Better Management Practices in Sugarcane Farming Systems

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Content

I. INTRODUCTION

Maharashtra is one of the leading states in sugar and sugarcane production in India. Sugarcane industry in Maharashtra is second largest agro-based industry next to cotton in which higher investment is made and has brought about desirable changes in social, economical, educational and political life in rural areas. In Maharashtra the highest harvested cane yields by farmers for Adsali/pre-seasonal; Suru and Ratoon have been 269, 217 and 202 T/ha respectively. However, the average yield of the State is about 85T/ha. Thus there is wide gap between the average yields and potential yield. These production potential can be achieved by adopting better irrigation water management and scientific crop production practices.

The consumptive water needs of seasonal (one year) Sugarcane are between 1600 – 2000 mm in Maharashtra State depending upon agro climatic conditions. After effective rainfall, the annual net irrigation requirement is only 1200 to 1600 mm. Considering 20% field application losses, 1400 to 2000 mm is enough under surface irrigation condition. Farmer's water use is 3000 to 4000 mm. It shows enormous wastage of water resource. The excess application result in water logging and salinity in the farm.

These are man made problems. Adoption of any one of the modern irrigation techniques such as straight ridges and furrows with gentle slope, contour furrows, leveled furrows, drip irrigation and a combination of sprinkler plus straight furrows can reduce these problems. Adoption of modern irrigation techniques and best management practices will save about 50% water use on farm and will almost double the sugarcane yield.

II. Improved planting techniques

1. Planting Time

In Maharashtra, Sugarcane is planted at three different times as given below.

Planting /Ratoon	Harvesting
Seasonal (December to 15 February)	February to April
Pre-seasonal (15 October to 15 November)	October to January
Adsali (July – August)	October to January
Ratoon (Ratoon of cane harvested during October to February)	November to April (depending upon maturity)

2. Varieties

Any of the following varieties may be selected.

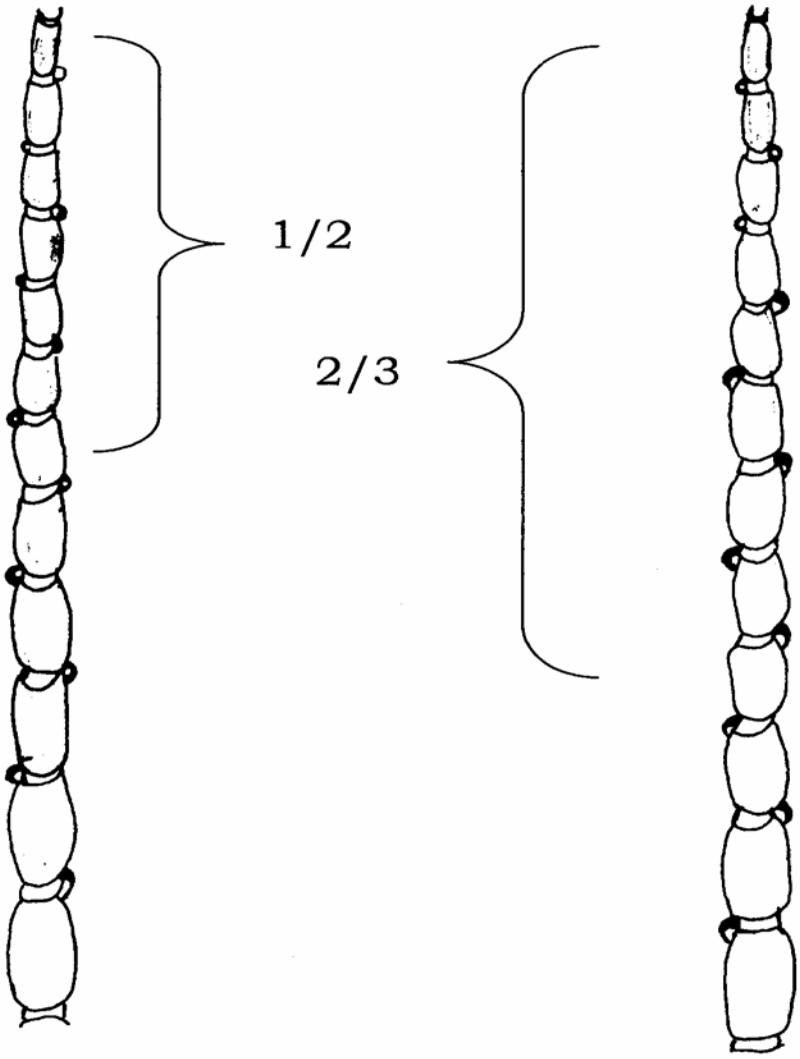
Variety	Characteristics
CO 86032	Resistant to smut and grassy shoot diseases, good ratooner, can sustain water stress, non-flowering.
CoC 671	Early maturity, moderately susceptible to smut, grassy shoot and stem borer (Recommended by Vasantdada Sugar Institute).
CO 94012	Resistant to smut and stem borer, good ratooner, low flowering, high sugar recovery.

3. Method of planting

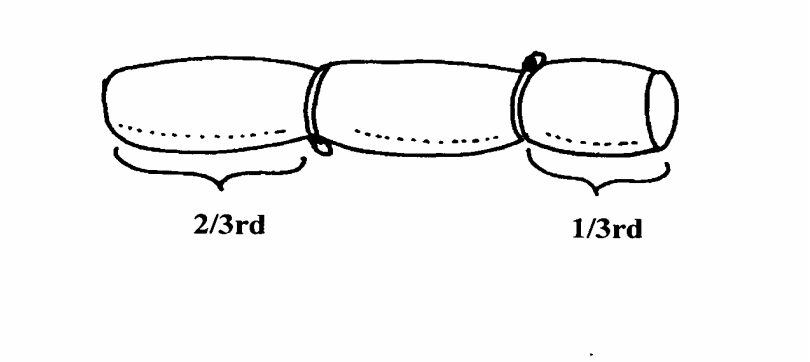
Dry method of planting should be followed. Sets should be placed 5 to 7.5 cm deep into soil. Care should be taken to place eye buds on side and covered with thin layer of soil and then irrigation should be given to the field.

4. Seed rate

Single, two and three eye bud methods of planting are in practice. To avoid heavy risk of gaps in single eye bud and over population by three eye bud planting methods, two eye bud method is recommended. About 25,000 two eye budded sets will be required to plant one hectare area. Only upper half or two third cane should be selected for planting as shown below.



