SUGARCANE

a. Early maturing	85 A261, 84 A 125, Co 8014, 83 A 30, 87 A 298, 99 V 30, 86 V 96, 91 V 83, 2000 V 59, 2003 V 46, 93 A 145, 2001 A 63, 2003A 255, 2005A 128, 2009V 127, 2005T 16 and 97A 85.
b. Mid-late maturing	Co T 8201, Co A 7602, Co 7805, 83 V 15, 86 A 146, 88 A 162, 2002 V 48, 98 A 163 and 2000 A 225
c. Late maturing	Co 7219, Co 7706 and 87 A 380
d. Moisture stress	Co T 8201, 87 A 298, 97 A 85, Co 7219, Co A 7602, 98A 163, 2005T16 and 2000A 56.
e. Saline – Alkaline soils	Co T 8201, 97 A 85, 93 A 145, 99 V 30, 2005T 16 and Co 7219.
f. Water logging	CoT 8201, 87A 298, 83V 15, 2000V 59, 2003V 46 and Co 7805
2. Soils	Alluvial and well-drained loamy soils.
3. Land preparation	Soils are to be worked to fine filth to a depth of 20-25 cm. Form furrows of 30 cm width and 20 cm depth by cattle drawn victory plough or tractor drawn ridgemar.
4. Seed rate	16,000 three budded setts 4 tons per acre. Seed from short crop of 6-7 months age ensures good germination and improve cane yield by 2-3 tones/acre
5. Seed sett treatment	Dip the setts in Carbendazim (0.5 g/lt) and Malathion (2 ml/lt) to eliminate pineapple disease and scale insect. Sett treatment with imidacloprid 48% FS @ 1 ml/lt for 15 minutes is recommended to control termite incidence.
6. Spacing	80 cm between rows for early varieties and 90 cm for mid-late varieties. Adopt paired row planting (60cm x 120 cm) to promote mechanization and drip irrigation.
7. Time of planting	
Early varieties	December – January
Mid varieties	February
Late varieties	March

8. **Fertilizer management**

Farm yard manure @ 10 tonnes per acre or press mud cake @ 5.0 tonnes per acre in the last ploughing. 45 kg nitrogen / acre (pocket application) is to be applied in two equal split doses at 45
and 90 days after planting.

Phosphorus @ 40 kg and Potassium @ 40 kg per acre are to be applied as basal at the time of planting. Spray Zinc sulphate (2 gm/lt) and Ferrous sulphate (10-20 gm/lt) at 45-60 days after planting where zinc and iron deficiencies are observed.

Use of biofertilizers like azatobactor (4kg/acre), azospirillum (4kg/acre) saves nitrogen to an extent of 25%

Use of phospho bacteria (4kg /acre) and VAM (5kg /acre) saves phosphorus to an extent of 20 to 25%.

Supply of recommended N&K fertilizers through drip fertigation in the form of Urea and muriate of potash (white potash) in 20 splits at weekly interval commencing from 30 DAP to 180 DAP is to be done to improve fertilizer use efficiency.

9.Weed management: **Pre emergence**:

Spray Atrazine @ 2 kg/acre or metribuzine @ 600 g/acre in 450 lts of water on the third or fourth day after planting, depending on soil moisture.

Post emergence

Spray 2,4-D (1.8 kg) + Gramoxone (1.0 lt) in 450 lts/ac at 20 & 60 DAP between cane rows with hood to protect the crop or spray metribuzine @ 40 g + 2,4-D Sodium salt @ 800 g /acre at 25-30 DAP as blanket application. For control of creeper weeds spray metsulfuran methyl + chlorimuron ethyl (Almix) @ 8.0 g/acre at 75 days after planting.

Other cultural operations:

Earthing up at about four months after planting, propping the crop by trash twist, twice or thrice, depending on crop growth.

Keep the crop erect by TT propping twice or thrice depending upon crop growth leaving 6-8 green leaves in the crown.

Inter cultivation between 45-60 DAP control weeds besides improving aeration.

10. Irrigation

Once in six days during summer and once in 15-21 days from November to harvest. During grand growth period, irrigation is to be provided when dry spell exceeds 15 days. If, only one irrigation is possible during formative phase, it has to be given at 30 days after planting and trash mulching has to be done three days after planting @ 1.25 t/acre.

