Sugarcane Manual

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Introduction:

- It is a widely grown cash crop
- After wheat and cotton it is grown on large scale in Pakistan
- For more and better production of sugar and its by-products, it is necessary to increase the per acre yield of sugarcane
- So, it is necessary to adopt all the good measurements i.e. deep ploughing / chiseling during seed bed preparation, use of approved varieties, optimum seed rate, proper sowing time, timely use of balanced fertilizers and granular insecticides and timely disposal of crop

Preparation of land:

- For the cultivation of land loamy soils with good drainage are preferable
- After harvesting of cotton or rice their residues can be incorporated with in the soil with rotator and one-time plough and one-time chisel will be used to prepare land
- Deep ploughing / chiseling during seed bed preparation will ensure good crop stand and will reduce lodging
- For deep ridges soil sub soiler / chisel plough will be used
- Sub soiler may be used after 2 years to improve crop yield

- **Time of sowing:**
- Autumn sowing: Mid of Feb to End of March
- September sowing: 1st of September to 15th October

Method of sowing:

- Sugarcane sowing can be done by making deep trenches 4 feet apart and 10 inches deep with sugarcane ridger
- Then three budded setts of sugarcane were placed end to end in dual row in ridges
- Planker should not be done for sugarcane and after sowing of seed it can be covered with soil manually
- Apply doses of N, P, K fertilizer and half of granular insecticide at the time of sowing
- Irrigate the field lightly immediately after sowing

Benefits of 4 feet apart Ridge Sowing:

- Proper sun shine and nutrients available
- Ease in intercultural operations with hoeing cultivator, rotary weeder and earthing up
- Time and cost can be reduced
- Proper and controlled irrigation can be done with more than 30 % water saving
- Crop can be protected from lodging

Recommendation of mechanical plantation sowing:

- Much efforts and labor are needed from the sowing to harvesting so much cost is required
- Due to these scenarios, mechanical sowing of sugarcane with sugarcane planter will lead to save the resources of the farmers

Inter cropping of various crops in sugarcane:

- In September planting, different inter crops like canola, gram and lentil while in spring sugarcane, turnip as inter crop can be sown to fetch more income

Selection and preparation of good seed:

- Good seed is necessary for taking good yield
- Always take seed from healthy crop
- It should be free from diseases like red rot and smut
- Upper part of sugarcane will be used for seed
- Seed should be select from plant crop
- Seed setts should be free from leaves and trashes as it affects the germination and increase termite attack
- Treat the setts with proper fungicide before planting
- Avoid seed from lodged crop

Seed rate:

- For sowing of sugarcane 60,000 eyes per acre will be used
- 30000 two budded setts per acre seed will produced optimum plant population
- For this purpose 100 – 120 maunds of sugarcane will be needed
- For this purpose, 12 – 16 marlas sugarcane is needed

Varieties of sugarcane:

Early Growing	Medium	Late
CPF 77400	HSF 240	CPF 252
CPF 237	SPF 213	
CPF 250	CPF 249	
CPF 251	CPF 253	

Fertilizers recommendations:

Fertility of soil	Nutrients kg per acre	Bags per care
	N: P: K	
Week soils	120 69 50	4 bags of urea, 2 bags of DAP, 2 bags of SOP
Medium soil	103 57 50	3.5 bags of urea, 2.5 bags of DAP, 2 bags of SOP
Fertile soil	87 46 50	3 bags of urea, 2 bags of DAP, and 2 bags of SOP

- Organic manure / compost can also be added at the rate of 300 – 400 maunds per acre to increase fertility of soil and improve soil health
- Press mud @4-5 tones / acres will increase the cane yield

Irrigation requirement:

- Feb sowing of sugarcane needed 64-acres inch water and September sowing 80 acres inches water
- This requirement can be fulfilled by 16 – 20 irrigation
- While, 12 - 26 % yield can be decreased if irrigation was delayed or skipped at grand growth period

Different periods of irrigation for sugarcane

Month	Number of irrigations	Difference of irrigation
Mar – Apr	2-3	20 to 30 days
May – June	5-6	10 to 12 days
July – Aug	3-4	15 to 25 days
Sep – Oct	2-3	20 to 30 days
Nov – Feb	4	30 days
Total water	16-20	