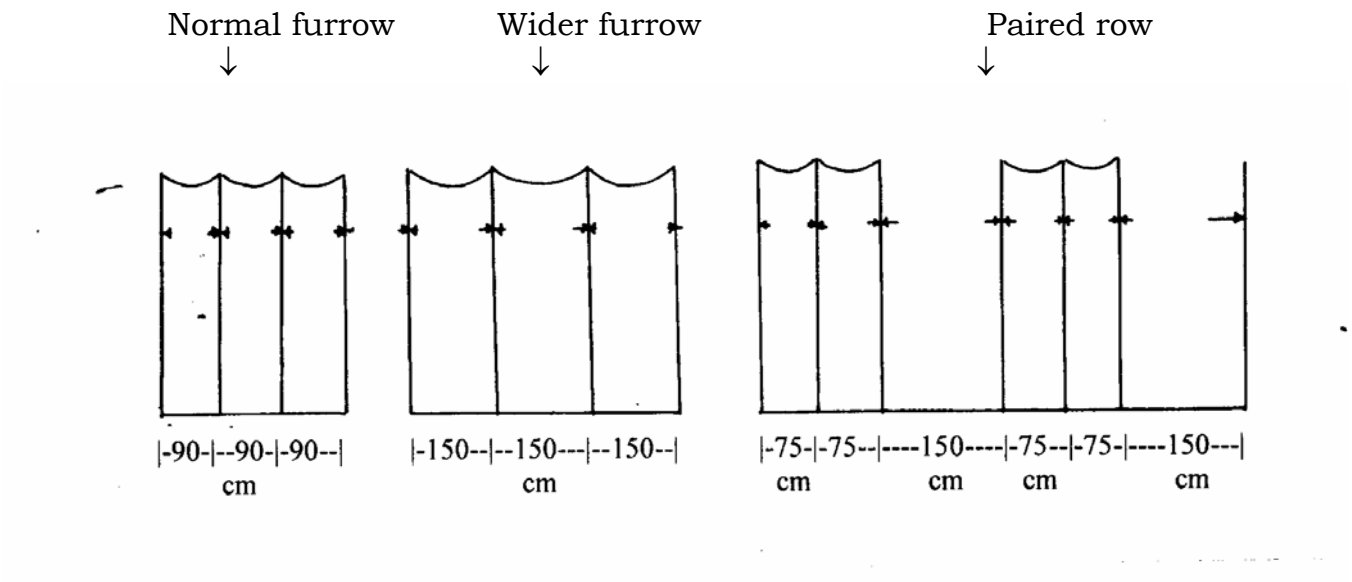
While preparing set, care should be taken to maintain minimum distanc (one third inter node) above the eye bud and maximum distance below the eye bud (two third inter node) so as to obtain high germination.



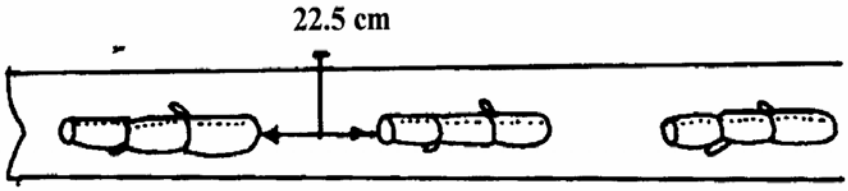
5. Spacing

Depending upon the soil type and method of irrigation, appropriate spacing should be adopted as given below.

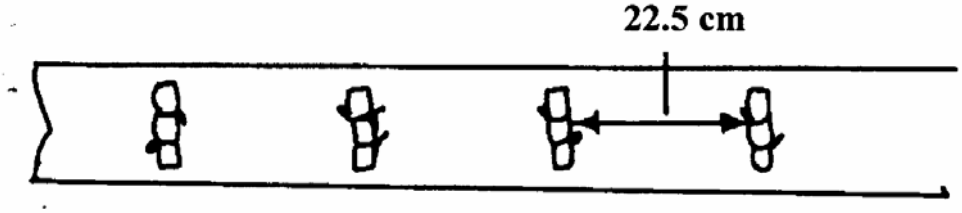
Soil type	Method of irrigation	Furrow spacing	Method of placement of set	Spacing between two sets
Coarse to medium textured soils	Surface	90 cm	Parallel to furrow	22.5 cm
Fine textured soils	Surface	150 cm	Across the furrow	22.5 cm
All kinds of soils	Drip	Paired row 75 cm X 150cm	Parallel to furrow	22.5 cm



In 75 or 90 cm furrows sets should be placed 22.5 cm apart as shown below.



In wider furrows (150 cm), sets should be placed across the length of furrow as shown below.



6. Seed treatment

- Seed treatment with hot water at 51 ^{o}C for two hours or moist air treatment at 54 ^{o}C for $2^{1/2}$ hours.
- Sets should be dipped in 0.1% solution of Bavistin (10 g Bavistin in 10 litres of water) or Bayleton (0.05%) (5 g Bayleton in 10 litres of water) for 10 to 15 minutes.
- If sets are infested with scale insect or wooly aphids, sets should be dipped in solution of Malathion (50EC), 30 ml or Dimethoate (30EC), 27 ml in 10 litres of water for 10 to 15 minutes.
- If fresh sets are not available for planting, sets should be dipped in solution of 500 g lime in 200 litres water for 12 to 24 hours.
- To increase biological nitrogen fixation and solubility of phosphatic fertilizers, setts should be treated with Azatobacter and Phosphate solubilising inoculants. For one hectare area, dissolve 10 kg Azatobacter and 10 kg P-solubilising inoculant in 100 litres of water and dip sets for 10 – 15 minutes and then do planting after drying them in shade.

III. Soil Management

1. Suitability of soil

Medium to fine textured, deep (depth > 1 m), rich in organic matter status, well drained, having pH between 6.5 to 8.0 are ideal for sugarcane crop. Growing sugarcane on coarse textured, shallow soils will result in poor yield. The crop is sensitive to soil salinity and sodicity. Sugarcane crop does not suffer as long as electrical conductivity of saturation extract of soil (ECe) is up to 1.7 millimhos/cm. Similarly exchangeable sodium percentage (ESP) of soil should be less than 15% for better crop production. Quality of irrigation water (surface and ground water) should necessarily be less than 1.5 millimhos/cm in its electrical conductivity for irrigation of sugarcane crop on fine textured deep soils under semi-arid conditions. Depth to ground water in sugarcane crop fields should be more than 3 m.

2. Preparatory tillage

As sugarcane crop stands in field for more than a year, it is necessary to give deep ploughing by iron mould board plough drawn by bullocks or tractor. If preceding crop is a green manure crop, ploughing is not necessary as for burring green manure crop ploughing is required. The proper time for ploughing is immediately after the preceding crop is harvested or just after a good shower of rain is received. The land is then exposed to atmosphere for a month or two and then harrow is worked three to four times to break clods and to make the land smooth and even. Before last harrowing, recommended dose of organic manure is applied and mixed well with soil. Furrows at required distance depending upon the spacing are then opened across the major slope.