11. Harvesting

Crop is to be harvested at peak maturity depending upon variety, date of planting and juice quality.

12. Post harvest management

Sugarcane harvested in a field should be free from root material, soil etc., The immature top portion should be cut to the first visible top internode. Such dressed cane should be crushed within 24 hours either in a sugar factory or jaggery crusher to avoid loss in the cane weight and sugar recovery.

Management for single node seedling cultivation:

In sugarcane, seed cost itself accounts for 15-20% of the total cost of cultivation. Generally, 4.0 tonnes of seed cane / acre is being used for getting optimum cane and sugar yields. Hence, to reduce seed cost and increase the cane production per unit area growing of

sugarcane through single bud seedlings is found to be the new innovative technology and becoming popular among the farming community.

Raising of seedlings in Nursery: **Selection of seed cane**:

- For growing sugarcane seedlings high yielding varieties suitable for that particular region are to be selected. It is always better to use 6-7 months aged healthy short crop as seed material.
- **Preparation of single nodes from the seed cane**:
- Node cutting machines are available for separating single nodes from the cane.
- In traditional method of 3 bud sett planting, seed material of 4-6 t/ac is required. But in single node seedlings planting method, only 750-800 kgs of seed cane is sufficient for raising seedlings required / acre.
- Selection of healthy and undamaged single buds by grading method will not only improve germination percentage but also gives strong seedlings.
- Treat the single nodes with 0.5 g carbendazim + 2.0 ml malathion or 1.6 ml monocrotophos/ liter of water for 15 minutes to reduce the incidence of pine apple disease and scale insect.
- Protrays (Plastic trays) having 48 pits can be used for sowing of single nodes.
- Fill the pits (half) with coco peat or well decomposed vermi compost + soil mixed in equal proportion. Then put the treated single buds keeping eye in upward direction. Then fill the trays completely with coco peat and press gently.
- Arrange trays in a shade net in such a way that each stack contains 10 trays and cover and tie with black polythene sheet tightly so that heat will be produced and germination of buds will be initiated.
- After 4-5 days, with the start of germination, arrange trays side by side in shade net and watering should be done in alternate days with rose can or sprinklers. Within one week all the buds will germinate. At 3-4 weeks after sowing every seedling will put forth 3-4 leaves with profuse root growth.

Preparation of main field and planting:

- For planting one acre field, 7,500-8,000 seedlings are required. (150-175 plastic trays are sufficient). Growth and vigour of the seedlings also depends on type of rooting media used. Spray 19:19:19 @ 0.1% or vermi wash @ 1.0% to improve the seedling growth.
- Main field is to be thoroughly prepared by ploughing with 2 M.B. plough or rotavator and perfect leveling should be done.
- Furrows are to be formed at 60/120 cm spacing i.e. paired rows of 20 cm depth within the row and seedlings are to be planted at 60 cm distance. In the inter space between rows pulse crops like blackgram, greengram and groundnut can be grown which will improve soil fertility besides suppressing weed growth to certain extent.

Drip system can be installed in the pairs to improve water use efficiency. While planting, seedlings are to be planted without disturbing root mass along with coco peat which holds moisture also

- Seedlings can also be planted with tractor drawn seedling transplanter.
- Light irrigations are to be given at 3-4 days interval at initial stages for quick establishment of the seedlings.
- Early planting in January – February is essential for good establishment of seedlings and synchronous tillering.

Nutrient Management:

Application of fertilizers at frequent intervals up to earthing up (90-100 days) found to give higher cane yields as compared to traditional method of application.

- Apply 10 tons FYM per acre in last plouhging and incorporate into the soil.
- Single super phosphate @ 250 kg /acre is to be applied in planting furrows before planting
- Nitrogen @ 90 kg/acre + 48 kg K_2O /acre (200 kg Urea/ac + 80 kg murate of potash) are to be applied in four splits at planting 30, 60 and 90 days after planting by pocketing. Immediately after fertilization light irrigation is to be given to promote good tillering.

Agronomic practices like weed management, water management and other cultural operations are to be done as recommended for sett planted crop.

