7. SUGARCANE (*Saccharum officinarum*)

CLIMATE REQUIREMENT

T_Max°C	T_Min°C	Optimum °C	Rainfall mm	Altitude m MSL
42	15	32 - 35	2500 - 3000	1000

Tropical crop. Besides temperature and rainfall, light (day length) plays a very important role in proper growth and development i.e. tillering of cane. A long, warm growing season with a high incidence of solar radiation and adequate moisture is required.Short day length decreases number of tillers. Under long day length conditions, plant produces more dry matter.

CROP IMPROVEMENT
A. PLANTED (MAIN) CROP

I. SEASON AND VARIETIES

Sugarcane is grown chiefly in the main season (December - May) in the entire State. In parts of Tiruchirapalli, Perambalur, Karur, Salem, Namakkal and Coimbatore districts, it is also raised during the special season (June - September). The particulars in respect of each season are given below:

SEASON, PERIOD OF PLANTING

1. Main season

i) **Early** **:** Dec - Jan ii) **Mid :** Feb - March iii) **Late:** April – May

2. Special season : June - July

All early season varieties are suitable for special season.

II. PARTICULARS OF VARIETIES

Variety	Duration (Month)	Cane Yield (t/ha)	CCS %	CCS (t/ha)
CoG 94077	11	133.2	13.50	17.60
Co 86032	10-12	110.0	13.00	14.30
CoSi (SC) 6	10-11	142.0	13.10	18.60
TNAU SC Si 7	10-11	156.0	13.40	20.90
TNAU SC Si 8	11-12	146.0	12.90	18.00
CoC 25	10-12	145.7	12.77	18.62
CoG 6	10-12	140.6	13.34	18.39

III. Morphological characters

Characters	CoG 94077	Co 86032
Parentage	Co 740 x Co 775	Co 62198 X CoC 671
Leaf size	Medium	Medium
Leaf colour	Dark green	Dark green
Sheath colour	Greenish with Purple tinge	Green with purple
Sheath clasping	Loose	Loose
Spines	Absent	Few, hard, deciduous
Ligular process	Present on one side	Absent
Stem colour	Greenish yellow	Reddish pink (exposed) Greenish yellow (unexposed)
Girth	Medium	Medium
Joint	Slightly staggered	Cylindrical
Bud Groove	Short, shallow	Absent
Size	Medium	Medium

Character	TNAU SC Si 7	TNAU SC Si 8
Parentage	Co 99034 x CoG 93076	CoC 90063 x Co 8213
Leaf Size	Medium	Medium
Leaf colour	Dark green	Green
Sheath colour	Yellowish Green with purple tinge	Green with purple stripes
Sheath clasping	Slightly tight	Loose
Spines	Present (deciduous)	Very few, soft and deciduous
Splits	Absent	Absent
Ligular process	Present	Present (asymmetrical)
Stem colour	Yellowish green (exposed) pinkish yellow (unexposed)	Greenish yellow (exposed) Greenish Yellow (enexposed)
Girth	Medium	Medium
Joint	Straight	Straight
Bud groove	Absent	Present, Shallow
Size	Medium	Big

Characters	CoC 25	CoG 6
Parentage	Co 85002 x HR 83-144	HR 83-144 x CoH 119
Leaf size	Medium	Medium
Leaf colour	Green	Light Green
Sheath colour	Green with pinkish tinge with scarious border	Greenish purle
Sheath clasping	Loose	Loose

Spines	Absent	Decidous spines
Splits	Absent	Absent
Ligular process	Slightly indicated asymmetrical	Present (crescent shaped)
Stem colour	Greenish yellow green (unexposed) Pinkish (exposed)	yellow green (unexposed) Green yellow (exposed)
Girth	Medium	Medium
Joint	Zig zag	Straight
Bud Groove	Deep and extent all over the length of the internode	Present
Size	Medium	Medium

Parameters	**Co 0212**	**Co 06022**
Parentage	Co 7201 X ISH 106	GU 92-275 X Co 86249
Maturity group	Mid-late	Early
Year of release	2016	2018
Institute name	ICAR-Sugarcane Breeding Institute, Coimbatore	ICAR-Sugarcane Breeding Institute, Coimbatore
Cane yield (t/ha)	150.56	135.8
CCS %	12.80	13.10
Sugar yield (t/ha)	19.27	17.68
Reaction to red rot	Moderately resistant	Moderately resistant
Special features	Tolerant to drought and salinity A1 quality jaggery Good ratooner Erect and medium thick cane	A1 quality jaggery of golden yellow colour Non lodging, erect, thick cane Tolerant to water deficit stress

Parameters	**Co 09004 (Amritha)**	**Co 11015 (Atulya)**
Parentage	CoC 671 X CoT 8201	CoC 671 X Co 86011
Maturity group	Early	Early
Year of release	-	2019
Institute name	ICAR-Sugarcane Breeding Institute, Coimbatore	ICAR-Sugarcane Breeding Institute, Coimbatore
Cane yield (t/ha)	109.85	142.72
CCS %	18.94 (Sucrose %)	20.22 (Sucrose %)
Sugar yield (t/ha)	14.56	20.16
Reaction to red rot	Moderately resistant	Moderately susceptible
Special features	Resistant to smut Less susceptible to borer Tall cane, early fast growth, high tillering, medium thick cane, non-flowering, non lodging, good ratooner	Short duration (8 month) High sugar content Tall (>250 cm) and erect plant Medium thick cane A1 quality jaggery of golden yellow colour

Varieties suitable for Jaggery: CoG 6, Co 0212, Co 06022 and Co 11015

Varieties suitable for different seasons

Early (Dec-Jan) :

CoC 25, CoG 6, TNAU Sugarcane Si 7, Co 09004, Co 06022, CO 91015(Atulya)

Mid-late (Feb-Mar) :

Co 86032, Co 06030, TNAU Sugarcane Si 8, Co 0212

Special season (June-sept)

CoC 25, CoG 6, TNAU Sugarcane Si 7, Co 09004, Co 06022, CO 91015(Atulya)

Source of Seed

For the varieties released from Tamil Nadu Agricultural University for supply of primary seed materials, the Sugarcane Research Stations at Cuddalore, Sirugamani and Melalathur may be contacted. For other varieties promoted by the factories, for seed materials the concerned factories may be contacted.

