar                       | Ph :05944-233075<br>Fax : 05944-233473<br>Mob: 094111-60075<br>(Dr. S.P. Singh)<br>075002-41511<br>(Dr. A.S. Jeena) | <a href="mailto:panwar588@gmail.com">panwar588@gmail.com</a><br><a href="mailto:dr.asjeena@gmail.com">dr.asjeena@gmail.com</a>                                       |
| 6                         | Sriganganagar  | Dr. B.R. Godara, Incharge AICRP (Sugarcane)            | Agricultural Research Station, Sriganganagar – 335 001 (Rajasthan)   | Ph: 0154-2440619<br>Fax : 0154-2440703<br>Mob: 094131-55287   | <a href="mailto:balram.g.ars@gmail.com">balram.g.ars@gmail.com</a>   |
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| 8                         | Kota           | Dr. N.R.Koli, Assoc. Prof. (PB&G) & Project Incharge   | Agricultural Research Station Ummedganj, P.B. No. 7, GPO – Nayapura, Kaithoon Road, Kota – 324 001 (Rajasthan) | Ph: 0744-2844369 (O)<br>Fax : 0744-2844306<br>Mob: 094144-89121   | <a href="mailto:nanag70@yahoo.co.in">nanag70@yahoo.co.in</a><br><a href="mailto:arkota@hotmail.com">arkota@hotmail.com</a> ;   |
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| 4 | Bethuadahari | Dr Kashinath Mandal, Head-Economic Botanist VII | Sugarcane Research Station, Bethuadahari – 741 126 Distt. Nadia (W.B.)                                 | Ph: 03474-255353<br>Mob.: 08016412906                     | <a href="mailto:srsbethuadahari@gmail.com">srsbethuadahari@gmail.com</a><br><a href="mailto:kashinath_pars@yahoo.com">kashinath_pars@yahoo.com</a> |
| 5 | Buralikson   | Dr. Bijnan Bordoloi Chief Scientist & Incharge  | Sugarcane Research Station (A.A.U.), Buralikson, P.O. Baruabamungaon – 785 618 Distt. Golaghat (Assam) | Ph: 03774-279627<br>Mob. 09435246414                      | <a href="mailto:bijnan57@gmail.com">bijnan57@gmail.com</a><br><a href="mailto:prasantagswm@yahoo.com">prasantagswm@yahoo.com</a>                   |
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| 1 | Coimbatore  | Dr. Bakshi Ram, Director & AICRP(S)            | P.I. (Crop Improvement), Sugarcane Breeding Institute, Coimbatore – 641 007 (T.N.)                | Ph:0422-2472621<br>2472986<br>Fax 0422-2472923<br>Mob: 098940-44711                               | <a href="mailto:sbitechnicalcell@gmail.com">sbitechnicalcell@gmail.com</a><br><a href="mailto:bryadav2003@yahoo.com">bryadav2003@yahoo.com</a>         |
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| 3 | Mandya      | Dr. S.N. Swamy Gowda, Sugarcane Breeder & Head | (AICRP on Sugarcane), Zonal Agricultural Research Station, V.C. Farm, Mandya- 571 405 (Karnataka) | Ph: 08232-277147<br>Fax : 08232-277392<br>Mob. 09341156455  | <a href="mailto:swamygowdavcf@gmail.com">swamygowdavcf@gmail.com</a>   |
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| 5 | Sameerwadi* | Dr. V.C. Patil, Director                       | K.J. SomaIya Instt. of Applied Agril. Res. Sameerwadi, Distt. Bagalkot – 587 316 (Karnataka)      | Ph:08350-260046/47 /48<br>Mob: 070222-60486<br>Fax : 08350-260037                                 | <a href="mailto:patil.vc@somaIya.com">patil.vc@somaIya.com</a>   |
| 6 | Sankeshwar  | Dr. Sanjay B Patil, Principal Scientist & Head | Agricultural Research Station, Sankeshwar – 591 314, Tal. Hukkeri,                                | Ph: 08333-273435<br>Mob. 094497-75400   | <a href="mailto:ars_sankeshwar@rediffmail.com">ars_sankeshwar@rediffmail.com</a><br><a href="mailto:sbp_ars@rediffmail.com">sbp_ars@rediffmail.com</a> |