IV. Nutrient management

1. Organic manures

Application of organic manures for maintenance of soil at high fertility level is almost essential. Organic manures improve physical, chemical as well as biological properties of soil. Organic manures @ 20 to 25 tonnes/ha are to be applied in different forms like Farm Yard Manure/Compost/Dung Manure. Press mud can also be used as an organic manure @ 5 tonnes/ha particularly useful in saline alkali soils. Sugarcane trash can be used as a mulch and sprayed with 80 kg urea, 100 kg Single Super Phosphate and 10 kg decomposing culture/ha for better decomposition. Sugarcane trash can also be incorporated while making organic manure along with press mud and use of earthworms for preparing vermicompost.

Crops like sannhemp and dhaincha are grown as green manure crop. Green manure crops can be grown as a sole crop and buried in the field at an age of 1.5 to 2 months (before flowering) followed by sugarcane crop. These can also be grown along with sugarcane by sowing in rows in between two rows of sugarcane and burring in soil at the time of earthing up. On an average, 20 tonnes of green matter and 90 kg nitrogen is added by growing green manure crop.

2. Fertilizers

The dose (kg/ha) and time of application of fertilizers is as below:

Sr No	Time of application	Adsali			Pre seasonal			Seasonal/Ratoon		
		N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
1	At planting	50	100	100	40	85	85	35	70	70
2	6 – 8 weeks after planting	200	-	-	160	-	-	140	-	-
3	12 – 16 weeks after planting	50	-	-	40	-	-	35	-	-
4	At earthing up	200	100	100	160	85	85	140	70	70
	Total	500	200	200	400	170	170	350	140	140

Precautions to be taken while applying fertilizers

- Always fertilizers should be well mixed with soil and applied 4 – 5 cm deep in the soil.
- Apply fertilizers when soil is moist. On the next day of fertilizer application, give light irrigation.
- While applying Urea fertilizer, it should be mixed with Neem cake in 6 : 1 proportion.
- Mixing phosphatic fertilizers with compost or dung manure is beneficial.
- During periods of water stress, additional dose of 125 kg Muriate of potash fertilizer should be applied.
- If green manure crop is planned, recommended dose of phosphorus for sugarcane crop should be applied as below

  25% dose to green manure crop

  25% dose to sugarcane crop at planting

  50% dose to sugarcane crop at earthing up.
- Soil test based fertilizer recommendations should be followed.
- In soils deficient with micro nutrients like iron, zinc, manganese, copper, molybdenum and boron, in addition to above fertilizers, 25 kg Ferrous Sulphate, 20 kg Zinc Sulphate, 10 kg Manganese Sulphate, 10 kg Copper Sulphate 2.5 kg, Sodium Molybdate and 5 kg Borax per hectare should be applied. Micro nutrient fertilizers should be mixed with well decomposed dung manure or compost and applied as basal dose.

V. Irrigation Water Management

1. Water Requirement

Seasonal sugarcane is planted in the first fortnight of January. The pre-seasonal sugarcane is planted in the first fortnight of October. The water requirement for Aurangabad district is given in Table 5.1.

Table: 5.1 Evapotranspiration (consumptive use) of Seasonal & Pre seasonal Sugarcane Location : Aurangabad

Sr. No.	Month	January planting seasonal water requirement		October planting pre-seasonal water requirement	
		mm/day	mm/month	mm/day	mm/month
1.	October	-	-	2.3	71.3
2.	November	-	-	3.2	96.0
3.	December	-	-	3.5	108.5
4.	January	2.0	62.0	4.2	130.2
5.	February	3.9	109.0	5.3	145.6
6.	March	6.1	189.0	7.0	217.0
7.	April	7.9	237.0	8.5	255.0
8.	May	9.8	304.0	10.1	313.1
9.	June	7.4	222.0	7.4	222.0
10.	July	5.5	170.0	5.5	170.0
11.	August	4.9	152.0	4.9	152.0
12.	September	5.4	162.0	5.3	159.0
13.	October	5.6	174.0	5.4	167.4
14.	November	4.2	126.0	3.8	144.0
15.	December	2.5	78.0	2.4	74.4
			1985.0		**2445.5**

2. Water Availability

The availability of water in the month of May should be assessed for planning the sugarcane area.

- Water source :: Open dug well / Bore well
- Volume of container :: A plastic drum of 50 litres
- Time required to fill the drum by the pipe outlet at the Farm Head :: 10 seconds
- Pumpset runs per day (Average of last 5 years) :: 4 hours
- Vol. of water available::0 ÷ 10 x 3600 x 4 = 72000 litres/day

- The irrigation requirement of Sugarcane in May (planting time: Dec., Jan.) :: 10 mm / day
- The area to be planned under:: Sugarcane crop 72000 ÷ 10 = 7200 m^2

3. Traditional versus improved surface irrigation techniques

Comparison of Traditional 'Serpentine Furrow' versus improved 'Straight Furrow' surface irrigation techniques

Sr. No.	Parameters	Serpentine Furrow	Straight Furrow
1.	a. Topography	Suitable on all type of topography.	Flat topography best suited for land slopes up to 1.0%
	b. Furrow orientation	In any direction	approximately parallel to contour
2.	Land Forming requirement	Not required	Land smoothening is required
3.	Control on the depth of application	No control, 100 to 300 mm per irrigation	Better control, 25 to 100 mm
4.	Aeration	Poor	Excellent
5.	Nutrient availability	Leached below root zone poor i.e. 30-50%.	Excellent 60 – 80%
6.	Soil environment - Resistance to pest & diseases	Unhealthy Poor	Healthy High
7.	Drainage condition	Poor (Ill drained)	Excellent (Well drained)
8.	Water application efficiency on farm	40 to 50%	80 to 90%
9.	Mulching with farm residues	Mulching is not possible	30% additional water saving with mulching
10.	Sugarcane yield	50 to 100 toones per ha.	100 to 200 toones per ha.
11.	Water use efficiency kg/ha.mm	25 kg/ha. mm	83 kg/ha. mm
12.	Net benefit cost ratio	0.43 to 0.60	1.32 to 1.5
13.	Internal rate of return on investment; % (IRR)	Not viable	23% to 30%

4. Surface drainage requirement

- Removal of excess rain water to control soil erosion during rainy season.
- Organic farm residue helps to control soil erosion during rainy season, and conserve water during hot summer.
- Maintain soil fertility and health
- Provide workable soil conditions for farm operation
- Provide better soil aeration and micro environment.