Management of ESB:

Seedlings are more vulnerable for early shoot borer. Hence, proper monitoring and timely plant protection measures are very much essential.

Ratoon crop management

1. Varieties — The same varieties indicated for plant crop are suitablefor ratoon crop

2. Soils/Areas — Alluvial, red and well drained loamy soils

3. Stubble shaving and interculture

Plant crop is to be harvested to the ground level or just below ground level. Stubble shaving has to be done with spades without disturbing the stool. The interspaces have to be ploughed to 12 to 15 cm depth to break the crust and improve aeration for better ratooning.

4. Trash mulching

Trash mulching @ 1.25 t/acre at 3-5 days after ratooning ensures conservation of soil moisture and suppression of early shoot borer and weed growth.

5. Manures and fertilizers

Additional dose of 45 kg Nitrogen /acre over the dose recommended for plant crop has to be applied in two splits at ratooning and 45 days later. P_2O_5 @ 45 kg / acre and K_2O @ 45 kg / acre are to be applied at the time of ratooning. If deficiency of iron is noticed ferrous sulphate @1.0% is to be sprayed on foliage immediately.

6. Gap filling:

Gap filling has to be done with seedlings raised in polythene bags or in nursery from single nodes within two weeks after ratooning.

7. Weed management:

Weeding and hoeing at $1^{st,}$ 4^{th} and 7^{th} week after ratooning or spraying Atrazine @ 2.0 kg / acre or metribuzine @ 600 g/acre in 450 litres of water immediately after ratooning control the weeds effectively. Post emergence weedicides recommended in plant crop can be used in ratoon crop also.

8. Harvesting:

Ratoon crop matures earlier than plant crop. Therefore ratoon crop is to be harvested earlier than plant crop at peak maturity.

Management under saline / alkaline conditions

1. Varieties	83V 15, 93 A 145, 97 A 85, Co T 8201, Co 7219 and 2005T 16.
2. Land preparation	Deep ploughing is to be avoided while other aspects are similar to plant crop.
3. Seed rate	18,000 three budded setts per acre. (4 tons) Seed material should be selected from mature crop.
4. Planting time	Early planting December – January

5. Manures and fertilizers

Gypsum has to be applied @ 0.8-2.0 t/acre depending upon P^H ranging from 8.5 – 9.2. Farm yard manure @ 10 t/acre or press mud cake @ 5 t/acre and Zinc sulphate @ 20 kg /acre are to be applied in the last ploughing. P_2O_5 @ 45kg / acre and K_2O @ 45 kg / acre for early planted crop and 20 kg K_2O / acre for late planted crop at the time of formation of ridges and furrows. For early planting, Nitrogen @ 90 kg/acre in two splits at 60 and 120 days after planting should be applied.

6.Inter cultivation and other management practices Provision of drainage and leaching with good quality water. Trash mulching @ 1.25 t/acre three days after planting. Earthing up at 4 months after planting and trash twist propping 2-3 times depending upon the growth of the crop.

7. Irrigation

For early planted crop – once in six days during summer and once in 15-21 days from November to harvest. During rainy season if dry spells prevails for more than 15 days one to two irrigations may be provided. Late planted crop is usually rainfed. Yield can be improved with supplemental irrigation during post monsoon period

8. Harvesting

Crop is to be harvested at peak maturity depending upon variety, date of planting and juice quality.

Management for Rainfed sugarcane Varities:

Early Planting (December – January): 85A261, 83A30, 84A125, 90A272, Co T8201, 93A145, Co A7602 , Co 7219, 97A85, 87A298, 2000A56 and 2001A63, 2003A 255

Late Planting (May- June): 85A261, 84A125, 83A30, 90A272, 93A145, Co T8201, 97A85, 87A298, 2001A63, 2000A 225, 2003A 255

Soils /Areas: Red loams, sandy loams and alluviums.

Seed Rate : 50,000 three budded setts/ha

Spacing : 80 cm between rows for December-January planting.

60 cm between rows for May-June planting.

Planting time with cut off dates:

Early planting: December-January, cut off date: 31st January.

Late Planting : May – June, cut off date : 30th July.

Fertilizer management:

Organic manures: Well decomposed Farm yard manure @ 10 t/acre or dried pressmud cake @ 5.0t/acre is to be applied before first ploughing.