CROP MANAGEMENT

IV. MAIN FIELD PREPARATION FOR PLANTING SUGARCANE

1. PREPARATION OF THE FIELD

a) **Wetland (Heavy soils):** In wetlands, preparatory cultivation by ploughing the land and bringing the soil to fine tilth could not be done.

i. After harvest of the paddy crop, form irrigation and drainage channels of 40 cm depth and 30 cm width at intervals of 6 m across the field and along the field borders.

ii. Form ridges and furrows with a spacing of 80 cm between rows with spade.

iii. Stir the furrows with hand hoes and allow the soil to weather for 4 to 5 days.

b) **Problem soils with excessive soil moisture:**

In problem soils, with excessive moisture where it is difficult to drain water, form raised beds at 30 cm intervals with Length - 5 m, Width - 80 cm, and Height - 15 cm.

a. Garden lands with medium and light soils:

In medium and light soil irrigated by flow or lift irrigation adopt the following:

i. The initial ploughing with two disc plough followed by eight disc plough and using cultivator for deep ploughing followed by one time operation of rotovator to pulverize the soil to get a fine tilth, free of weeds and stubbles.

ii. Level the field with laser leveler for effective and proper irrigation management.

iii. Open ridges and furrows with tractor operated victory plough with a depth of 30cm and spacing of 80 cm between the rows for normal planting with furrow irrigation.

iv. Open irrigation channels at 10 m intervals.

2. BASAL APPLICATION OF ORGANIC MANURES:

Apply FYM at 12.5 t/ha or compost 25 t/ha or filter press mud at 37.5 t/ha before the last ploughing under gardenland conditions. In wetlands this may be applied along the furrows and incorporated well.

Preparation of reinforced compost from sugarcane trash and pressmud:

Spread the sugarcane trash to a thickness of 15 cm over an area of 7 m x 3 m. Then apply pressmud over this trash to a thickness of 5 cm. Sprinkle the fertilizer mixture containing mussoorie rock phosphate, gypsum and urea in the ratio of 2:2:1 over these layers at the rate of 5 kg/100 kg of trash. Moist the trash and pressmud layers adequately with water. Repeat this process till the entire heap rises to a height of 1.5 m. Use cowdung slurry instead of water to moist the layer wherever it is available. Cover the heap with a layer of soil and pressmud at 1:1 ratio to a thickness of 15 cm. Leave the heap as such for three months for decomposition. Moist the heap once in 15 days. During rainy season, avoid moistening the heap. After three months, turn and mix the heap thoroughly and form a heap and leave it for one more month. Then turn and mix the heap thoroughly at the end of the fourth month. Moist the heap once in 15 days during 4th and 5th month also. This method increases the manurial value of trash compost by increasing, N, P and Ca content. It also brings down the C:N ratio by 10 times as compared to raw cane trash.

Composition of cane trash, pressmud and cane trash compost

Major nutrients	Cane trash	Pressmud	Cane trash compost
Nitrogen (N)	0.40	Percent 1.90	1.60
Phosphorus (P)	0.13	1.50	1.10
Potassium(K)	0.40	0.50	0.40
Calcium (Ca)	0.56	3.00	1.00
Magnesium (Mg)	0.30	2.00	0.60
Sulphur (S)	0.12	0.50	0.48
Micronutrients	**Cane trash**	**Pressmud**	**Cane trash compost**
		PPM	
Iron (Fe)	360	2240	2710
Manganese (Mn)	110	400	450
Zinc (Zn)	90	360	370
Copper (Cu)	30	130	80
C:N ratio	113:1	16:1	22:1

2. BASAL APPLICATION OF PERTILIZER

(i) If soil test is not done, follow blanket recommendation of NPK @ 300:100:200 kg/ha Apply super phosphate (625 kg/ha) along the furrows and incorporate with hand hoe.
(ii) Soil test crop response based integrated plant nutrition system (STCR- IPNS) recommendation may be adopted for prescribing fertilizer doses for specified yield targets. (ready reckoners are furnished)

Sugarcane (1)

Soil : Mixed black calcareous (Perianaickenpalayam series)
Target : 125-150 t ha^{-1}

FN = 4.17 T - 1.09 SN - 1.11 ON
FP_2O_5= 1.01 T - 2.56 SP - 1.01 OP
FK_2O = 3.44 T - 0.84 SK - 1.03 OK

Initial soil test values (kg ha^{-1})			Yield target – 125t ha^{-1} NPK (kg ha^{-1}) + FYM @ 12.5 t ha^{-1} + *Azospirillum* @ 2 kg ha^{-1} + PSB @ 2 kg ha^{-1}			Yield target – 150 t ha^{-1} NPK (kg ha^{-1}) + FYM @ 12.5 t ha^{-1} + *Azospirillum* @ 2 kg ha^{-1} + PSB @ 2 kg ha^{-1}		
SN	**SP**	**SK**	**FN**	**FP_2O_5**	**FK_2O**	**FN**	**FP_2O_5**	**FK_2O**
200	15	300	223	50*	113	328	68	199
220	17	350	201	50*	100*	306	63	157
240	19	400	180	50*	100*	284	58	115
260	21	450	158	50*	100*	262	53	100*
280	23	500	150*	50*	100*	240	50*	100*

* Maintenance dose

Sugarcane (2)

Soil : Red coastal alluvium (Gadillum series)
Target : 125 t ha^{-1} and 150 t ha^{-1}

FN =4.06 T-0.74SN-0.87 ON
FP_2O_5=0.71T-1.09 SP-0.72 OP
FK_2O=2.67T-0.57SK-1.33 OK

Initial soil test values (kg ha^{-1})			Yield target – 125 t ha^{-1} NPK (kg ha^{-1}) + FYM @ 12.5 t ha^{-1} + *Azospirillum* @ 2 kg ha^{-1} + PSB @ 2 kg ha^{-1}			Yield target – 150 t ha^{-1} NPK (kg ha^{-1}) + FYM @ 12.5 t ha^{-1} + *Azospirillum* @ 2 kg ha^{-1} + PSB @ 2 kg ha^{-1}		
SN	**SP**	**SK**	**FN**	**FP_2O_5**	**FK_2O**	**FN**	**FP_2O_5**	**FK_2O**
200	15	200	280	50*	155	381	50*	222
220	17	220	265	50*	143	366	50*	210
240	19	240	250	50*	132	351	50*	199
260	21	260	235	50*	121	337	50*	187
280	23	280	220	50*	109	322	50*	176

*Maintenance dose

Sugarcane (3)

Soil : Red sandy loam (Irugur series)

Target : 100 t ha^{-1} -125 t ha^{-1}

FN =3.42 T-0.56 SN-0.93 ON
FP_2O_5=1.15T-1.94 SP-0.98 OP
FK_2O=3.16T-0.73SK-0.99 OK

Initial soil test values (kg ha^{-1})			Yield target – 100 t ha^{-1} NPK (kg ha^{-1}) + FYM @ 12.5 t ha^{-1} + *Azospirillum* @ 2 kg ha^{-1} + PSB @ 2 kg ha^{-1}			Yield target – 125 t ha^{-1} NPK (kg ha^{-1}) + FYM @ 12.5 t ha^{-1} + *Azospirillum* @ 2 kg ha^{-1} + PSB @ 2 kg ha^{-1}		
SN	**SP**	**SK**	**FN**	**FP_2O_5**	**FK_2O**	**FN**	**FP_2O_5**	**FK_2O**
200	14	200	150	50*	105	236	72	184
220	16	220	139	50*	100*	224	68	169
240	18	240	128	50*	100*	213	64	155
260	20	260	116	50*	100*	202	60	140
280	22	280	105	50*	100*	191	56	126

*Maintenance dose

Note: FN, FP_2O_5 and K_2O are fertilizer N, P_2O_5 and K_2O in kg ha^{-1}, respectively; T is the yield target in t ha^{-1}; SN, SP and SK respectively are available N,P and K in kg ha^{-1} and ON, OP and OK are the quantities of N, P and K supplied through organic manure inkg ha^{-1}.