Drainage Network

- Irrigation direction approximately parallel to contours, fig. 5.1
- Bund alignment approximately parallel to contours, fig. 5.1
- Keep bund spacing as per Table: 5.3
- Construct link drain and main drain as shown in fig. 5.1 and cross section given in Table: 5.2.
- Construct farm drain cross section as shown in fig. 5.2

Table : 5.2 Cross selection of link and main drains in steep topography
(i = 60 mm/hr, c = 0.3, n = 0.05, s = 0.003)

Catchment Area, ha.	Side slope (H:V)	B.W. m,	Depth, m.	Top Width, m.
1	1:1 1.5:1 2.0:1	0.20 0.20 0.18	0.30 0.30 0.27	0.80 1.1 1.26
2	1:1 1.5:1 2.0:1	0.25 0.24 0.23	0.38 0.36 0.34	1.01 1.32 1.60
4	1:1 1.5:1 2:1	0.35 0.30 0.30	0.52 0.45 0.45	1.40 1.65 2.1
6	1:1 1.5:1 2:1	0.40 0.36 0.35	0.60 0.54 0.52	1.6 1.98 2.43
8	1:1 1.5:1 2:1	0.45 0.40 0.39	0.70 0.60 0.58	1.85 2.20
10	1:1 1.5:1 2:1	0.50 0.44 0.42	0.75 0.66 0.63	2.00 2.42 2.94
20	1:1 1.5:1 2:1	0.60 0.56 0.55	0.90 0.84 0.82	2.40 3.08 3.83

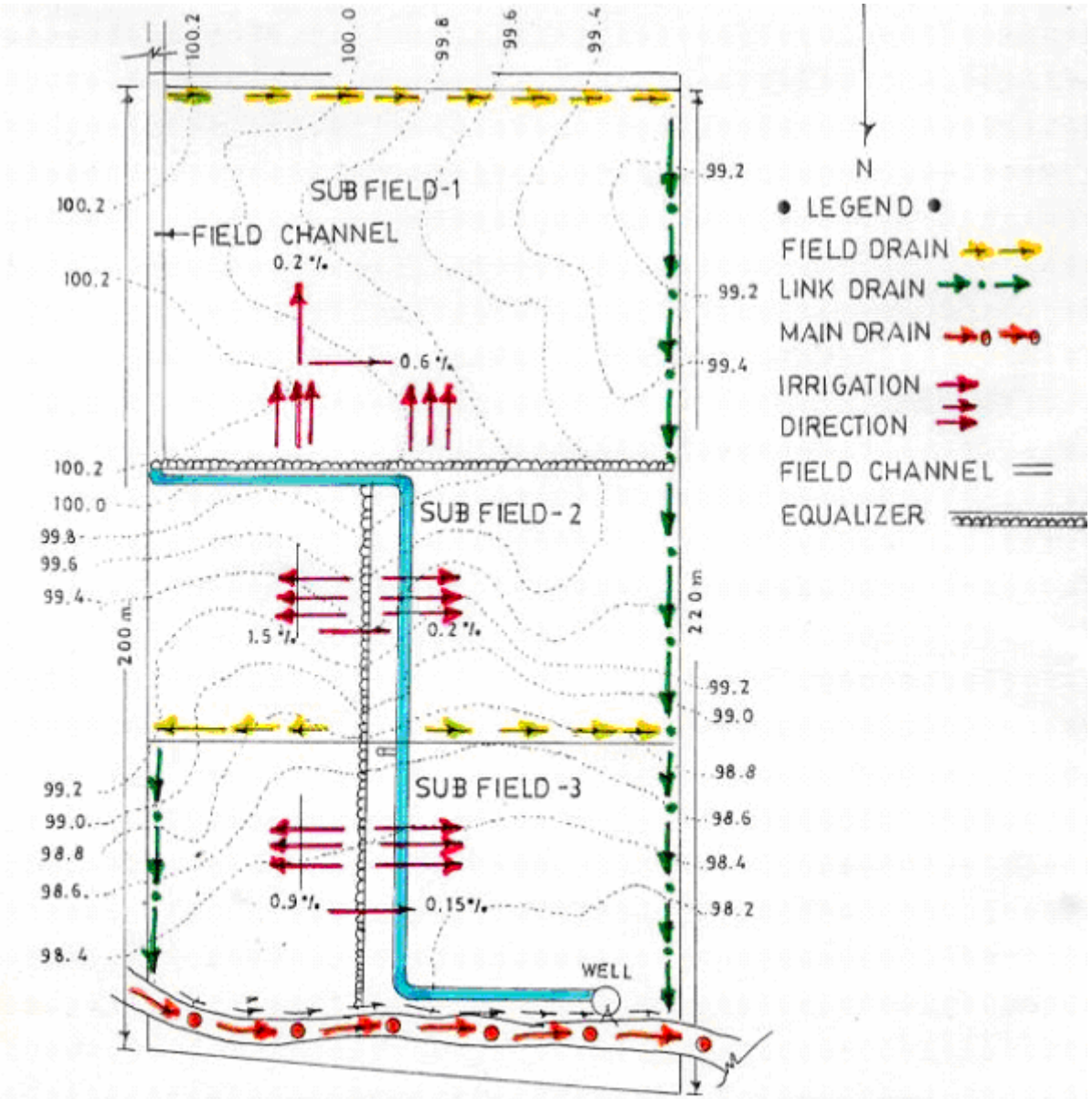


Fig. 5.1 A CONTOUR MAP OF A FIELD INDICATING FIELD DRAIN LINK DRAIN & MAIN DRAIN

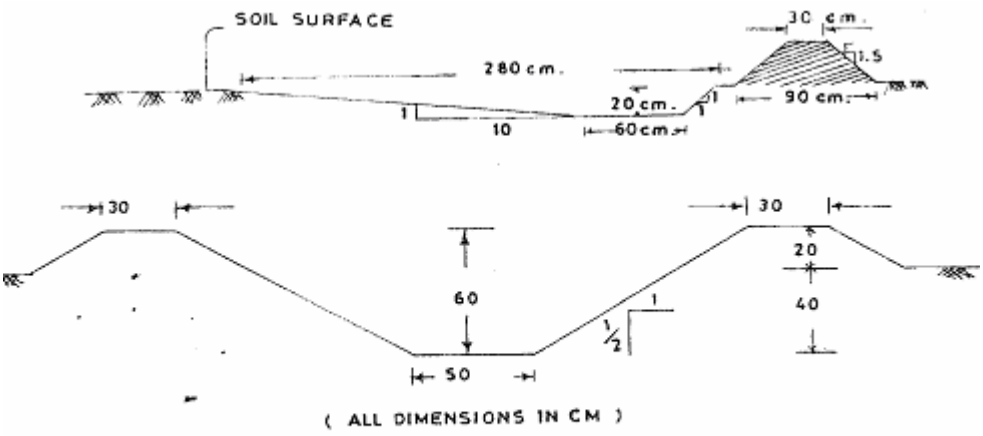


Fig. 5.2 Typical Cross Section of Field Drain & Link/Main Drain

5. Land smoothening for Straight Furrows

The Need

- Removal of excess rain water without causing soil erosion
- Provide uniform slope for efficient water application
- Provide better aeration, workable condition for farm operations, healthy micro climate and soil environment to the crop.