Inorganic fertilizers:

Early Planting: Nitrogen (pocket application) @ 45 kg/acre in two equal split doses at 30 and 60 days after planting. Phosphorus @40 kg P_2O_5/acre as basal application at planting. Potassium @40 kg K_2O /acre in two splits at planting and before cessation of monsoon rains.

Late Planting: Nitrogen @30 kg/acre in two equal doses at about 30 and 60 DAP whenever a minimum rainfall of 2.5 cm is received. Phosphorus @ 20 kg P_2O_5 per acre at the time of planting . Potassium @ 20 kg K_2O/acre in two splits at planting and before cessation of monsoon rains.

Foliar nutrition: Spray 2.5% urea + 2.5 % muriate potash twice during dry spell to mitigate moisture stress.

Micronutirents: Whenever varieties like Co 7219 are cultivated foliar sprays with zinc sulphate (0.2%) have to be taken up twice at 15 days interval as soon as deficiency symptoms are noticed. In case of varieties like 85 A 261, foliar sprays with 0.5-1.0% Ferrous sulphate is recommended twice at 10 days interval as soon as deficiency symptoms are noticed.

Moisture conservation:

- On the third day after planting or immediately after ratooning, trash mulching @ 1.25 t/acre is to be done to conserve soil moisture.
- Where ever termites are a problem, trash mulching is to be preceded by application of fipronil granules @ 10 kg/acre or chlorantriniliprole granules @ 8 kg/acre.

Weed management:

- Hand weeding and hoeing thrice at 30, 60 and 90 days after planting (or)
- Atrazine @2 kg/acre in 450 lts of water has to be sprayed on the third day after planting followed by one hand weeding and hoieing at 60 DAP (or)
- Atrazine @ 2 kg/acre in 450 lts is to be sprayed on 3rd day after planting followed by interculivation between rows at 40 and 60 days after planting.
- Post emergence application of metribuzine @ 400 g/acre + 2,4D sodium salt @ 800 g/acre at 25-30 DAP

Other cultural operations: Earthingup:

Early planting: At 4 months stage depending on growth.

Late planting: Usually earthing up is not done because roots will be damaged when worked with spades in between narrow rows.

Propping

Early planting: Trash twist propping twice

Late planting: No propping.

Harvesting: Crop is to be harvested at peak maturity depending upon variety, date of planting and juice quality.

Management of pests and diseases <u>INSECT PESTS:</u>

Early shoot borer

- Planting of setts in deep furrows.
- Application of carbofuran 3 G @ 10.0 kg/acre or Fipronil 0.3 G @ 10 kg/acre or chlorantriniliprole @ 9kg/acre at the time of planting.
- Trash mulching @ 1.25 t/acre at 3 days after planting in plant crop and immediately after stubble shaving in ratoon crop.
- Irrigate the crop at frequent intervals during summer.
- Spray chlorpyriphos (2.5 ml/lt) or monocrotophs (1.6 ml/lt) or acephate (1g/lt) at 4, 6 and 9 weeks after planting with 450, 675 and 900 lts of spray fluid respectively.
- Early ratooning in the months of December – January coupled with closer irrigations in the formative phase of the crop.
- Use synthetic pheromones in water traps @ 3 /acre commencing from 35 days after planting or ratooning for monitoring of the pest.
- Release egg parasitoid, *Trichogramma chilonis* four times @ 20,000/acre commencing from 30 days after planting or ratooning and subsequent releases should be made at 7- 10 interval

Internode borer

- Control early shoot borer in early stages of the crop growth.
- Detrash the crop to destroy the larvae and pupae attached with the leaf sheaths.
- Remove water shoots at eighth/ ninth month age.
- Avoid high dose of nitrogen

- Drain out excess of water in low-lying areas.
- Use synthetic pheromones in water traps @ 3 /acre commencing from the internode formation stage of the crop for monitoring of the pest.
- Release egg parasitoid, *Trichogramma chilonis* @ 20,000/acre (4 cards/ac) at fortnightly intervals from 120 days after planting until a month before harvest.
- Spray chlorpyriphos (2.5 ml/lt) 0.05 % or monocrotophos (1.6 ml/lt) twice at 15 days interval during June-July months.