(i) Apply 37.5 kg Zinc sulphate/ha and 100 kg Ferrous sulphate + 12.5 t FYM/ha to zinc and iron deficient soils.
(ii) Application of sulphur in the form of Gypsum @ 500 kg /ha to sulphur deficient soils to increase the cane yield and juice quality.
(iii) Basal application of 5 kg $CuSO_4$ for copper deficient soil.

V. MANAGEMENT OF MAIN FIELD OPERATIONS

1. PREPARATION OF SETTS FOR PLANTING

a. Take seed material from short crop (6 to 7 months age) free from pests and diseases.
   i) Detrash the cane with hand before setts preparation.
   ii) Use sharp knife or sett cutting machine developed by TNAU to prepare setts without splits.
   iii) Discard setts with damaged buds, sprouted buds, splits etc.
   iv) **Sett treatment with biofertilizers:** Prepare slurry with 2 kg of *Azospirillum/ Gluconacetobacter,* 2kg of phosphobacteria , 2 kg of SSB and dip the setts required for one ha for 30 minutes and plant. (or) sett treatment with powder formulation of *Gluconacetobacter diazotrophicus* and AM fungi each @ 67.5 g/ha along with 75% of recommended dose of N & P.

2. SETT TREATMENT

- Select healthy setts for planting.
- The setts should be soaked in 100 litres of water dissolved with 50g Carbendazim, 200ml Malathion and 1 kg urea for 15 minutes.
- Treat setts with Aerated steam at 50°C for one hour to control primary infection of grassy shoot disease.

3. SEED RATE

75000 two-budded setts/ha.

4. PLANTING

Different systems of planting is not found to influence the millable cane population, commercial cane sugar per cent, cane and sugar yield.

a) Irrigate the furrows to form a slurry in wet land condition (Heavy soil)
b) Place the setts along the centre of the furrows, accommodating 12 buds/metre length. Keep the buds in the lateral position and press gently beneath the soil in the furrow.
c) Next day cover the exposed setts with soil to avoid exposure of setts to sunlight.
d) Plant more setts near the channel or double row planting at every 10^{th} row for gap filling, at later stage.
e) In dry/ garden land dry method of planting may be followed. First arrange the setts along the furrows, cover the setts with soil and then irrigate.

Improved technologies on cane planting systems
Mechanisation of planting

- TNAU mechanical planter is useful for cost effective planting with saving of Rs.3750 / ha and it can cover an area of 1.5ha/day
- Reduces the human labour drudgery and seed rate up to 5 tones/ha.
- Paired row system of planting double side planting of sugarcane setts with 150 + 30 cm spacing for Astraf 8000 series (Mechanical harvester) operated areas and 150 + 30 cm spacing for New Holland 4000 series operated areas may be adopted with single row of cane planting.
- Sugarcane cultivates under subsurface drip system the laterals may be placed 20cm depth in the furrows and setts are placed 5cm above the laterals.
- For sustainable sugarcane initiative system (SSI) transplanting young chip bud seedling raised in portray (25-35 days old) in wide spacing (5x2 feet) in the main field with drip fertigation system.
- Daincha / Sunhemp intercropping in the wider spaced cane cultivated area for improving soil health and reduce the weed infestation. It also reduces early shoot borer incidences and increases cane yield.
- Plant the setts on one side of the ridge for 80 cm spacing in heavy soil to avoid sett rot resulted better germination
- Sow rhizobium treated green manure seeds @ 10kg/ha on the opposite side of ridge with 10cm. Spacing on or before 3 days after planting.
- Incorporate the green manure crop 50-60 days after planting in between inter row of wider spaced crop and give partial earthing up with recommended dose of N fertilizer on 90 – 100 day after planting.
- Introduction of power weeder with rotovator for weeding and earthing up with ridger to save the cost on labour and also to reduce human drudgery.

5. FILLING UP GAPS

ii. Fill the gaps, if any, within 30 days after planting with sprouted setts.
iii. Gap filling with two budded setts/ poly bag seedlings within 15 to 20 days after planting to maintain optimum plant stand.
iv. Maintain adequate moisture for 3 weeks for proper establishment of the sprouted setts.

6. TRASH MULCHING

Mulch the ridges uniformly with cane trash to a thickness of 10 cm within a week after planting. It helps to tide over drought, conserves moisture, reduce weed population and minimise shoot borer incidence. Mulch the field with trash after 21 days of planting in heavy soil and wetland conditions. Avoid trash mulching in areas where incidence of termites is noticed.

7. RAISING INTER CROPS

In areas of adequate irrigation, sow one row of soybean or blackgram or greengram along the centre of the ridge on the 3rd day of planting. Intercropping of daincha or sunnhemp along ridges and incorporation of the same on the 45th day during partial earthing up helps to increase the soil fertility, and also the cane yield.

8. WEED MANAGEMENT

WEED MANAGEMENT IN PURE CROP OF SUGARCANE

i. Wherever weed menace is higher, one line weeding along the crop row and spade digging of ridges have to be done on 30, 60 and 90 DAP
ii. Spray Atrazine 1 kg or Oxyflurofen 750 ml/ha mixed in 500 liters of water as pre emergence herbicide on the 3rd day of planting, using deflector or fan type nozzle fitted with knapsack sprayer.
iii. Pre emergence application of Atrazine @ 1.0 kg ha^{-1} on 3 DAP followed by post emergence application of Glyphosate @ 10 ml / litre of water on 45 DAP + one hand weeding on 90 DAP registered the maximum cane yield.
iv. If the parasitic weed striga is a problem, Pre-emergence application of Atrazine 1.0 kg/ha on 3 DAP + hand weeding on 45 DAP with an earthing up on 60 DAP combined with post-emergence spraying of 2,4-D @ 6 g (0.6%) + Urea @ 20 g (2%) / litre of water on 90 DAP + Trash mulching 5 t/ha on 120 DAP.
v. Pre- plant application of Glyphosate at 2.0 kg h^{a-1} along with 2% ammonium sulphate at 21 days before planting of sugarcane followed by post emergence direct spraying of Glyphosate at 2.0 kg h^{a-1} along with 2% Ammonium sulphate with a special hood on 30 DAP suppressed the nut sedges *(Cyperus rotandus*) and provided weed free environment.
vi. If herbicide is not applied work the junior-hoe along the ridges on 25, 55 and 85 days after planting for removal of weeds and proper stirring. Remove the weeds along the furrows with hand hoe. Otherwise operate power tiller fitted with tynes for intercultivation.
vii. Control of creeper weeds post emergence directed application of Fernoxone (2, 4 –D sodium salt) @ 2 gm + 10 gm of urea per liter of water may be sprayed over the creeper weeds.