Fig. 5.3 Land Farming Techniques

It is the process of forming uniform slope in the direction of irrigation without changing the natural land slope. (Fig. 5.3)

Appropriate Applications

- Less costlier than drip and sprinkler irrigation
- Land slope less than ≤ 3.0 %
- Soil depth more than ≥ 0.3 m.
- Coarse, medium & fine texture

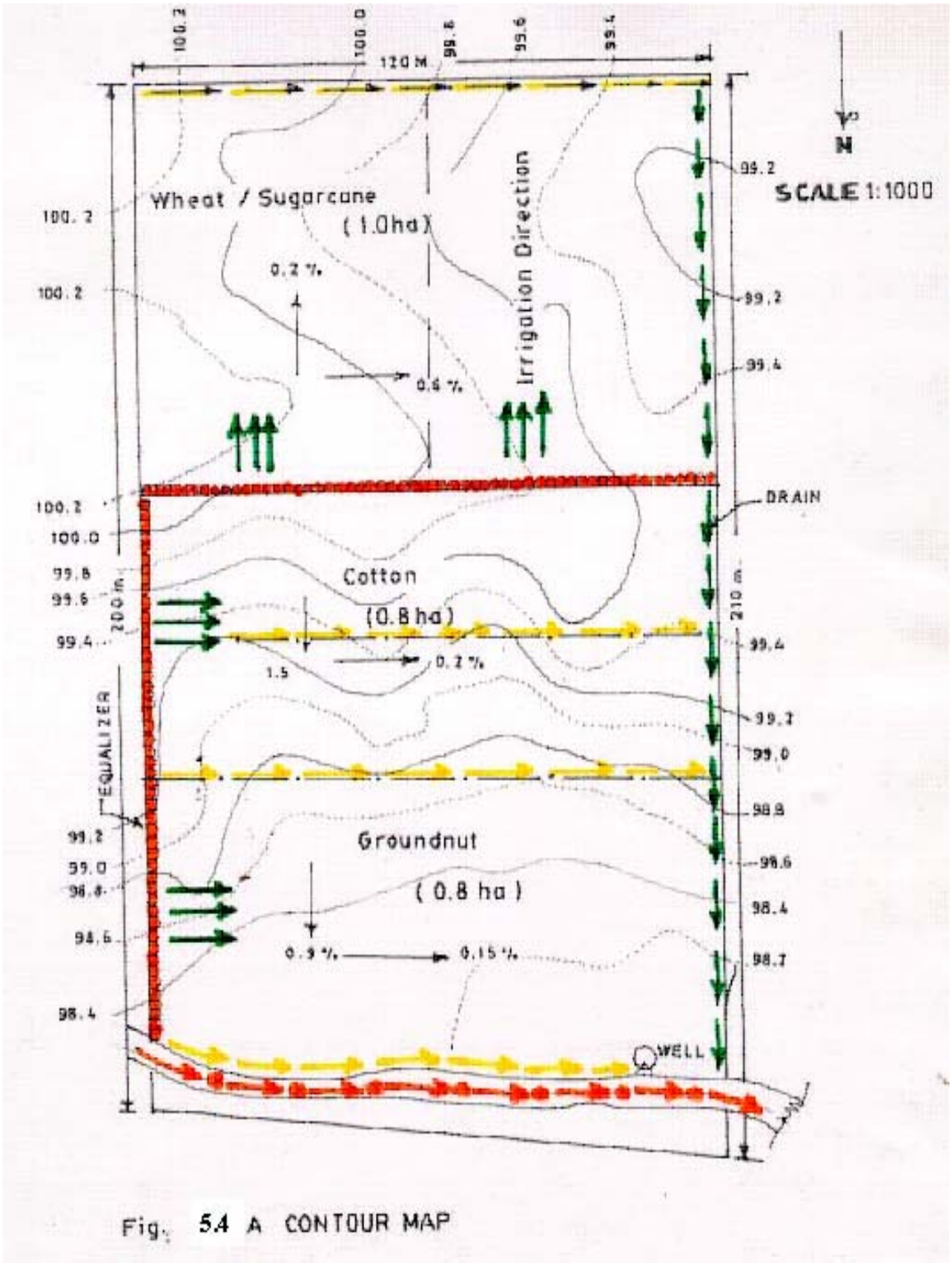


Fig. 5.4 A CONTOUR MAP

THE PLANNING PROCESS

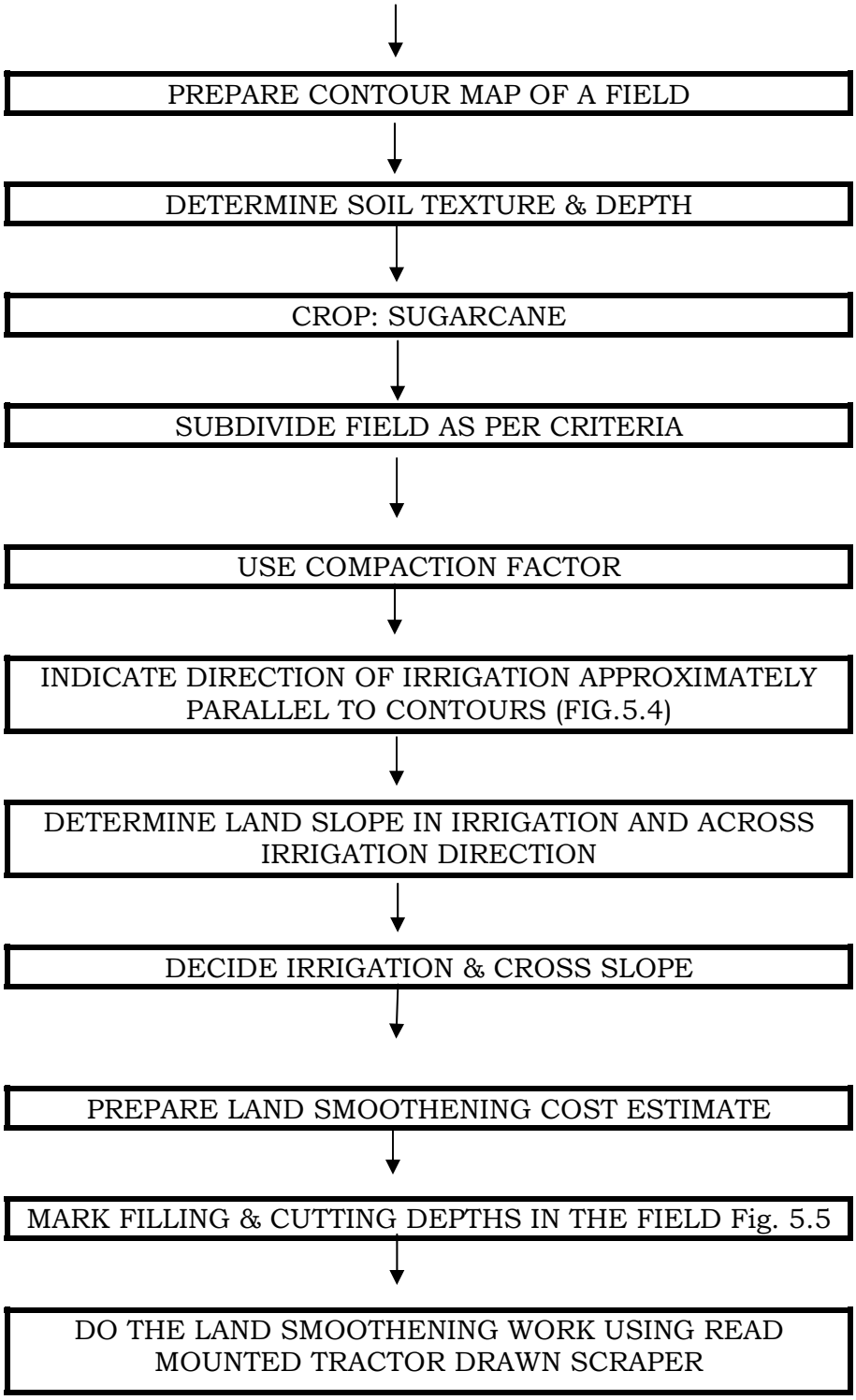


Table 5.3 : Criteria for Sub Division of Field for Land Forming (fig. 5.4)

Sr. No.	Land slope along Field Channel or Equalizer Align. In %	Width of sub field along the field channel align., m.
1.	0 – 0.5	90 – 120
2.	0.5 – 1.0	60 – 90
3.	1.0 – 2.0	30 – 60
4.	2.0 – 3.0	15 – 30
5.	3.0 – 4.0	10 – 15

Note: The width of sub field can be as small as 30 m. to optimize the depth of cutting.

Table : 5.4 Desired slope criteria for Land Smoothening Technique

Sr. No.	Soil Texture	Irrigation Slope, %	Cross Slope, %
1.	Coarse	$\leq$ 0.3	$\leq$ 3.0
2.	Medium	$\leq$ 0.3	$\leq$ 3.0
3.	Fine	$\leq$ 0.2	$\leq$ 3.0

(Mainly used for Straight Ridges and Furrows)

Table: 5.5 Cut-Fill Ratio (Compaction Factor)

Sr. No.	Soil Texture	Cut-Fill Ratio
1.	Coarse	1.1 – 1.2
2.	Medium	1.2 – 1.3
3.	Fine	1.3 – 1.5

Construction of Land Forming Works

- The grid survey layout is marked in the field.
- The wooden pegs or iron Bars of about 0.3 to 0.5 m are used for marking cutting and filling depths.
- The rear mounted tractor drawn scraper, buck scraper, front mounted tractor drawn scraper or a chain tractor i.e. bulldozer are the equipments used for land forming work.