Scale insect

- Dip the three budded setts in malathion (2 ml/lt) or dimethoate (2 ml/lt) for 15 minutes before planting.
- Detrash the cane in the first week of July, August and September months followed by spraying with dimethoate 1.7 ml/lt or malathion 3 ml/lt.
- Dimethoate is preferred for spraying during heavy rains.
- Avoid ratooning of plant crop affected with heavy scale infestation .

Mealy bug:

- Avoid ratooning of the plant crop infested with mealy bugs .
- Destroy alternate host plants (certain grasses like *Cymbopogan*) near sugarcane fields.
- Avoid excess usage of nitrogenous fertilizers.
- Avoid multi ratooning in areas prone to mealy bug.
- Detrash the grown-up crop and spray dimethoate @ 1.7 ml/lt or malathion @ 2ml/lt. by using foot sprayer with long lance.

White fly:

- Provide adequate drainage facilities
- Heavy rainfall wash out the pest.
- Apply 'N' fertilisers at recommended dose at stipulated time.
- Avoid ratooning in low lying areas prone for water logging.
- Spray malathion @ 2ml/lt or chlorpyriphos @ 2.5 ml/lt or monocrotophos @ 1.6 ml/lt or imidacloprid 0.3 ml/lt using foot sprayer with long lance.

Termites:

- Systematic digging of termite mounds and destruction of queens. Apply methylparathion 2%D @ 200g/ mound followed by proper leveling.
- Apply Fipronil granules @10 kg/acre or chlorantriniliprole granules @ 8.0 kg/acre in planting furrows at the time of planting.
- Spay imidacloprid 48% FS @ 1 ml/lt or chlorpyriphos 20 EC @ 5ml/lt wherever damage is noticed in standing crop

Cane fly/ Pyrilla:

- Detrash the lower leaves
- Use Nitrogenous fertilizers Judiciously.
- Prevent lodging by timely TT propping.
- Spray malathion @ 2 ml/lt or dimethoate 1.7 ml/lt or monocrotophos @ 1.6 ml/lt

with

foot sprayer

- Release *Epiricania melanoleuca* 1800-2000 cocoons/acre or 1.8 to 2.0 lakhs eggs per acre.
- Avoid spraying of insecticides if Epricania is observed in the field

9. Mites:

- Removal and destruction of infested leaves
- Removal and destruction of grasses on the bunds.
- Spray wettable sulphur (50%) @ 3g/lt at 15 days interval starting from the appearance of the pest on crop as well as grassy weeds.
- Adopt balanced nutrition.
- Provide frequent irrigations during the pre-monsoon if possible.

10. Woolly aphid:

- Harvest affected matured crop on priority basis.
- Avoid transport of cane with infested leaves.
- Avoid ratooning, if the plant crop is heavily infested with woolly aphid.
- Adopt paired/wider row planting.
- Removal and burning of affected leaves.
- Wrapping and propping of canes to avoid spread of pest.
- Use Nitrogenous fertilizers and irrigation water judiciously.
- Provide proper drainage.
- Conserve the existing natural enemies like C*hrysoperla carnea*, Syrphid fly, Brown Lace wing, *Micromus timidis* (Ord.Neuroptera) and *Dipha aphidivora* (Ord. Lepidoptera). Release the bioagents if infestation is severe.
- Monitor the pest incidence through yellow traps.
- Spray malathion @ 2ml/lt or monocrotophos @ 1.6 ml/lt. or dimethoate @ 1.7ml/lt or chlorpyriphos @ 2.5 ml/lt. or methyl demeton @ 2ml/lt. or acephate @ 1g/lt on lower surface of leaf.

11. Root grub

- Root grub is more problematic in light soils.
- Apply Fipronil (10 kg/acre) or chlorantraniliprole (9 kg/acre) at planting in endemic areas.
- In standing crop, flooding of fields for 2-3 days is effective in reducing the severity.
- Avoid ratooning of infected fields

DISEASES:

1. **Smut**

- Systematic eradication of smutted clumps.
- Avoid second ratoon if incidence is severe.
- Treat three budded setts in hot water at 52^{o} C for 30 minutes or aerated steam at 51^{o} C for two hours followed by dipping setts in carbendazim and raise special seed nurseries.
- Select seed material from disease free areas atleast 40m away from affected fields.
- Treat the setts with propiconazole (1 ml/lt) or hexaconazole (2ml/liter) for

15 minutes before planting the susceptible varieties like 87A 298, Co 6907.