Weed management in Sugarcane intercropping system

Premergence application of Thiobencarb @ 1.25 kg ai/ha under intercropping system in Sugarcane with Soybean, Blackgram or Groundnut gives effective weed control. Raising intercrops is not found to affect the cane yield and quality.

9. EARTHING UP

After application of 3rd dose fertilizer (90 days), work victory plough along the ridges for efficient and economical earthing up. At 150 days after planting, earthing up may be done with spade.

10. DETRASHING

Remove the dry cane leaves on 150th and 210th day to avoid borer infestation.

11. PROPPING

Do double line propping with trash twist at the age of 210 days of the crop.

12. TOP DRESSING WITH FERTILIZERS

Apply 275 kg of nitrogen and 112.5 kg of K O/ha in three equal splits at 30, 60 and 90 days

a. Soil application

Coastal and flow irrigated belts (assured water supply areas). In the case of lift irrigation belt, apply 225 kg of Nitrogen and 112.5 kg of K O/ha in three equal splits at 30, 60 and 90 days (water scarcity areas). For jaggery areas, apply 175 kg of nitrogen and 112.5 kg of K_2O/ha in three equal splits on 30, 60 and 90 days.

NITROGEN SAVING

a. **Neem Cake Blended Urea**: Apply 67.5 kg of N/ha + 27.5 kg of Neem Cake at 30 days and repeat on 60th and 90th days.

Note: Neem cake blending: Powder the required quantity of neem cake and mix it with urea thoroughly and keep it for 24 hours. Thus, 75 kg of nitrogen/ha can be saved by this method.

b. **Azospirillum**: Mix 12 packets (2400 g)/ha of Azospirillum inoculant or TNAU Biofert –1 with 25 kg of FYM and 25 kg soil and apply near the clumps on 30th day of planting. Repeat the same on 60th day with another 12 packets (2400 gm). Repeat the above on the other side of the crop row on the 90th day (for lift irrigated belt).

c. **Band placement:** Open deep furrows of 15 cm depth with hand hoes and place the fertilisers in the form of band and cover it properly.

d. **Subsurface application:** Application of 255 kg of Nitrogen in the form of urea along with potash at 10cm depth with 15cm intervals by the side of the cane clump will result in the saving of 20 kg N/ha without any yield reduction.

Nutritional Disorders :

Nitrogen deficiency : All leaves of sugarcane exhibit a yellow – green colour and retardation of growth. Cane stalks are smaller in diameter and premature drying of older leaves. Roots attain a greater length but are smaller in diameter.

Phosphorus deficiency : Reduction in length of sugarcane stalks, diameter of which taper rapidly at growing points. The colour of the leaves is greenish blue, narrow and somewhat reduced length, reduced tillering, decreased shoot / root ratio with restricted root development.

Potassium deficiency: Depressed growth, yellowing and marginal drying of older leaves and development of slender stalks. An orange, yellow colour appears in the older lower leaves which develop numerous chlorotic spots that later become brown with dead centre. A reddish discoloration which is confined to the epidermal cells of the upper surfaces and midribs of the leaves. The young leaves developed from a common point giving a "Bunched top" appearance. Poor root growth with less member of root hairs.

Zinc deficiency: Mild zinc deficiency exhibit a tendency to develop anthrocyanin pigments in the leaves. Pronounced bleaching of the green colour along the major veins and also striped effect due to a loss of chlorophyll along the veins. In acute cases of zinc deficiency there is evidences of necrosis and growth ceases at the growing point (meristem).

Iron deficiency: Symptoms of Iron deficiency are generally seen in young leaves where pale stripes with scanty chlorophyll content occur between parallel lines. In advanced stages of deficiency the young leaves turn completely white, even in the veins. Root growth also becomes restricted.

Boron deficiency : Boron deficiency could be seen in the cane by depressed growth, development of distorted and chlorotic leaves and the presence of definite leaf and stalks lesions. In extreme cases of boron deficiency the plant will die.

Importance of Balanced Nutrition

The soil fertility has declined in many sugarcane growing areas of the state due to improper and some times, distorted fertilizer schedules adopted over the years under intensive cultivation of the crop. Hence balanced application of fertilizer based on soil test values and crop requirement is essential.

How to Evaluate fertilizer requirement

Through STCR fertilizer prescription equations

a. Perianaickenpalayam series (Inceptisols) of Coimbatore and Erode STL Jurisdiction
   FN = 4.17 T – 1.09 SN – 1.11 ON FP_2O_5 = 1.01 T – 2.56 SP – 1.01 OP FK_2O = 3.44 T – 0.84 SK – 1.03 OK
b. Gadillum series (Red laterite) of Cuddalore STL Jurisdiction
   FN = 4.06 T – 0.74 SN – 0.87 ON FP_2O_5 = 0.71 T – 1.09 SP – 0.72 OP FK_2O = 2.67 T – 0.57 SK – 1.30 OK

c. Irugur series (Inceptisols) of Coimbatore, Erode, Trichy and Salem STL Jurisdiction
FN = 3.42 T – 0.56 SN – 0.93 ON FP_2O_5 = 1.15 T – 1.94 SP – 0.98 OP FK_2O = 3.16 T – 0.73 SK – 0.99 OK

Micro nutrient fertilizers

1. (a) Zinc deficient soils : Basal application of 37.5 kg/ha of Zinc sulphate.
   (b) For Zinc deficiency symptoms: foliar spray of 0.5% Zinc sulphate with 1% Urea at 15 days interval till deficiency symptoms disappear.
2. (a) Iron deficient soils: Basal application of 100 kg/ha of Ferrous sulphate + 12.5t FYM.
   (b) For Iron deficiency symptoms: Foliar spray of 1% ferrous sulphate + 0.1% Citric acid with 1% Urea at 15 days interval till deficiency symptoms disappear.
3. For Copper deficiency Symptoms Soil application of $CuSO_4$@ 5 kg/ha in Copper deficient soils. Alternatively foliar spray of 0.2% $CuSO_4$ twice during early stage of crop growth.