Eradication of weeds:

- In Feb sowing weeds include Bathu, Billi boti, jangli cholai, jangli palak, karand, dumbi sitti, it sit, qulfa, gajar boti and lehli
- In September sowing it sit, deela, jangli swanak, dhidhan, lomar grass, makro, madhana ghass, hazar dani, qulfa and cholai etc are weeds
- Weeds eradication is must, due to weeds estimated loss is 25 %

Chenopodium album (Bathu)

Cyperus rotundus (Deela)

Amaranthus viridis (Jangli cholai)

Phalaris minor (Dumbi sitti)

Non – chemical methods of eradication:

Hoeing:

- Hoeing is of much importance in proper nourishment of sugarcane
- By this method weeds are eliminated as well as soften the soil
- First hoeing is done after completion of germination i.e. 20-30 days after a month of 1st hoeing
- After 90-100 days of sowing, one more hoeing is done before earthing up
- For hoeing, rotary weeder and hoeing plough is used

2-Changing of cropping pattern:

- Weeds can eradicate by changing cropping pattern means after harvesting of one crop, grow any other crop such as berseem, barley etc

Chemicals to eradicate weeds:

Use of herbicides:

- Spray of mesotrione *+ atrazin* @ 1.5 Liter + Sunstar gold *(15% W.G.)* @30 g per acre after 25 days of sowing in watter condition

Ratoon Management:

- Keep ratoon from mid-January- mid March (frost-free) harvested crop
- Cut crop close to the ground level
- Use disc ratooner and stubble shaver for better ratoon crop
- Irrigate and inter culture in 15 days after harvesting
- Apply DAP & Potash after inter culture and breaking of ridges and then irrigate the field
- Apply 1st dose + 30% more N fertilizer in 15 days after harvesting
- Control weeds from ratoon crop with weedicides and inter culture

- Control insect pests with similar practice

Use of fertilizers in Ratoon crop of sugarcane:

Fertility of soil	Nutrients kg per acre	Bags per care
	N: P: K	
Week soils	156 69 50	5.5 bags of urea, 3 bags of DAP,2 bags of SOP
Medium soil	134 57 50	5 bags of urea, 2.5 bags of DAP, 2 bags of SOP
Fertile soil	113 46 50	4 bags of urea, 2 bags of DAP, and 2 bags of SOP

Pests of sugarcane:

- Insect pests and disease causes 20 - 50 % yield reduction.
- Sugarcane is infested by 287 species of insect pests, fungal and viral disease.

1.Sugarcane top borer:

Damage:

- Small holes in emerging leaves
- Red tunnels in the mid rib of leaves
- Dead heart is grown up canes which can be easily pulled out
- 4 - 5 generations during March - November

Management:

- Collect and destroy the egg masses

- Cut and attacked the destroy tillers from April to June
- Pull out the dead hearts
- Destroy the hibernating larvae by cutting attacked tops 15th of Feb
- Use of light traps to kill moths
- Apply granular insecticide in early crop stages
- Use of 20 - 25 trichogramma cards in 1 acre during April to October

2.Sugarcane stem borer:

Damage:

- Dead heart in the plant which can be easily pulled out
- Holes on stem with feces
- 5 generations and attacking time Feb to Nov
- Sprouting of lateral buds

Management:

- Destruction of stubble before mid of march
- Collection and destruction of egg masses
- Harvest the crop 1 - 1.5 inches below the soil surface
- Use of light traps
- Bio control by Trichogramma
- Apply granular insecticide @ 12 - 15 kg per acre.