- Spray propiconazole (1.0 ml/lt) immediately after ratooning and 30 days after 1st spray in ratoon crop.

2. **Red rot**

- Select healthy seed material from disease free areas
- Systematic eradication of affected clumps.
- Uproot and destroy un-germinated setts of plant crop and un-sprouted clumps of ratoon crop.
- Avoid ratooning of infected plant crop
- Provide good drainage and avoid stagnation.
- All stubbles and debris should be burnt and further cane planting should not be done up to four months in the infected field.
- Harvest the infected crop as early as possible and burn the crop residues.
- Keep the crop erect without lodging by trash twist propping.
- Grow resistant varieties like.

3. **Grassy shoot disease**

- Uproot and destroy affected clumps.
- Avoid ratooning of severely affected plots.
- Select seed material from disease free plots.
- Treat the setts in hot water at 52^{O} C for 30 minutes or aerated steam at 50^{O} C for one hour and raise special seed nursery.
- Spray malathion (2 ml/ lt) or dimethoate (1.7 ml/lt) to check vector population.

4. **Pineapple disease:**

Treat the setts by dipping in carbendazim solution (100 g of Carbendazim in 300 litres of water for 40,000 three budded setts sufficient to plant in one hectare).

5. **Wilt:**

- Provide frequent irrigations during summer
- Avoid water logging / moisture stress
- Use disease free seed material
- Control the diseases and pests effectively to avoid primary infection
- Apply recommended dose of nitrogen within the stipulated time
- Apply talk based formulation of *trichoderma viridi* @ 2 kg/acre (multiplied in 90 kg FYM + 10 kg of Neem cake) in planting furrows in endemic areas.

6. **Top rot:**

- Two sprays of mancozeb (3 g/lt) at 2-3 weeks interval during rainy season.
- **Ring spot:**
- Spray either carbendazim (0.1 5) or mancozeb (0.3 %) or copper oxychloride (0.04 %) twice or thrice at 2 weeks interval starting from the first appearance of disease.
- **Rust:**
- Spray tridemorph @1 ml / lt. or Mancozeb @ 3 g/ lt. at 15 days interval

starting from the first appearance of disease.

9. Viral diseases (YLD and Mosaic)

- Uproot and destroy affected clumps
- Avoid ratooning of severely affected crop
- Use disease fee seed material, preferably cane raised from tissue culture seedlings
- Spray Dimethoate 2ml/lt or monocrotopos @ 1.6 ml/lt to control vector population (aphid)

Management practices under heavy

cyclonic rains : Sugarcane:

1. Drain out the excess water as early as possible.
2. Apply booster dose of 50 kg urea +50 kg MOP/acre after draining excess water. If it is not possible go for spraying of urea 25 g/l + MOP 25 g/lt
3. Lifting and propping of the canes.
4. Harvesting of matured canes as early as possible for making of jaggery or supply to sugar factory.
5. Monitoring for sucking complex incidence in sugarcane.

MECHANISATION IN SUGARCANE

Sugarcane is most important commercial crop in India next to cotton. In Andhra Pradesh, it is cultivated in an area of 0.196 million hectares producing about 15.68 million tones of cane. The farm mechanization in the context of sugarcane cultivation aims at introducing timeliness of operation, reducing human drudgery and improving overall production efficiency.

Sugarcane is one of the important commercial crops of Andhra Pradesh. It provides raw material to sugar industry. Sugar industry is an important agro based industry in the state which is substantially contributing to rural economic growth. In our state the cane productivity is low compared to neighboring states like Tamilnadu, Maharastra and Karnataka. The cane productivity was low and stagnant (71-77 t/ha) for the past sixteen years. Sugarcane crop is highly labour intensive starting from planting to processing. Now –a-day's the wages of agricultural labour are increasing abnormally resulting in high cost of sugarcane production. Moreover due to demand of labour in peak season, certain operations are getting delayed resulting in loss of yield and deterioration of quality of the produce. On an average 134 man hours of labour force is employed to produce 1 MT sugar. Nearly, 26% of cost of production of sugarcane utilized for harvesting and transport and also 22% for land preparation. Under these circumstances, mechanization in sugarcane cultivation is the need of the hour. Innovative implements operated by human, animal and machine drawn are very much essential to reduce the cost of cultivation and drudgery. Mechanization in sugarcane cultivation starts from land preparation to harvest of the crop. The machinery for harvesting is highly expensive as they are not manufactured in our country and the machinery related to planting and other operations of sugarcane is manufactured indigenously and farmers can afford themselves either collectively or through the sugar factories.