Common Micronutrient mixture : To provide all micronutrients to sugarcane, 50 kg /ha of micronutrient mixture containing 20 kg Ferrous sulphate,10 kg Manganese sulphate, 10 kg Zinc sulphate, 5 kg of Copper sulphate, 5 kg of Borax mixed with 100 kg of well decomposed FYM, can be recommended as soil application prior to planting. (Or) Application of TNAU MN mixture @ 50 kg/ha as EFYM for higher cane yield.

Recommended dosage of macro and micronutrients

a. Sugarcane – plant crop (meant for sugar mills) 300:100:200 kg N, P_2O_5 and K_2O per ha
b. Sugarcane – Ratoon crop (meant for sugar mills)
   300 + 25% extra N : 100 : 200 kg N, P_2O_5 and K_2O per ha
c. Sugarcane for jaggery manufacture (plant as well as ratoon crop)
   225 : 62.5 : 112.5 kg N, P_2O_5 and K_2O per ha

13. BIOFERTILIZER FOR SUGARCANE

Azospirillum is the common biofertilizer recommended for N nutrition which could colonize the roots of sugarcane and fix atmospheric nitrogen to the tune of about 50 to 75 kg nitrogen per ha per year. Recently, another endophytic nitrogen fixing bacterium, *Gluconacetobacter diazotrophicus* isolated from sugarcane can able to fix more nitrogen than *Azospirillum*. It colonizes throughout the sugarcane and increases the total N content. In soil, it can also colonize the roots and able to solubilize the phosphate, iron and Zn. It can also enhance the crop growth, yield of sugarcane and sugar content of the juice. Since it is more efficient than *Azospirillum*, this new

organism was test-verified in various centres and released as new biofertilizer Gluconacetobacter diazotrophicus TNAU Biofert-I. Phosphobacteria as P solubiliser are recommended for sugarcane crop.

Sett treatment with *Gluconacetobacter diazotrophicus*
Before planting the sugarcane setts can be treated with ten packets (2 kg) per ha of *Gluconacetobacter diazotrophicus* prepared as slurry with 250 L of water.

Soil application *Gluconacetobacter diazotrophicus*
Twelve packets (2.4 kg) per ha is recommended for soil application each at 30th, 60th and 90th day after planting under irrigated condition.

Same method of application can be followed for Phosphobacteria.

- If basal application is not followed, apply the same with 30th day, 60th day and 90th day after planting and copiously irrigate the field.
- Biofertilizer treatment should be done just before planting.
- Immediately plant/ Irrigate after biofertilizer application
- Do not mix biofertilizer along with chemical fertilizer.
- Reduces 25% of the recommended N to reap the benefits of biofertilizer application

14. WATER MANAGEMENT

Irrigate the crop depending upon the need during different phases of the crop.

Germination phase (0 - 35 days):

Provide shallow wetting with 2 to 3 cm depth of water at shorter intervals especially for sandy soil for enhancing the germination. Sprinkler irrigation is the suitable method to satisfy the requirement, during initial stages.

Later, irrigation can be provided at 0.75, 0.75 and 0.50 IW/CPE ratio during tillering, grandgrowth and maturity phases respectively. The irrigation intervals in each phase are given below:

Stages	Days of irrigation interval	
Tillering phase (36 to 100 days)	8	10
Grand growth phase (101 - 270 days)	8	10
Maturity phase (271 - harvest)	10	14

Drip Irrigation:

- Planting setts, obtained from 6-7 months old healthy nursery and planted in paired row planting system with the spacing of 30x30x30 / 150 cm. for manual harvest and 30/150 cm for machine harvest

- Eight setts per metre per row have to be planted on either sides of the ridge thus making it as four row planting system.
- 12 mm drip laterals have to be placed in the middle ridge of each furrow with the lateral spacing of 240 cm & 8 'Lph' clog free drippers should be placed with a spacing of 75 cm on the lateral lines. The lateral length should not exceed more than 30-40 m.
- Phosphorus @ 62.5 kg ha^{-1} has to be applied as basal at the time of planting.
- Nitrogen and Potassium @ 275:112.5 kg ha^{-1} have to be injected into the system as urea and muriate of potash by using "Ventury" assembly in 10-12 equal splits starting from 15 to 150- 180 days after planting.
- Low or medium in nutrient status soil to be given with 50 per cent additional dose of Nitrogen and Potassium.
- Irrigation is given once in three days based on the evapo-transpiration demand of the crop.
- The double side planting of sugarcane with lateral spacing of 120+40 cm under subsurface drip fertigation system improves the yield.
- Application of 125 % recommended NPK (Rec NPK-275 :63:112.5 kg /ha) through fertigation under pit system of planting inprove the yield and yield attributes.

Concept of fertigation

- Fertigation is the judicious application of fertilizers by combining with irrigation water.
- Fertigation can be achieved through fertilizer tank, venturi System, Injector Pump, Non- Electric Proportional Liquid Dispenser (NEPLD) and Automated system.
- Recommended N & K @ of 275 and 112.5 kg. ha^{-1} may be applied in 14 equal splits with 15 days interval from 15 DAP.
- 25 kg N and 8 kg K_2O per ha per split.
- Urea and MOP (white potash) fertilisers can be used as N and K sources respectively
- Fertigation up to 210 DAP can also be recommended.

Advantages of Fertigation

- Ensures a regular flow of water as well as nutrients resulting in increased growth rates for higher yields
- Offers greater versatility in the timing of the nutrient application to meet specific crop demands

- Improves availability of nutrients and their uptake by the roots
- Safer application method which eliminates the danger of burning the plant root system
- Offers simpler and more convenient application than soil application of fertilizer thus saving time, labour, equipment and energy
- Improves fertilizer use efficiency
- Reduction of soil compaction and mechanical damage to the crops
- Potential reduction of environmental contamination
- Convenient use of compound and ready-mix nutrient solutions containing also small concentration of micronutrients.

15. Contingent plan

Gradual widening of furrow:

At the time of planting, form furrow at a width of 30 cm initially. After that, widen the furrow to 45 cm on 45th day during first light earthing up and subsequently deepen the furrow on 90th day to save 35% of water.

Drought Management:

i. Soak the setts in lime solution (80 kg Kiln lime in 400 lit) for one hour.
ii. Plant in deep furrows of 30 cm depth.
iii. Foliar spray of kel and urea each at 2.5 per cent during moisture stress period at 15 days interval.
iv. Foliar spray of Kaolin (60 g in 1 ltr. of water) to alleviate the water stress.
v. Under water scarcity condition, alternate furrow and skip furrow method is beneficial.
vi. Apply 125 kg of MOP additionally at 120 day of planting.
vii. Basal incorporation of coir waste @ 25 tonnes/ha at the time of last ploughing.
viii. Removal of dry trash at 5th month and leave it as mulch, in the field.