3.Sugarcane root borer:

Damage:

- Larvae bore in to the stem just above the soil surface and go downward to roots
- More attack in dry season and on fresh germinated crop
- Dead hearts cannot be pulled out easily
- After cane formation plants are not killed but weight and sugar contents are reduced

Management:

- Destruction of stubble of crop before mid of March from which ratoon is not to be obtained
- Cut the infested tillers from the field and use them as fodder
- Harvest the crop 1 - 1.5 inches below the soil surface
- Use of light traps
- Bio control by trichogramma
- Apply granular insecticide in the early stages of the crop

4.Gurdaspur borer:

Damage:

- It causes damage in patches
- Start damage ring shape

- Breaking and falling of tops with current of air

Management:

- Avoid ratooning of heavily infested crop
- Destruction of stubble
- Earthing up of ratoon crop in May - June to destroy larvae of Gurdaspur borer
- Use of light traps
- Cut tops infested and use them as fodder
- Bio control by Trichogramma

Sucking insects:

5.Sugarcane pyrilla:

Damage:

- Most destructive foliage sucking pests in sugarcane
- Both nymph and adult suck the sap of plant
- under heavy infestation leaves turns yellowish white and wither away
- Excrete honey dew which affects photosynthesis
- Broad and tender leave varieties are preferred
- Deteriorate the quality of juice up to 35 %

Management:

- Destroy egg masses
- Catch and kill hand netting
- Bio control with *Epiricania melanoleuca and Tetrastichus pyrillae*
- Avoid insecticide spray and trash burning
- Apply granular insecticide during early crop stages
- Apply chlorpyrifos 40 EC 2 L / acre or Fipronil 5 % 1 L per acre with irrigation at lateral stages
- Avoid excessive and late applications of N fertilizers

6.Sugarcane mites:

Red mite:

- Both nymph and adults such the sap from under sides of leaves
- Pest becomes more severe in hot and dry weather
- Leaves loose chlorophyll and become pale, ultimately turning red
- Attack in May and July

White mite:

- Parallel lines of white spots appear on leaves
- Both adults and nymph suck saps from under sides of leaves in August and September
- Pest becomes more severe in hot and dry weather

Management:

- Clean cultivation
- Destroy Johnson grass
- Irrigation reduces pest incidence
- Heavy rains provide relief to mite attack
- Beetle adults and grubs' controls attack effectively

7.Sugarcane black bug and chinch bug:

Damage:

- Both the nymph and adult suck sap from the leaf whorl in April - May
- The attacked crop looks pale
- Damage more in ratoon crop
- Holes and red spots appear on leaves
- Drought affected crop is most susceptible
- Hot and dry weather favors the infestations level

Management:

- Avoid ratooning of heavily infested leaves
- Frequent irrigation
- Spray crop with 350 ml endosulfan or 350ml Fipronil or Bifenthrin 250 ml in 120 liters of water per acre. Direct the spray material into the leaf whorl

8.Sugarcane white fly:

Damage:

- Only the nymph sucks the cell sap from the leaf
- Seriously infested leaves become pale and dry
- Pest secretes honey dew, make leaves sticky
- Black sooty mold effects photosynthesis and even unfit for fodder

Management:

- Avoid trash burning
- Removal of severely infected leaves
- Introduction of natural enemies (Chrysoperla and Coccinellids)
- Apply chlorpyrifos 40 EC 2 L per acre or fipronil 5% 1 L per acre with irrigation at alter stages
- Avoid excessive and late use of N fertilizers

9.Sugarcane mealy Bug:

Damage:

- Both nymph and adult cause damage by sucking cell sap from leaves
- Sooty molds are developed due to honey dew
- Drop affected crop is more affected

Management:

- Apply chlorpyrifos 40 EC 2 L per acre or fipronil 5 % 1 L per acre with irrigation
- Trash burning

10.Sugarcane beetle:

Damage:

- Both grubs and adults cause damage to the underground portion of plant
- More attacked in hot and dry and sandy areas
- Drought affected crop Is more susceptible
- Crop become pale in color

Management:

- Use well rotten FYM
- Irrigation reduces attack
- Apply chlorpyrifos 40 EC 2 L per acre or fipronil 5 % 1 L per acre with irrigation

11.Termite:

Damage:

- Serious in sandy soils
- Make termitarium in soil

- Termite attack results in poor germination and drying up of shoots
- feed on cellulose material of cane setts filled it with mud
- Active period: April to June and October

Management:

- Use well rotten FYM
- Irrigation reduces attack
- Apply chlorpyrifos 40 EC 2 L per acre or fipronil 5 % 1 L per acre with irrigation