The mechanization in sugarcane mainly involves the following operations 1) Land preparation 2) Planting, 3) Inter cultivation and earthing up, and 4) Harvesting.\

Equipment for Land Preparation

Sugarcane crop requires deep tillage with fine tilth so as to facilitate better aeration. This improves water and nutrient uptake thereby providing good germination and proper root penetration. It is observed that deep ploughing to a depth of 45 cm showed better root development which has resulted in increased cane and sugar yields. Most of the tillage operations are performed by tractor drawn implements. Generally ploughing will be carried out in two operations viz. primary and secondary. Primary tillage operations are carried out with one or two passes of deep mould board or disc plough. Secondary tillage was done in soils with clods and stubbles using rotavators, harrow ploughs and cultivators to get fine tilth. Then the soil is leveled using leveler mounted to tractor. In the leveled soil, tractor drawn ridgemar is used for making furrows. In soils where hard pan is observed, the root growth is restricted to top 20 cm. In such soils, ploughing with sub soiler is very much beneficial.

Land preparation using rotavator

Equipment for Sugarcane Planting:

Planting of Sugarcane is generally done by planting sugarcane setts (2 or 3 buds) in furrows. For mechanizing sett cutting and planting operation, various types of sugarcane planters are developed and available for use to the farmers.

Sugarcane Cutter Planter:

Sugarcane cutter planter is used for planting sugarcane setts in two rows. The cutter planter consists of two way Mould board shaped furrowers for opening of furrows and slanting chutes for sliding of whole cane to cutting unit through gravitational force. The rotating blades cuts the cane giving rise to setts of 30 cm length .It also contains provision for placing sett treatment solution over the setts during planting for which PVC pipe with 15 cm diameter has been provided as tank for liquid chemical application for sett

treatment. The seating arrangement has been provided to the sugarcane cutter planter to accommodate two persons for feeding of cane to the chute during planting. Making of furrows, cutting setts, distribution of setts in furrows, application of basal fertilizers and sett treatment operations will be done in single action with the use of planter. The row to row spacing in sugarcane cutter planter could be 90 to 150cm cm and can also be used for planting of sugar in 150 cm spacing as solo or paired row. The field capacity of the machine is 1.0 acre 2.5 hour. The cost of the sugarcane cutter planter is approximately Rs.1,95,000/- (excluding tractor). Sugarcane cutter planter reduces seed and labour cost by 50% in comparison with the farmers practice. It was observed that the girth and number of nodes were more in machine planted sugarcane compared to conventional planting. The root depth penetration was more in sugarcane planted using

sugarcane cutter planter compared to farmers practice. The farmer could save an amount of Rs.3000-00 per acre as compared to farmers practice

Planting with sugarcane cutter planter

Sugarcane Budchip planter:

The farmers are tending towards raising of single bud sugarcane seedlings using budchip technology. Approximately, 20% of the cost of production in sugarcane crop is being spent towards seed material and planting. In conventional planting, about 3-4 tonnes of sugarcane are being utilized for planting as seed material. Using budchip planting, about one tonne of cane is enough for planting of one acre land. There will be huge saving in seed material (75%). Introduction of budchip technology is highly essential to reduce seed cost by 75% compared to farmers practice. Manual planting of budchip seedlings is tedious and labour intensive. To overcome this problem, introduction of sugarcane budchip planter is highly essential to reduce the seed and labour cost by 75 % and 50%. Jaggery recovery also recorded higher (10.5) in mechanical budchip planted sugarcane compared to manual planting (9.6%).

