

Integrated sustainable sugarcane cultivation techniques

for improved livelihoods of the cane farmers

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Sugarcane is one of the most important agro-industrial crop and is a best alternative to intensively cultivated rice-wheat cropping system in Punjab which is already suffering from many sustainability issues. In Punjab, it is cultivated over an area of nearly 96 thousand hectare with an average cane yield of 338 quintals per acre with average sugar recovery was 9.78%. Being a long duration crop of about 10-13 months, it required good quality soils well before going to any cane cultivation practice. Further, cane crop after sometime becomes prone diseases and insect-pests attack, which could significantly reduced both yield and quality of the canes. Therefore, an integrated approach is required for the sustainable sugarcane production in the region to enhance both productivity and quality of the produced canes, which further helps in improving the livelihoods of the cane farmers. The major approaches for the sustainable sugarcane cultivations are discussed in the paper.

Keywords: Organic carbon, Sugarcane, Sugarcane disease

Nutrition requirement of sugarcane

To achieve maximum economic profits through judicious fertilizer use, adequate knowledge about optimum rate and proper time as well as correct method of fertilizer application is essential. Some important points of sugarcane fertilization are given below:

Nitrogen: Nitrogen is important to meristematic activity and in this way stimulates vegetative growth and tillering of sugarcane for overall growth. The uptake of nitrogen is about 1.4-1.7 kg/tonne of cane. For spring planted crop, under Punjab soil conditions for containing medium amounts of available nitrogen, requirement is 150 kg N ha⁻¹ or 325 kg urea ha⁻¹. However, when the soil is rated as low in organic carbon, the recommended dose of fertilizer should be increased by 25% and conversely reduced by 25% if the soil tests high in

organic carbon. Nitrogen dose should be supplied in two splits for having higher nutrient use efficiency. Sugarcane planted in September–October (autumn crop requires one and a half times nitrogen than that for spring planted crop i.e. 225 kg N ha⁻¹ or 488 kg urea ha⁻¹. Of this, one third dose should be applied at planting in furrows below the cane setts, one third at end of March and the remaining one third in end of May. The nitrogen requirement of the ratoon crop is also one and a half times than that for spring planted crop. Hence, apply 225 kg N ha⁻¹ in three equal splits. Top dress or drill one third dose of nitrogen in February with first interculture, one-third in April and the remaining one-third in May. As drilling of nitrogen fertilizer gives higher cane yield, this method should be preferred over top-dressing/ broadcasting.

Phosphorus: Soils having less than 12.5 kg ha⁻¹ of phosphorus i.e low P soils, its application definitely increases the yield. Apply 30 kg phosphorus ha⁻¹ in soils which on test basis prove low in available phosphorus. In plant crop whole of phosphorus fertilizer should be placed in furrows below the cane setts at the time of planting while in ratoon it should be drilled along the cane rows at the time of first interculture in February. Since the organic carbon content also influences the amount of fertilizer phosphorus required, the dose of phosphatic fertilizer should be decided based on both the soil organic carbon and available phosphorus content as shown in Table 1.

For intercrops viz. mentha, in addition to fertilizers recommended for sugarcane, apply 45 kg N (98 kg Urea) and 25 kg P₂O₅ (155 kg Super Phosphate) ha⁻¹. Applied 50% of N

Table 1. Recommendations of phosphatic fertilizers based on the available Phosphorus and organic carbon content of the soil

Soil organic carbon (%)	Available P (kg acre ⁻¹)			
	<5 (Low)	5-9 (Medium)	9-20 (High)	>20 (Very high)
<0.4%	25% more than recommendation	Recommended	25% lesser than recommendation	Nil
0.4-0.75%	25% more than recommendation	25% lesser than recommendation	50% lesser than recommendation	Nil
>0.75%	25% more than recommendation	50% lesser than recommendation	Nil	Nil

and 100% of phosphorus at planting while remaining 50% N about 40 days after planting.