Diseases of sugarcane:

1. Red rot:

- Causing organism is ***Colletotrichum falcatum***
- It is cancer in sugarcane crop
- More than one type damage the crop
- It decreases the yield and sugarcane content of crop
- Intensity of disease destroys the whole crop
- The spindle leaves (3rd & 14th)) display drying. At a later stage, stalks become discolored and hollow
- Acervuli (black fruiting bodies) develop on rind and nodes. After splitting open the diseased stalk, a sour smell emanates
- The internal tissues are reddened with intermingled transverse white spots

2. Whip smut:

- Causing organism is *Ustilago scitamineae*
- It decreases the yield and sugarcane content of crop
- Production of whip like structure (25 – 150 cm) from the growing point of the canes
- Whip covered by translucent silvery membrane enclosing mass of black powdery spores
- Initial thin canes with elongated inter nodes later become reduced in length
- Profuse sprouting of lateral buds with narrow, erect leaves especially in ratoon crop

3. Pokkah Boeng:

- It's causing organism is *Fusarium moniliforme*

- It causes malformed and distorted top
- It causes distortion and shortening of the top and leaves
- Yellowing (chlorosis) at the base of young leaves and ladder-like longitudinal breaks in the rind
- It spread from plant to plant and it can be spread by irrigation

4. Red stripe:

- It's causing organism is *Xanthomonas rubilinians*
- It is caused by bacteria
- The development of symptoms was from red, brown stripes to leaf necrosis, rotting, and death of the spindle leaves

5. Rust:

- Its causal organism is *Puccinia melanocephala*

- The earliest symptoms are small, elongated yellowish spots that are visible on both leaf surfaces
- The spots increase in length, turn brown to orange-brown or red-brown in color, which coalesced and formed large, irregular necrotic areas, thus it shows rusty appearance of leaf
- This eventually resulted in premature death of the leaves

6. White leaf disease of sugarcane:

- Its causal organism is Phytoplasma
- The initial symptom of sugarcane white leaf disease (SCWL) is a white line that runs vertically down the middle of the leaf blades
- Parallel to the initial line, white or yellow lines appear, eventually covering the entire leaf length
- This disease is carried by leaf hopper insects

Animal harmful for sugarcane:

1.Rodents:

- They cause damage to roots
- They cut the crops and cause heavy damage
- Attacked plants becomes dried

Management:

- Ensure the weed free soil to control them
- Use natural predators
- Use traps to kill them
- Zinc phosphide tablets can be used

2.**Porcupine:**

- They cause damage to roots
- It makes bunds in soil
- It causes damage away from their homes

Management:

- Destroy their houses
- Kill them where saw
- Use tablets of phosphine or delta gas

Harvesting of sugarcane:

- Harvesting of sugarcane done according to varieties sown and when it is ready to harvest
- First September and early sowing varieties can be harvested
- After that middle and late sowing can be harvested
- Lodged, affected from rodent or flooded crop can be harvested early
- Stop irrigation before one month of harvesting
- Supply sugarcane immediately to mill after harvesting so that it can't reduce the sugar content
- For ratoon crop harvesting should be done after 15th Jan
- Nitrogen should be used in recommended amount, increased nitrogen reduces sugar content of crop

- Sugarcane should be harvest halt to 1 inch below surface to grow better next year as well destroy insects.

Key points:

- Use heavy loamy soils for the best production of sugarcane
- Best land can be prepared by using 2 times chisel plough / sub soiler
- Timely sowing should be done. Feb sowing will be done from 15th Feb to 30th of Marc
- Seed rate should be 100 - 120 maunds
- Always cultivate the approved and latest varieties
- Sowing can be done on ridges with 4 feet distance
- Seeds can be sowed below 1 to 1.5 inches
- Weeds should must be eradicated
- **Gap filling is very necessary in ratoon crop**
- Always use recommended fertilizers
- Infected crop's ratoon should not be kept
- In Ratoon crop 30 % more **NPK** to be used
- Stop irrigation before 1 month of harvesting
- For ratoon crop harvesting should be done after 15th of January
- After harvesting immediately supply the sugarcane to the sugar mill