- Leger land leveling equipment is also used for precise land forming construction.

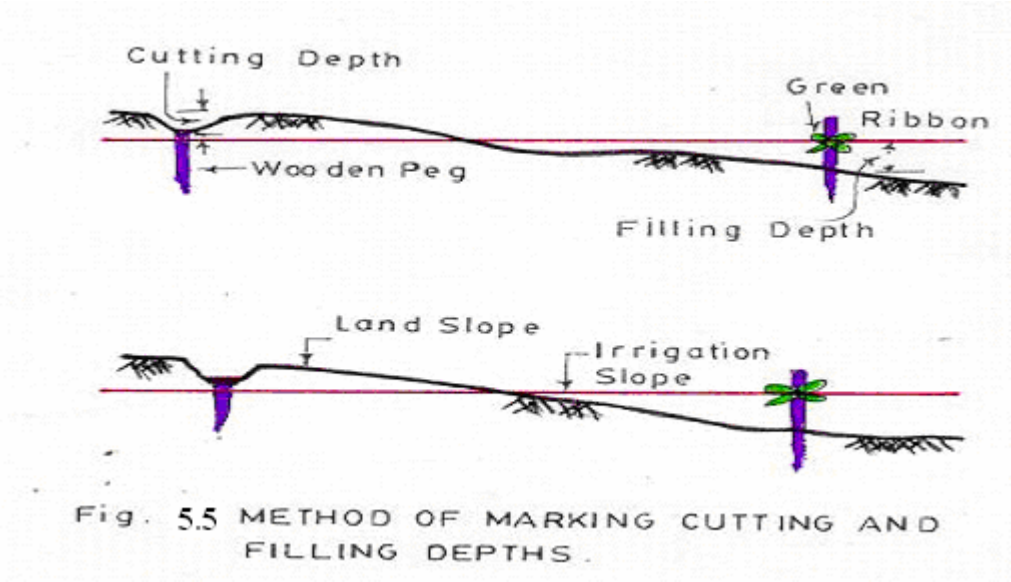


Fig. 5.5 METHOD OF MARKING CUTTING AND FILLING DEPTHS.

6. Straight Furrow Irrigation

Basic requirements

- Most suitable for coarse, medium and fine soil texture soils
- Soil depth should be more than 30 cm.
- Land smoothening is essential to make the land slope uniform in the irrigation direction
- Furrows must be oriented approximately parallel to contours (fig. 5.4)
- For a given soil texture, the furrow slope, length and flow rate released in each furrow should be in the specified limits given in Table 5.6 for obtaining 80 to 90% irrigation efficiency.
- Gated pipe or Siphon tubes must be used to release the desired flow rate in each furrow.
- Straight furrow irrigation can be fully automated using solar powered or electric powered surge irrigator.

The designed parameters for straight furrow irrigation are given in Table 5.6. For example soil texture is medium, furrow slope is 0.3 % then length of

furrow should be 50 to 75 m., the flow rate 1.5 to 2.5 l.p.s., and the cutoff length should be 90%. The depth applied would be 30 to 50 mm.

If the Siphon tubes are to be used to release the desired discharge, the equalizer must be constructed as indicated in Photo 5.1. If the gated pipes are to be used then construction of equalizer is not required. Automation is possible with gated pipe arrangement.