Potassium: The potassium requirement of sugarcane is higher than any other nutrient, which is roughly twice than that of nitrogen and three times that of phosphorus. Most of the soils of Punjab are rich in potassium due to abundance of K-containing minerals *viz.* illite, smectite while these are the facts 55 years ago. Initial trials conducted at Regional Research Station, Kapurthala and Gurdaspur revealed that at low K soils, application of 80 kg K₂O ha⁻¹ will sustainably improved the growth, yield and quality parameters of sugarcane both under irrigated and water stressed conditions. Further, organic manures either of Farm yard manure or press mud cake @ 20 t ha⁻¹ will also serve the purpose for improving the soil health status and growth, yield and quality of so produced sugarcanes. Further, after complete germination by mid-April, uniformly spread of sugarcane trash at the rate of 50-63qt ha⁻¹ between the rows serves as mulch which further reduces soil temperature, conserves soil moisture, suppresses weeds, and reduces the incidence of shoot-borer. Straw-mulching increases the yield of sugarcane both under rainfed and irrigated conditions. Similarly application of Azotobacter/ Consortium biofertilizer @ 10 kg ha⁻¹ in the furrows at the time of cane planting would be helpful in increasing the cane yield.

SUGARCANE DISEASES

Red Rot

It is caused by fungus. The disease is primarily caused through infected

setts and appears from July till the crop is harvested. The disease mainly affects the cane stalk though symptoms also appear on leaves. The first symptoms appear mostly on third or fourth leaf which turn pale and ultimately leading to withering and drying up of whole crown. Later the whole clump dries up and upon splitting open the diseased cane longitudinally, the tissue exhibits red discoloration interspersed with white spots (bands) which are usually elongated at right angle to the long axis of the stalk. The pith of affected cane emits alcoholic smell and juice turns sour.

Management

- For autumn planting use seed from absolutely disease-free seed plot. Cultivation of fairly resistant early maturing varieties like CoPb 92, Co 118 and CoJ 85.
- Do not plant sugarcane in the disease affected fields for one year.
- Crush the affected crop early and plough up the fields soon after harvesting the crop. Collect and burn the stubbles.
- Rogue out the diseased clumps and destroy it by burning.
- Avoid ratooning of the diseased crop.

Wilt

This disease appears from July onwards. The leaves of the affected cane top first turn yellowish and finally dry up. On splitting open the diseased cane longitudinally, the tissue exhibits dirty red or diffused purple discoloration which is invariably darker near the nodes than in the remaining internodal portion. The tissue emits a disagreeable smell. The affected stalk becomes light and hollow. The control measures against

this disease are the same as those of red rot. As the causal fungus persists in the soil over long period, the affected field should not be put under sugarcane for three years.

Smut: Smut is another disease caused by a fungus. This disease is prevalent throughout the year but is severe from May to July and again in October-November. Its incidence is more pronounced in the ratoon crop. The disease is easily recognized by the appearance of long whip-like shoots covered with dusty black mass of spores. These whips may arise from the top of the canes as well as from the lateral sprouted buds.

Management

- Use only smut free canes for seed. Reject even the healthy looking canes in the diseased stools or those growing in the vicinity of the smutted clumps.
- Remove the smutted whips gently after putting them inside a closely woven drill bag. Then uproot the entire diseased clumps and burn or bury them deep.
- Do not ratoon the smutted crop.

Pokkahboeng (top rot)

This disease appears during rainy season from July–September. The young leaves in the top portion of the plant become chlorotic at the base and get distorted and shortened. They turn dark red and fall off gradually. In severe cases, the rotting of the top portion of the cane occurs.

Management

- Regular rouging and burying of diseased stools help to mitigate the disease.

Grassy shoot disease (GSD)

This disease is spreading at an alarming rate and adversely affecting the crop yield. The affected plants give rise to numerous thin tillers, leaves become chlorotic and reduced in size and gives grassy appearance. Severely diseased clumps remain stunted and may produce one or two weak canes. The disease increases in successive ratoon crops.

Management

- This disease is seed transmissible,

always use disease free seed from crop raised after heat treatment.

- The moist hot air treatment (MHAT) at 54°C for 4 hours inactivates the causal organism though other modes of heat treatment are also effective.
- Rogue out the diseased clumps regularly and do not keep ratoon of the diseased crop.

