SUGARCANE (*Saccharum Officinarum* L.)

Sugarcane is grown in 110 countries. It is consumed raw for juice, for the manufacture of sugar, jaggery and sugarcane baggase is used as fuel, and used for making paper.

CLIMATE: Sugarcane can be grown from warm tropical climate to foothills of Himalayas. Under warm humid conditions it can continue to grow till flowering. Temperature above 50˚ C restricts its growth and below 20˚ C slows its growth markedly, less than 10˚ C with severe frost is fatal during germination and establishment. It requires annual rainfall of 750 – 1,200 mm. For ripening it needs cool dry season. Bright sunny days and cool nights with a temperature of 15 - 18˚ C and low relative humidity 50 – 60 % are important for sugar accumulation and ripening.

SOIL: Sugarcane grows best on medium to heavy soils but can also be raised on light soils provided there is adequate irrigation facility and for heavy soils good drainage is essential. Dark rich clay loams 120 to 150 cm deep with an underlying impervious substratum of *murrum* (disintegrated trap – rock) are selected for cultivation of this crop.

SEED CANE: Healthy seed material, free from insect pest and diseases having high viability is essential. The top one third to half portion of cane being immature has good viable buds hence it is best to use as seeds. The bottom portion is usually richer in sugar so it is used for making sugar or jaggery (Gur). If seed cane is to be transported to a distant place it is carried without stripping off the leaves and not cut into setts, this is to prevent drying and injury to dormant buds. If planting is to be delayed for any reason, the cut canes should be kept in shade and periodically sprinkled with water. The stalks are cut into 3 bud setts each, usually 30 – 40 cm long. Soaking the setts in water for 4 – 6 hours before planting hastens germination. To prevent rotting and infection setts are dipped in 0.2 % Carbendazin for 30 minutes or Chlorpyriphos at 1 kg a.i/ha in emulsion form and diluted 300 times and is sprinkled with a watering can on the setts placed in furrows.

VARIETIES: CO–740, CO–997, CO–961, CO–JOR 1, CO–JOR 2, CO-421.

SEED RATE: 35,000 – 40,000 setts (3 budded)/ha i.e. 15 – 30 q of cane weight depending on thickness is required to provide 10,000 three budded setts. For late planting seed rate is often increased and closer row is maintained to guard against low germination.

LAND PREPARATION: Sugarcane requires clean preparation of land. Where soils are clay 1 or 2 deep ploughing and 1 cross ploughing is required. Cattle manure, compost are usually applied to soil and incorporated into it in advance before planting.

PLANTING SEASON:

April to May	- for 8 months crop (Plant – crop)
August to October	- for 18 months crop (Autumn Cane)

METHOD OF PLANTING:

i. Flat Planting: - In this method shallow furrows are made 60 – 90 cm apart and setts are placed in them end to end and covered with 5 – 7 cm of soil and the field is leveled with a plank.

ii. Furrow Planting :- Furrows are made with a ridger 10 – 15 cm deep with a row spacing of 75 – 90 cm. The prepared setts are laid end to end in the furrows and covered with 5 – 7 cm soil.

iii. Trench Planting: - 20 – 25 cm deep rectangular or trapezoidal in section are made either by manual labour or with a tractor drawn ridger and the bottom of the furrow is loosened by digging. Shallow furrows are made in bed of the trench and setts are placed end to end in the furrows and covered with 5 – 7 cm soil .

The tractor drawn sugarcane cutting – planter designed at Institute of Sugarcane Research (IISR) Lucknow. The use of cutter-planter is becoming popular in large farms, as it combines all planting operations like furrow opening, fertilizer application, sett cutting, sett treatment, placement and covering including planking, direct planting can be done by using cutter – planter without tillage.

MANURING: Sugarcane is a heavy feeder. A crop producing 100 MT/ha removes 205 kg N, 55 kg P, 275 kg K. Under Nagaland condition 150 kg N, 80 – 90 kg P and 70 – 80 kg K is required. ⅓ of Nitrogen and full quantity of Phosphorus and Potash are applied at the time of sowing. Remaining nitrogen is applied in 2 split doses 1^{st} dose at tillering stage and 2^{nd} dose in grand growth stage. Acetobacter a nitrogen fixing bacteria is also added at the time of sowing. Bacterium Acetobacter diazoter Ophicus unlike legumes or other nitrogen fixing plants which do not form root nodules in the soil. They lives within the entercellular spaces of the sugarcane stem.

TYING OR PROPPING: Tying or propping of canes are desirable so that they may not sway away during windy season and lodge.

IRRIGATION: In Nagaland Sugarcane crop is grown as rainfed, therefore trash – mulching in inter-row spaces is done for conserving soil moisture.