The sugarcane is cut into buds using budchip cutting machine. The budchip cutting machines are operated either manually or power operated. The cost of pedal operated budchip cutting machine is Rs.2000/ and power operated pneumatic budchip cutting machine is Rs.40,000/. After removal of budchips from cane, the budchips are then raised

in protrays. The sugarcane seedlings of 20 to 30 days age are used for transplanting. The transplanting of these seedlings can be done manually or mechanically. For mechanical transplanting, tractor drawn sugarcane budchip planter is being used. This tranplanter is mounted on 3 point linkage hitch point at the rear side of the tractor. This implement could plant 3500-4000 seedlings per hour in 2 rows at a time. Three labourers are sufficient to operate sugarcane budchip planter in the field. Using this equipment, the row to row distance for sugarcane seedlings transplanting can be adjusted from 90 to 150 cm and interplant distance can be adjusted from 12 to 75 cm. The cost of the equipment is approximately Rs.2, 14,000/- with a field capacity of 1.0 acre per 2.5 hours.

Intercultivation Equipment:

In sugarcane crop, around 3 to 4 intercultural operations like loosening soil, harrowing and weeding, are required during entire crop period to maintain weed free crop. In farmers practice, about 20 to 25 labourers are required to carry out intercultural operations per acre, which is highly expensive. To reduce the cost of cultivation, introduction of power weeders or mini tractor with rotavator attachment is highly essential. The power weeder is operated by
2.0 H.P , 2 stroke petrol engine. The power weeder can also operate in between the rows of sugarcane with 80 cm spacing. About 3 to 4 hours are required for weeding in one acre of sugarcane field. The cost of power weeder varies from 60,000 to 70,000 depending upon the width of cut. For wider spacing (row to row spacing of 120 cm), mini tractor with rotavator can be used for removing weeds and also for loosening the soil between the rows.

Sugarcane Leaf Stripper

After the harvest of sugarcane crop, the tops and trash of sugarcane has to be

removed before transporting the cane to mills. Usually stripping of sugarcane is done manually. About three labourers are required to remove tops and trash from one tonne of cane for one day. To reduce the cost of operation, introduction of self propelled sugarcane stripper to remove tops and trash is highly essential. It is operated by 3.6 H.P diesel engine. About two labouers are required for stripping sugarcane using sugarcane leaf stripper. In this machine, cane is fed manually one by one and stripped by machine. The capacity of the machine is 1 ton/hr. The cost of the machine is approximately Rs. 1,10,000/-


Leaf Stripper

Sugarcane Trash Shredder

Trash shredding is the first operation in the ratoon crop which is very vital to enrich the soil by incorporating the decomposed trashes and other plant residues in the cane fields. After harvesting of sugarcane, around 3 to 4 tonnes of trash in one acre was remained in the field. The farmers were hitherto burning the trashes after the cane harvest (or) around 15 labourers is being employed to remove trash from one acre. To reduce the cost of operation and to conserve biomass, introduction of sugarcane trash shredder is highly essential to cut the sugarcane leaves into small pieces of 3 to 4 cm in the field, which could be used for mulching and to increase the soil fertlity. By this operation, trash bed is made on field which increases the water holding capacity of soil and saves 35-40% irrigation water. The trash shredder works with tractor PTO shaft. The machine can be operated by 35 or 45 HP tractor. The field capacity of the trash shredder is 2.5 ac/hr**.** The cost of sugarcane trash shredder is Rs.2, 63,000/-.

Operation of Sugarcane Trash Shredder Ratoon Management Device

(RMD)

The tilling, off-baring and earthing up operations are highly essential in ratoon crop management, which accounts 30% of the total cost of operation. To reduce the cost of operation, introduction of ratoon management device is highly essential for tilling, off-baring and earthing up operations in one or two passes. The stubble is cut by a sharp edged blade. The earthing unit i.e., a mould board provides soil cover the stubble in the form of a ridge. The field capacity of the machine is one acre/1.5 hrs. The cost of the machine is Rs.90,000-00. The benefits of RMD are: (i) it cuts cane stubbles below ground level and thus improves germination, (ii) cuts the old cane root system leading to better growth of ratoon crop and establishment of new root system and (iii) aerates soil structure.

Ratoon Management Device in Sugarcane Crop