16. CROP PROTECTION

A. Pest Management:

SUGARCANE

- Deep plough during summer
- Select scale insect free setts
- Treat the setts with Imidacloprid 70% WS @ 100 ml/ 100 kg to avoid termite
- Adopt early planting (Dec-Jan)

- Plant sugarcane in paired or wider rows for taking effective control measures
- Trash mulch on ridges at 3 DAP
- Intercrop with green gram, black gram and daincha
- Keep bunds free from weeds
- Avoid ratoons in infested fields
- Provide adequate rrigation & avoid excessive use of nitrogenous fertilizers
- Detrash on 150 and 210th DAP
- Drain excess water
- Avoid use of insecticide treated leaves as cattle feed.

Early Shoot borer, *Chilo infuscatellus*	• Release *Sturmiopsis inferens* gravid females @ 125/ha on 30 and 45 DAP **Apply any one of the following insecticides/ha** • Chlorantraniliprole 0.4% G @ 18.75 g • Chlorantraniliprole 18.5 % SC @ 375 ml • Chlorpyriphos 20%EC 1.0 lit • Fipronil 0.3% GR @ 25 kg • Fipronil 5% SC @1.5 lit • Monocrotophos 36 %SL 1.5 lit • NSKE 5 % • Thiamethoxam 75% w/w SG @ 160 g
Internode borer, *Chilo sacchariphagus indicus*	• Release egg parasitoid, *Trichogramma chilonis* at the rate of 2.5 cc / release/ha (Six releases at 15 days interval starting from fourth month).
Top shoot borer, *Scirpophaga excerptalis*	• Collect and destroy egg masses • Release prepupal parasitoid, *Isotima javensis* @ 125 females /ha **Apply any one of the following insecticides/ha** • Carbofuran 3% CG @ 66 kg • Chlorantraniliprole 0.4% G @ 18.75 kg • Chlorantraniliprole 18.5% SC 375 ml
Pyrilla, *Pyrilla perpusilla*	• Release lepidopteran parasitoid, *Epiricrania melanoleuca* @ 8000 -10,000 cocoon /ha (or) 8 - 10 lakh eggs/ha **Spray any one of the following on 150 and 210 DAP /ha after detrashing** • Chlorpyriphos 20 % EC @ 1.50 lit • Monocrotophos 36%SL @ 1.50 lit

Aleurodids, *Aleurolobus barodensis* **Aphid,** *Melanaphis sacchari, M. indosacchari* **Scale insect,** *Melanaspis glomerata* **Mealybug,** *Saccharicoccus sacchari*	• Spray monocrotophos 36%SL @ 1.50 lit/ha
Termite, *Odontotermes obesus*	• Flood irrigate the furrows at the time of planting • Drench soil with chlorpyriphos 20% EC @ 6.25 lit/ha Apply any one of the following insecticides/ha • Chlorantraniliprole 18.5% SC @ 500 ml • Clothianidin 50% WDG @ 250 g • Imidacloprid 17.8% SL@ 350 ml • Thiamethoxam 75% w/w SG @160 g
Root grub *Holotrichia consanguinea H. serrata Leucopholis lepidophora*	• Set up light trap to collect and destroy adults • Collect and destroy adult beetles present on neem, *Ailanthus* and *Acacia* trees • Imidacloprid 17.8% SL@ 350 ml / ha
Woolly aphid, *Ceratovacuna lanigera*	• Avoid transportation of aphid infested leaves from one location to another • Conserve and augment biocontrol agents like *Dipha aphidivora, Micromus* and coccinellids Spray any one of the following insecticides /ha • Chlorpyriphos 25%EC 1.0 lit • Monocrotophos 36%SL 625 ml
Root borer	Spray any one of the following insecticides /ha • Fipronil 5% SC @1.5 lit • Fipronil 0.3% GR @ 25 kg

B) Disease management

Disease	Recommendations
Red rot: *Colletotrichum fal catum*	• Selection of setts from healthy nursery programme. • Growing of recommended resistant and moderately resistant varieties *viz*., Co 86249, CoC 22, CoC 25, CoG 6 and Co 0212

	• Sett treatment with carbendazim before planting (Carbendazim 50 WP @ 0.05% along with 1.0% urea for 15 minutes) • The irrigation interval in red rot affected field must be lengthened. Once in 15 days during tillering, growth phases and once in 25 days during maturity phase which restricts the spread • Removal of the affected clumps at an early stage and soil drenching with 0.1 % Carbandazim 50 WP • The trash of red rot affected field after harvest may be uniformly spread and burnt • In the red rot affected field crop rotation with rice for one season and other crops for two seasons could be adopted
Sett rot: *Ceratocystis paradoxa*	• Sett treatment with carbendazim before planting (Carbendazim 50 WP @ 0.05% along with 1.0% urea for 15 minutes) • Proper drainage and planting of setts in 1-2 cm depth
Smut: *Sporisorium scitamineum* (*Ustilago scitaminea)*	• Sett treatment with carbendazim before planting (Carbendazim 50 WP @ 0.05% along with 1.0% urea for 15 minutes) • Treating the setts with Aerated Steam Therapy (AST) at 50 ºC for 1 hour or in hot water at 50 ºC for 30 minutes or at 52 ºC for 18 minutes • Roguing of smut whips with gunny bags/polythene bag and burnt • Discourage ratooning of the diseased crops having more than 10 per cent infection
Grassy shoot disease (GSD): Candidatus Phytoplasma	• Rogue out infected plants in the seed nursery • Treat setts with aerated steam therapy at 50°C for 1 hour to control primary infection • Spray Dimethoate @ 0.1 % to control insect vector • Avoid ratooning if GSD incidence is more than 15 % in the plant crop

Leaf spot: *Cercospora longipes*	• Spray Mancozeb @ 2 kg or Carbendazim @ 500 g/ha
Rust: *Puccinia melanocephala*	• Spray Mancozeb @ 2 kg/ha
Yellow leaf disease: Sugarcane yellow leaf virus (Vector: *Melanopsis sacchari*)	• Use of disease free setts for planting • Selection of tissue culture seedling from meristem tip culture • Proper nutritional management

General Recommendations

- Select healthy setts for planting. In the seed crop, select plants which do not show symptoms of red rot, smut, grassy shoot and ratoon stunting. Setts showing red colour at the cut end and hollows should be rejected.
- In fields which had shown high level of red rot disease, follow crop rotation with rice.
- Sett treatment with Carbendazim before planting (Carbendazim 50 WP @ 0.05% along with 1.0% urea for 15 minutes.
- Treat setts with aerated steam at 50°C for one hour to control primary infection of smut and grassy shoot disease.

  Clumps infected by grassy shoot, smut and ratoon stunting diseases should be uprooted and destroyed.