INTERCULTURAL AND WEED MANAGEMENT : 1^{st} hoeing after 3 – 4 week of planting depending on the field condition 2 – 3 more hoeing and weeding may be required in the first 3 months after planting. Since manual weed control is expensive, alternative chemical weed control can also be done. Atrazine 2 kg a.i/ha, followed by 2, 4 – D at 1 kg a.i/ha applied 60 days after planting has been found to provide good weed control. The final earthing up should be completed before monsoon rains and should generally synchronize with application of the final dose of Nitrogen. Good inter-culture operation allows the canes to tiller early and attain good size canes, thus helps keep down weeds.

MAJOR PEST AND DISEASES:

- Early shoot borer (*Chilo infuscatellus*) is a pre-monsoon pest and causes dead-hearts, maximum activity is observed during April – August.

Control – Clean cultivation, grow resistant varieties, avoid rationing, remove infested plants. Spray the crop with 0.5 % Dimecron or 0.4 % Nuvacron or apply trichogramma 2½ cards/ha, 6 releases every 2 weeks, 3 - 3½ months after planting.

- Pyrilla or Leaf hoppers (*Pyrilla perpusilla*) : Straw coloured adults and nymph suck the sap from the leaves which become yellow and dry up. Hoppers also exude honeydew which attracts ants, and favour the growth of sooty mould. Control – Spray the crop with 0.25 % Malathion 50 EC.
- White flies (*Aleurolobus barodensis*) – Adult and nymph suck the plant sap. Control – Spray the crop with 0.25 % Malathion 50 EC.
- Mealy bugs (*Saccaharicoccus sacchari*), Scale insect (*Melanaspis glomerata*) and Aphids (*Ceratovacuna lanigera*) – These pest sometimes assume a serious status in certain pockets. The insects suck the sap near the nodes and leaf sheaths. Control – Destroy infested sheaths and if serious spray the crop with 0.5 % Dimecron, 100 EC or 0.4 % Rogor 30 EC.
- Red ants (*Dorylus orientalis*) and Termites (*Odontotermes obesus*)
  Control – Use only well decomposed manure, apply Malathion dust @ 25kg/ha.

DISEASES:

- Red rot of Sugarcane (*Glomerella tucumanensis*) Control – i)Grow resistant varieties ii)Avoid planting in red rot infested field iii)Avoid planting in ill drained soils iv)Treat the setts with Aretan or Agallol (1:100)
- Smut (*Ustilago scitominea*) – The growing shoot turns into a whip – like black growth, covered by a powdery mass of black spores, enclosed in a thin membrane. Control – i)Grow resistant varieties. ii)Avoid rationing iii)Treat the setts with agallol solution 0.5 % (5gm/lit of water)
- Rust (*Puccinia kuchnii*) – Orange pastules later on turning brown appear on the under surface of leaves. Control – Remove disease clumps.
- Grassy Shoot Disease (*Mycoplasma*) and Ratoon Stunting Disease – Are important disease of sugarcane and it is transmitted through cuttings. Excesive tillering, sprouting and poor cane formation particularly in Ratoon crop takes place.

Control –

i) Plant healthy setts
ii) The moist hot – air treatment
iii) Dip the cane before planting in 0.5 % Agallol solution.

RIPENING: Maturity of Sugarcane is determined by gradual withering of lower leaves. Most satisfactory result is obtained by using a hand refractometer by taking the sample from the middle portion of the stalk. If reading is at 20 then the cane is considered matured. The Fehling's test for glucose gives better assessment. The glucose value is less than 0.5 % in juice at peak maturity.

HARVESTING: The canes are cut 3 – 5 cm below the ground level, the dried leaves are stripped off upto top most internode. The harvested canes should be crushed quickly otherwise canes lose weight unless kept moist. In tropical areas quick processing is essential to avoid deterioration of the quality due to activity of *Leuconostoc* bacteria.

YIELD : 400 – 500 q/ha (11 – 12 months plant-crop)
600 – 700 q/ha (18 months crop Autumn Cane)

CROP ROTATION: Sugarcane is normally grown in rotation with crop like rice, wheat, green gram, black gram, lentil, pea, coriander etc.

RATOONING: Ratooning is the method of allowing stubbles of the harvested crop to sprout and form the basis for the next crop. Varieties having high regeneration capacity are required for rationing. The optimum temperature for quick sprouting of stubbles is around 27˚ C, hence plant – crop should be harvested from Mid – February to Mid – March. Only first ratoon is recommended in most of the States in India. The crop to be ratooned is cut at 3 – 5 cm below the ground, the stubble is shaved , at that level and the trash is burnt or mulched. At the proper stage the inter rows are ploughed to encourage fresh roots. However the ratoon crop requires 25% more nitrogen than the plant – crop and gives lower yield than the plant – crop. But they mature early, less cost of cultivation such as tillage, seed and planting etc. So practically they are more renumerative than the plant crop. Sugarcane cultivation suffering from disease or excessive population of pest should not be ratooned.