Photo 5.1 Straight furrow irrigation with Siphon Tubes

Table 5.6 Straight Furrow Irrigation Design Parameters

Sr. No.	Soil Texture	Furrow Slope %	Furrow width %	Furrow length, m.	Flow Rate lps	Shut off length %	Approx. Depth applied mm
1.	Coarse	0.05 - 0.1	0.6 - 0.75	60 - 90	3 - 4	100	50 - 75
		0.1 - 0.2	0.6 - 0.75	60 - 90	2 - 3	95	40 - 60
		0.2 - 0.3	0.6 - 0.75	60 - 75	1.5 - 3	90	30 - 50
2.	Medium	0.05 - 0.1	0.75 - 0.9	100 - 150	3 - 4	100	50 - 75
		0.1 - 0.2	0.75 - 0.9	60 - 100	2 - 3	95	40 - 60
		0.2 - 0.3	0.75 - 0.9	50 - 75	1.5 - 2.5	90	30 - 50
3.	Fine	0.05 - 0.1	0.9 - 1.0	100 - 200	2 - 3	95	50 - 75
		0.1 - 0.2	0.9 - 1.0	50 - 100	1.5 - 2.5	90	40 - 60

Irrigation Scheduling

- Collect the field data

  - Soil texture : Medium, Irrigation slope: 0.2 %
  - Soil depth/root zone (D) : 100 cm.
  - Available soil water (Sa) : 240 mm/m. soil depth
  - Management allowable depletion of sugarcane (p): 0.6
  - Evapotranspiration of sugarcane in May (ETc): 10 mm
  - Water application efficiency (Ea): 0.8

- Calculate the maximum depth of water application, (MDWA)

  MWDA = p x Sa x D / Ea

  MDWA = 0.6 x 240 x 1.0 / 0.8 = 180mm

- Irrigation interval (i) = p x Sa x D / Etc
  = 0.6 x 240 x 1.0 / 10
  = 14 days

- The irrigation schedule is given in Table 5.7

Equipments for irrigating straight furrows

Flow monitoring devices are most essential to release desired flow rate in each straight furrow.

Siphon Tubes

- Equalizers should be constructed to get at least 10 cm driving head for the siphon tubes (Fig. 5.1)
- Easy to operate during day time
- Low cost
- Measured quantity of water can be given at desired frequency
- Irrigation efficiency (water application efficiency) would be 85 to 90%

Gated Pipe

- An arrangement should be made to connect gated pipe to the water source i.e. field channel (Fig. 5.2)

- Easy to connect to the pipe irrigation network
- Easy to operate during day and night time
- One gated pipe cost Rs. 700 to 1000 for 6 m.
- Measured quantity of water can be given at desired frequency
- Irrigation efficiency would be 85 to 90%
- Automated irrigation is possible (Fig. 5.2)
- Easy to operate with solar powered computer
- Water application efficiency would be 85 to 90%.

Fig. 5.2 Solar Powered Surge Irrigator with gated pipe in straight furrows

Table 5.7 Irrigation Scheduling of Seasonal Sugarcane Using Straight Furrow Irrigation

[Planting : 1st January]

Irrigation No.	Irrigation Dates	NIR, mm	GIR, mm	Irrigation Interval, Days			Depth of water applied, mm			Remarks
				C	M	F	C, d=0.5m	M, d=1.0m	F, d=1.0 m	
1	Jan.15	62	78				75	100	100	
2	Jan.31			15	15	15	75	100	100	
3	Feb.14	109	140	14	14	14	75	100	100	
4	Feb.28			14	14	14	75	100	100	
5	Mar.10,15	189	236	10	15	15	75	120	120	
6	Mar.20			10			75			
7	Mar.31			10	15	15	75	120	120	
8	Apr.7,10	237	296	7	10	10	75	130	130	
9	Apr.14			7			75			
10	Apr.21,20			7	10	10	75	130	130	
11	Apr.30			7	10	10	75	130	130	
12	May.7	304	380	7	7	7	75	100	100	
13	May.14			7	7	7	75	100	100	
14	May.21			7	7	7	75	100	100	
15	May.31			7	7	7	75	100	100	
	June to October Irrigate as per need									
16	Nov.1	126	158				75	100	100	
17	Nov.15			15	15	15	75	100	100	
18	Nov.30			15	15	15	75	100	100	
19	Dec.15	78	100	15	15	15	75	100	100	
20	Dec.21			15	15	15	75	100	100	
							1500		**1930**	

NIR – Net Irrigation Requirement, GIR – Gross Irrigation Requirement, C – Coarse Texture, M – Medium, F – Fine, d – Depth of soil

7. Sprinkler Irrigation

- Most useful for irrigating just planted sugarcane. Sprouting will be more than 90%.
- Most suitable for decomposing Sugarcane trash. It enhances decomposition process.
- It creates healthy and congenial environment to the verms. Provides better aeration and enhances crop growth.
- This method is conveniently used for irrigating sugarcane up to 5 months from the planting date or from harvesting date.
- This method is most suitable for undulating and steep topography. Land forming is not required.

Planning Pipe Network

- Laterals preferably HDPE, should be portable and must be oriented approximately parallel to contours.
- The PVC manifold should be aligned from higher to lower ground (Fig.5.3)
- The Sprinkler hydrants should be planned in such a way that portable HDPE lateral length should be minimum (Fig.5.3)
- Raingun can be conveniently used for irrigating sugarcane crop.
- Manifold, submain and main should be laid underground. The Minimum depth should be 60 cm.