17. PRE-HARVEST PRACTICES

a. Apply cane ripeners

i. Spray Sodium metasilicate 4 kg/ha in 750 litres of water on the foliage of crop at 6 months after planting.
ii. Repeat the same twice at 8th and 10th months to obtain higher cane yield and sugar percentage.

b. Assessing maturity of crops

i. Assess the maturity by hand refractometer brix survey and 18 to 20 per cent brix indicates optimum maturity for harvest.
ii. Top-bottom ratio of H.R.Brix reading should be 1:1.

18. HARVESTING

i. Early varieties have to be harvested at 10 to 11 months age and mid-season varieties at 11 to 12 months age.
ii. Harvest the cane at peak maturity. Cut the cane to the ground level for both plant and ratoon crops.

B. RATOON CROP

I. MANAGEMENT OF THE FIELD AFTER HARVEST OF THE PLANT CROP

Complete the following operations within 10 days of harvest of plant crop to obtain better establishment and uniform sprouting of shoots.

1. Remove the trash from the field. Do not burn it. Irrigate the field copiously.
2. Follow stubble shaving with sharp spades to a depth of 4 - 6 cm along the ridges at proper moisture.
3. Work with cooper plough along with sides of the ridges to break the compaction.
4. The gappy areas in the ratoon sugarcane crop should be filled within 30 days of stubble shaving. The sprouted cane stubbles taken from the same field is the best material for full establishment. The next best method is gap filling with seedlings raised in polybags.
5. Apply basal dose of organic manure and super phosphate as recommended for plant crop.

II. MANAGEMENT OF THE CROP

1. 25% additional N application on 5-7 days after ratooning.
2. Foliar spray of Ferrous sulphate at 2.5 kg/ha on the 15th day. If chlorotic condition persists, repeat the spray twice further at 15 days interval. Add urea 2.5 kg/ha in the last spray.
3. Hoeing and weeding on 20 th day and 40th to 50 th day.
4. First top dressing on 25 th day, 2nd on 45th to 50 th day.
5. Final manuring on 70 th to 75 th day.
6. Partial earthing up on 50 th day. If junior-hoe is worked two or three times upto 90 th day, partial earthing up is not necessary.
7. Final earthing up on 90th day.
8. Detrashing on 120th and 180 th day.
9. Trash twist propping on 180 th day.
10. Harvest after 11 months.

C. SHORT CROP (NURSERY CROP)

SELECTION OF PROPER PLANTING MONTHS FOR RAISING NURSERY CROP IN RELATION TO MAIN FIELD PLANTING

Raise six to seven months old nursery crop prior to main field planting as follows:

Raise nursery crop during	Main field planting
June	December - January (early season)
July	February - March (Mid season)
August	April - May (Late season)
Dec - Apr	June - September (Special season)

II. PRECAUTIONS IN MAINTAINING NURSERY CROP

Adopt similar production techniques for raising short crop with the following modifications.

1. Do not detrash
2. Do not prop
3. Harvest at 6 to 7 months age
4. Remove trash by hand while preparing setts
5. Avoid bud damage
6. Transport the seed material to other places in the forms of full canes with trash intact.
7. Apply 50 kg of urea as top dressing additionally before one month of cutting the seed cane.

CROP PHYSIOLOGY

Foliar spray of TNAU Sugarcane Booster @ 1.0, 1.5 and 2 kg/acre in 200 litres of water at 45,60 and 75 days after planting enhances cane growth and weight, internodal length, cane yield, sugar content and offers drought tolerance.

CROP PROTECTION

A. Pest Management: Economic threshold level for important pests Economic threshold level for important pests

Pests	Management strategies
Shoot borer *Chilo infuscatellus*	< Cultural: Early season planting (Dec-Jan) ; < Trash mulching on ridges on 3DAP < Intercropping with green gram, black gram, daincha effectively checks shoot borer. < Spray Granulosis virus at 1.5 x 10^{12} PIB/ha twice on 35 and 50 days after planting (DAP) or release 125 gravid females of *Sturmiopsis inferens* /ha on 30 and 45 DAP **Apply any one of the following insecticides: Soil application** Lindane 10 G 12.5 kg Carbofuran 3CG 33 kg **Spraying** Chlorantraniliprole 18.5%SC 375 ml/ha Fipronil 5%SC 1500-2000 ml/ha Fipronil 0.3%GR 25-33.3 Kg/ha Quinalphos 25%EC 2000 ml/ha Phosalone 35 EC 1000 ml NSKE 5 % 25 Kg/ha < Daincha intercropped sugarcane recorded the lowest early shoot borer incidence.

	Note: The virus should be applied with Teepol (0.05%) during evening hours. The granular application should be immediately followed by irrigation. 'Granulosis' virus spraying on Sugarcane at 750 Nos. of diseased larvae, crushed and filtered mixed in 500 l of water has been found harmless to parasitoids and predators. A sticker like 'Teepol' (250 ml for 500 l) can also be added to make the solution stick on to the surface of the crop and it is preferable to use high volume sprayer to be more effective. On cost benefit ratio basis NSKE 5% is recommended.
Internode borer *Chilo sacchariphagus indicus*	< Release egg parasitoid, *Trichogramma chilonis* at the rate of 2.5 cc/release/ha. Six releases in fifteen days interval starting from fourth month onwards will be necessary. < During rainy weather and when ants are present, release the parasite through musquito net covered plastic disposable cups. < Detrash the crop on the 150th and 210th day after planting.
Top shoot borer *Scirpophaga excerptalis*	**Spraying any one of the following insecticides:** Carbofuran 3%G 33.3 kg/ha Chlorantraniprole 18.5%SC 375 ml/ha Phorate 10%G 30 kg/ha **Biocontrol:** Release *Isotima javensis* at 100 pairs/ha
Pyrilla *Pyrilla perpusilla*	**Spray any one of the following on the 150th and 210th day (1000 l spray fluid):** Chlorpyrifos 20% EC 1500 ml/ha Dichlorvos 76% EC 376 ml/ha < Detrash on the above days < Avoid excess use of nitrogen.
Aleurodids *Aleurolobus barodensis*	< **Spray any one of the following when the incidence is noticed (1000 l spray fluid):** Fenitrothion 50 EC 2000 ml Monocrotophos 36 WSC 2000 ml < The pest generally occurs in ill drained soil.
White grub *Holotrichia consanguinea*	< Crop rotation, < Deep ploughing during summer, < Avoid ratoons in infested fields, < Provide adequate irrigation, since under inadequate soil moisture conditions, the pest appears in the root zone.
Termite *Odontotermes obesus*	< Flood irrigate the furrows to avoid termite attack in the furrows at the time of planting