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|---|----------------|-------------------------------|--|---|--|
|   |                |                               | Belgaum Distt. (KN)  |   |  |
| 7 | Perumalapalle* | Dr. M. Hemanth Kumar, Head    | Agricultural Research Station, Perumalapalle, Tirupathi – 517 505 Distt. Chittoor (A.P.)                   | Ph: 0877-2276240 (O)<br>Mob. 099896-25227                   | <a href="mailto:arsperumallapalle@gmail.com">arsperumallapalle@gmail.com</a><br><a href="mailto:hemanthangrau@gmail.com">hemanthangrau@gmail.com</a> |
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| 2 | Navsari            | Dr. S.C. Mali, Unit Head (Sugarcane)                         | Main Sugarcane Research Station, Navsari Agricultural University, Navsari – 396 450 (Gujarat)           | Ph: 02637-282136<br>Fax:02637-282856/283794/282554<br>Mob.: 097250-18791 | <a href="mailto:sugarnau@gmail.com">sugarnau@gmail.com</a><br><a href="mailto:drshaileshmali@gmail.com">drshaileshmali@gmail.com</a>       |
| 3 | Powarkheda         | Dr. A. Chatterjee, Incharge                                  | AICRP on Sugarcane, Zona Agricultural Research Station, Powarkheda – 461 110, Distt. Hoshangabad (M.P.) | Ph: 07574-227222<br>Fax : 07574-227257<br>Mob. 094251-38220              | <a href="mailto:chatterjeeanimesh@rediffmail.com">chatterjeeanimesh@rediffmail.com</a>   |
| 4 | Pune*              | Dr R.S. Hapse, Head and Principal Scientist (Plant Breeding) | Vasantdada Sugar Institute, Manjari (BK) – 412 307, Distt. Pune (M.S.)                                  | Ph: 020-26902246;<br>Fax : 020-26902244<br>Mob: 098903-13681             | <a href="mailto:vilib@vsnl.com">vilib@vsnl.com</a><br><a href="mailto:rshapse@yahoo.co.in">rshapse@yahoo.co.in</a>                         |
| 5 | Padegaon           | Dr. B.S. Raskar, Sugarcane Specialist                        | Central Sugarcane Research Station, P.O. Padegaon Farm – 415 521 Distt. Satara (M.S.)                   | Ph/Fax: 02169-265333<br>Mob. 09960802028                                 | <a href="mailto:csrspadegaon@rediffmail.com">csrspadegaon@rediffmail.com</a><br><a href="mailto:bsraskar@gmail.com">bsraskar@gmail.com</a> |
| 6 | Pravaranagar*      | Padmashri Dr. Vitthalrao Vikhe Patil                         | Sahakari Sakhar Karkhana Ltd., P.O. Pravaranagar – 413 712, Tal. Rahata Distt. Ahmednagar (M.S.)        | Ph:02422-252301 252304<br>Fax : 02422-253397                             | <a href="mailto:pravarasugar@rediffmail.com">pravarasugar@rediffmail.com</a>   |
| 7 | Rudrur*            | Dr. M. Venkataiah, Principal Scientist (Ento.) & Head        | Regional Sugarcane and Rice Research Station, Rudrur 503 188 Distt. Nizamabad                           | Mob: 09848493441 09989625218   | <a href="mailto:venkataiah1997@gmail.com">venkataiah1997@gmail.com</a> ;<br><a href="mailto:rsrrs.head@gmail.com">rsrrs.head@gmail.com</a> |
|   | Kawardha (Raipur)* | Dr O.N. Verma, Asstt. Prof (Genetics and Plant Breeding)     | S.K.College of Agriculture and Research Station, Kawardha- 491995, (C.G.)                               | Mob: 09424183084   | <a href="mailto:omnarayanverma1@gmail.com">omnarayanverma1@gmail.com</a>   |

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