Red Stripe/Top Rot

Red stripe is a bacterial disease which appears during June-August months. The affected leaves show bright red streaks which are long, narrow and run longitudinally on the leaf-blade, causing the rotting of tops in severe cases.

Management

- Rogue out the affected canes and burn or bury them.

SUGARCANE INSECT PESTS AND THEIR MANAGEMENT

Termite infestation

It usually occurs soon after planting of setts in the field both in autumn and spring planted crops. Termites are active during April to June and again in October and becomes more serious under prolonged drought conditions, particularly in light textured soils where proper irrigation facilities are not available and in stressed crop due to disease or physical damage. The cut-ends and the buds of cane setts are the first to be attacked resulting in drying up of shoot after germination leading a gappy stand of the crop.

Management

- Apply well-rotten farmyard manure 15 days before planting.
- Remove the stubbles and debris of previous crop from the field.
- Apply 200 ml Coragen 18.5 SC (chlorantraniliprole) using 400 litres of water over seed setts in furrows before covering them with soil or spray 45 ml Imidagold 17.8 SL (imidacloprid) in 400 litres of water with sprinkler along the rows at post germination stage (about 45 days after planting).

Top-borer

It is unique among the moth borers as it infects sugarcane during all stages of crop growth. This pest appears from March to October and causes severe damage during July-August. The central leaf of the cane top dries up and turns dark. The other typical symptoms are the shot-holes in the leaf, white or red streaks on the upper side of the leaf midrib and bunchy tops from July onwards.

Management

- Collect and destroy its moths and egg-clusters.
- Cut the attacked shoots at the ground level from April to June.
- Use Tricho-card having 20,000 eggs of *Corcyra cephalonica* parasitized (seven days old) by *Tricogramma majapopnicum* per acre at 10 days old interval from mid-April to end-June.
- Apply 10 kg granules of Ferterra 0.4 GR or 12 kg Furadan/Diafuran/Furacarb/Carbocil/Fury encapsulated 3G (carbofuran) at the base of the shoots in the last week of June or in the first week of July only if the top borer damage exceeds 5% level. Earth up slightly to check the granules from flowing with the irrigation water and irrigate the crop immediately.

Stalk borer

It is active throughout the year. The larvae overwinter in the stubble and water-shoots. The attack remains low during April-June and increases in July. Its incidence is highest during October-November. There are no outward symptoms of the attack of this pest. Entrance or exit holes on the attacked canes can be seen only after stripping. A larva sometimes damages upto 3 nodes and the cane may be attacked at several places. The cane yield and sugar recovery are adversely affected in the case of serious attack.

Management

- Do not use the cane-seed from the infested field.
- Staple 40 Tricho-cards (5 × 2.5 cm) hard paper piece glued with

7 days old eggs of laboratory host, *Corcyra cephalonica* parasitized by *Trichogramma achilonis* to the under-sides of sugarcane leaves from July to October at 10 days interval. Each card should have approximately 500 parasitized eggs and be spread uniformly at 40 spots per acre. Normally 10-12 releases are required.

- At harvest, do not leave the water-shoots in the field.
- Do not ratoon a heavily infested crop. Plough the affected fields, collect the stumps and destroy.

Black bug

It is a pest of sugarcane mainly in ratoon crop. It prefers hot and dry conditions. The black adults and pink young nymphs suck the sap from the leaf-sheaths. The attacked crop looks pale. This pest is active during April to June.

Management

Spray the crop with 350 ml of Dursban/Lethal/Massban/Goldban 20 EC (chlorpyrifos) in 400 litres of water per acre with manually operated sprayer. Direct the spray material into the leaf-whorl.

Pyrilla

This pest appears in April-May and severely damage the crop in August-September. The leaves of the damaged plants turn yellow which resulted in reduction in cane yield and sugar recovery.

Management

Spray the crop with Dursban 20 EC (chlorpyrifos) @ 600 ml per acre using 400 litres of water with manually operated knapsack spray pump.

Therefore, it could be concluded that adopting proper integrated nutrient, diseases and pest management is the key to improve different growth, yield and quality parameters of the sugarcane in the region.

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