	< **Sett treatment:** Dip the setts in imidacloprid 70 WS 0.1% or Chlorpyriphos 20 EC 0.04 % for 5 min. < **Soil application:** Apply lindane 1.3 D 125 kg/ha < **Spray:** Chlorantraniliprole 18.5%SC 500-625 ml/ha Imidacloprid 17.8% SL 350 ml/ha Chlorpyriphos 20%EC 750 ml/ha
Root borer	**Spraying any one the following insecticides:** Fipronil 5% SC 1500-2000 ml/ha Fipronil 0.3% GR 25-33.3 kg/ha Phorate 10% CG 25 kg/ha
Black bug	**Apply any one of the following insecticides** Chlorpyriphos 20% EC 750 ml/ha Quinalphos 25% EC 2000 ml/ha
Mealy bug *Saccharicoccus sacchari*	< Detrash as per schedule < Drain excess water **Apply any one of the following insecticides when the incidence is noticed spray on the stem only:** Methyl parathion 50 EC 1000 ml/ha Malathion 50 EC 1000 ml/ha
Leaf hopper	**Spraying any one the following insecticides:** Quinalphos 25% EC 1200 ml/ha Carbofuran 3% CG 33.3kg/ha

IMPROVED TECHNIQUES IN BIOLOGICAL CONTROL

Improved adult feeding techniques for *Trichogramma*

- *Trichogramma* adult feeding through cotton swabs will trap the adults which get entangled in the sticky cotton lint. To avoid this, a better adult feeding technique is developed.
- Make small dotted holes in a thick mylar film sheet or old film negatives by using a sewing machine, leaving a gap of 1 cm between the dotted holes horizontally. One side of the sheet (7 x 6 cm) will be smooth and the other will be eruptive. Streak 50% honey solution on the smooth side by using a camel hair brush. Then fold the sheet in such a way that the honey-smeared surface is on the inside and the eruptive surface outside and staple it. The gap between the dotted holes will provide free movement for the adults, which imbibe the honey through eruptive surface. In this method, the adults do not get trapped in the honey solution.

Special problem: Woolly aphid (*Ceratovacuna lanigera*)
Attacked plants could be recognized from a distance by the following symptoms:

- White appearance of the lower surface of colonized top leaves; sooty mould growth and the honeydew exudations deposited on the upper surface of lower or adjacent leaves; occasional white woolly deposition on the ground under severe colonization.
- Established colonies, characterized by the presence of members most of which showed white woolly filaments, can be generally observed from the second leaf downward in the grown-up crop. At low numbers, colonization on leaves is restricted to a short perpendicular distance on either side of the midrib for a considerable length of the leaf.
- Among the plants the attack is seen only in patches.
- Since the infestation has become a major cause for concern, major initiatives have been started by the Department of Agriculture and ICAR.

Management strategies:

- Enforcement of compulsory IPM measures against woolly aphid infestation in newly planted and ratoon sugarcane fields by invoking suitable provisions of the State Pest Act of the State.
- Harvesting of the entire matured sugarcane crop on priority for crushing as well burning of the trash.
- Application of granular systemic insecticides after two days of irrigation may reduce the infestation of aphids even up to 30 days.
- Promotion of paired or wider row cultivation of sugarcane for taking effective control measures.
- Conservation and augmentation of identified potential biocontrol agents like *Dipha aphidivora, Micromus and coccinellids* in woolly aphid infested fields.
- Release of *Dipha aphidivora* @ 1000/ha or *Micromus igorotus* @ 2500/ha wherever possible.
- Conservation of lepidopteran predator, *Dipha aphidivora* predator population in limited areas of sugarcane crop for further distribution and use thereof.
- Regular surveillance and monitoring of sugarcane woolly aphid for timely forewarning and adoption of IPM measures including judicious use of recommended pesticides and bio-pesticides (*Metarhizium anisopliae*, *Beauveria bassiana*, *Verticillium lecanii*).
- Avoiding transportation of aphid infested leaves from one location to another.
- Avoiding use of infested cane for seed purpose.
- Ensuring that the insecticides treated leaves are not used as fodder.
- Insecticide application at low levels or at initial stages of infestation may be restricted to only attacked plants since the attack is seen only in patches

During acute incidence, spray any one of the following insecticides once or twice in affected patches: Acephate 75SP 2gm/lit Chlorpyrifos 25EC 2ml/lit Monocrotophos 36WSC 2ml/lit.

Disease	Recommendations
Red rot: *Colletotrichum falcatum*	• Removal of the affected clumps at an early stage and soil drenching with 0.1 % carbandazim 50 WP • The irrigation interval in red rot affected field must be lengthened. Once in 15 days during tillering, growth phases and once in 25 days during maturity phase which restricts the spread • The trash of red rot affected field after harvest may be uniformly spread and burnt • In the red rot affected field crop rotation with rice for one season and other crops for two seasons could be adopted
Smut: *Sporisorium scitamineum* (*Ustilago scitaminea)*	• Roguing of smut whips with gunny bags/polythene bag and burnt • Discourage ratooning of the diseased crops having more than 10 per cent infection
Grassy shoot disease (GSD): Candidatus Phytoplasma	• Spray dimethoate @ 0.1 % to control insect vector • Avoid ratooning if GSD incidence is more than 15 % in the plant crop
Leaf spot: *Cercospora longipes*	• Spray mancozeb @ 2 kg or carbendazim @ 500 g/ha
Rust: *Puccinia melanocephala*	• Spray mancozeb @ 2 kg/ha
Yellow leaf disease: Sugarcane yellow leaf virus (Vector: *Melanopsis sacchari*)	• Proper nutritional management • Selection of tissue culture seedling from meristem tip culture

General Recommendations

- Select healthy setts for planting. In the seed crop, select plants which do not show symptoms of red rot, smut, grassy shoot and ratoon stunting. Setts showing red colour at the cut end and hollows should be rejected.
- In fields which had shown high level of red rot disease, follow crop rotation with rice.
- Sett treatment with carbendazim before planting (Carbendazim 50 WP @ 0.05% along with 1.0% urea for 15 minutes.

- Treat setts with aerated steam at 50°C for one hour to control primary infection of smut and grassy shoot disease.

  Clumps infected by grassy shoot, smut and ratoon stunting diseases should be uprooted and destroyed.

NEMATODE MANAGEMENT

Nematode pest	Control measures
Lesion nematode, *Pratylenchus coffeae*	*Apply Carbofuran 3 CG at 33 kg/ha at the time of planting or 2 months after or Cartop 1.5 kg ai/ha or apply pressmud at 15 t/ha or poultry manure at 2 t/ha or neem cake 2 t/ha or apply pressmud at 15 t/ha or poultry manure at 1 t/ha before last ploughing in garden lands. * Under wetland conditions, intercropping Sunnhemp or Marigold or Daincha coupled with application of pressmud 25 t/ha or neem cake 2 t/ha.