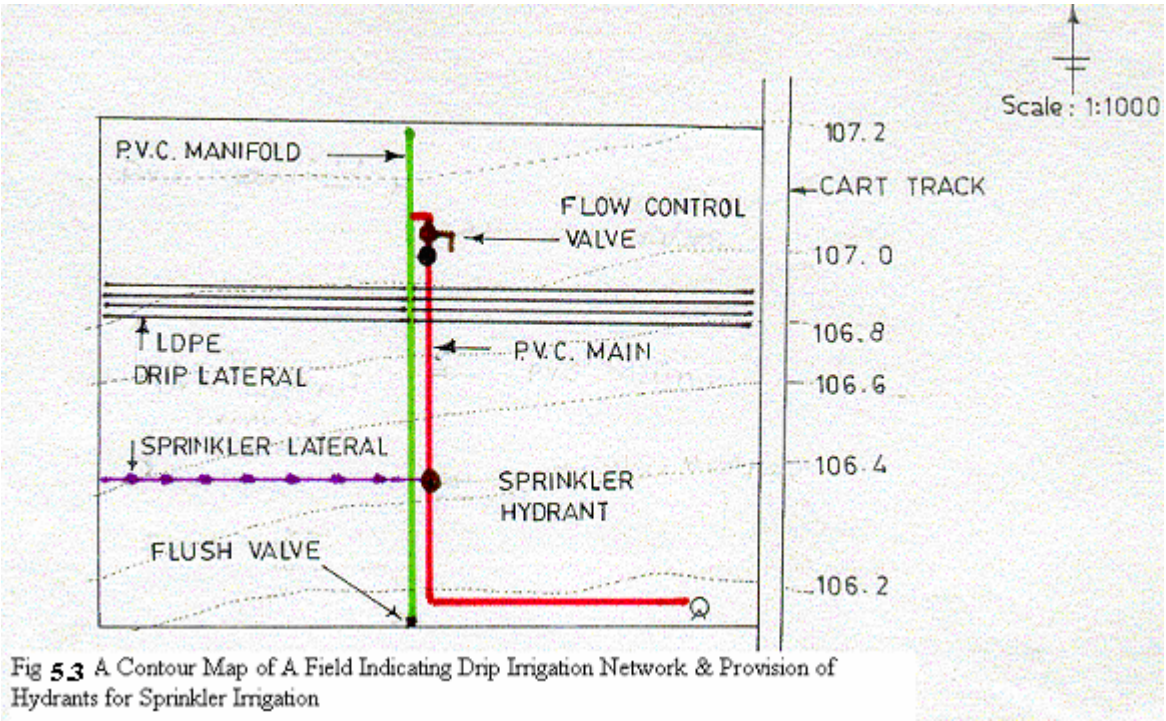


Fig 5.3 A Contour Map of A Field Indicating Drip Irrigation Network & Provision of Hydrants for Sprinkler Irrigation

Design Principles

- Maximum head loss or gain in the lateral should not exceed 10% of the operating pressure in the lateral
- Maximum head loss or gain in the manifold should exceed 20% of the operating pressure in the manifold.
- Velocity of flowing water in the sub main and main should be 0.5 to 1.5 m/sec.
- The overlap of sprinkler jet length between two sprinklers and between two laterals should be 100% for getting the best distribution uniformity.

Fig. 5.4 Raingun is most suitable for decomposing Sugarcane trash

Table : 5.8 Irrigation Scheduling of Seasonal Sugarcane in Coarse Textured Soil Planting (January First Week)

Sr. No.	Month	Etc mm/day	I.R. mm/day	Irrig. Inter-val days	Depth to be given, mm.	Precip-itation rate mm/hr.	Operating hours of the Pump set per shift
1	Jan.	2.0	2.3	15	35	12	3.0
2	Feb.	4.0	4.7	14	66	12	5.5
3	Mar.	6.1	7.1	7	50	12	4.2
4	Apr.	7.85	9.4	7	66	12	5.5
5	May	9.8	11.5	7	80	12	6.7
6	June	7.3	8.6	7	60	12	5.0
7	July	5.5	6.5	7	46	12	4.0
8	August	5.0	5.9	7	42	12	3.5
9	Sept.	5.4	6.4	7	45	12	4.0
10	Oct.	5.6	6.6	7	46	12	4.0
11	Nov.	4.2	5.0	7	35	12	3.0
12	Dec.	2.5	3.0	7	21	12	2.0

Note: From June to October irrigate as per need in the rainy season.

8. Drip Irrigation

The uniformity of water application in drip irrigation would be as high as 95% if the system is properly planned, designed and operated. (fig. 5.5)

Data Requirement

Farmer's Name :: Ashish Patodekar, Tq. & Dist. Aurangabad

Soil Data - Soil Texture :: Silty Clay (Medium Texture)

- Soil Depth :: More than 1.0 m.

Table: 5.9 Cropping Scheme and Peak Irrigation Requirement of full grown crops

Crop	Area, ha.	Irrigation requirement
Sugarcane (1.2 x 0.3 m)	0.8	10 mm/day

Water Availability

The yield of open dug well is calculated based on the field observations. The calculations for determining yield of well and the adequacy of water availability for irrigation is illustrated below

Assessment of Water availability

Water source	:	Open dug well
Pumping hours in May	:	8 hours/day
Discharge	:	4 l.p.s.
Time required to recoup the pumped quantity of water	:	16 hours
Average recuperation Rate 115200 ÷16 ÷ 3600	:	2.0 l.p.s.
Therefore yield of well	:	2 l.p.s.

Adequacy of Water Availability

Water Available	:	115.0 m^3/day
Water Required 10 x 0.8 x 10	:	80 m^3/day

Fig. 5.5: 30 – 40 % additional water saving with farm residues used for mulching in drip irrigation

Table:5.10 Spacing between two drippers on the lateral, wetting strip Per dripper and lateral spacing as a function of Soil Texture and Depth

Sr. No.	Soil Depth & Soil Texture	Dripper Spacing m.	Width of wetted Strip m.	Desired Lateral spacing to well 30% crop root zone
1	Up to 0.75 m.			
	Coarse	0.75	0.9	3.0
	Medium	0.9	1.0	3.0
	Fine	1.0	1.2	4.0
2	0.75 m. to 1.5 m.			
	Coarse	0.90	1.0	3.0
	Medium	1.20	1.2	4.0
	Fine	1.30	1.5	5.0

Appropriate applications

- Coarse, medium and fine soil textures
- Shallow, medium and very deep soils
- Flat (0 to 0.50)and steep slopes (more than 0.5%) are suitable
- On steep slopes soil conservation measures are essential
- Fertilizer application efficiency 80 to 90%
- Pest & disease control

Fig. 5.6 : Crop yield increase 20 to 30% in drip irrigation

- 50 – 60 % water saving when compared with serpentine furrow cum basin irrigation
- 30 – 40% water saving when compared with straight furrow and border irrigation methods
- 30 – 40 % additional water saving with farm residues used for mulching
- Economically viable for Sugarcane and high value crops
- Crop yield increase 20 to 30%
- Integrated benefit 2 x 1.25 x 2 = 5 times

Table: 5.6 Irrigation Scheduling of Drip irrigated Seasonal Sugarcane

Sr. No.	Month	Etc mm/day	I.R. mm/day	I.R. Cum/day Per ha.	Pump discharge Cum/hr.	Irrigation Inter-val Days	Operating hours of the Pump set
1	Jan.	2.0	2.3	23	20	2	2.3
2	Feb.	4.0	4.7	47	20	2	4.7
3	Mar.	6.1	7.1	71	20	1	3.6
4	Apr.	7.85	9.4	94	20	1	4.7
5	May	9.8	11.5	115	20	1	5.75
6	June	7.3	8.6	86	20	1	4.30
7	July	5.5	6.5	65	20	1	3.25
8	August	5.0	5.9	59	20	1	3.00
9	Sept.	5.4	6.4	64	20	1	3.20
10	Oct.	5.6	6.6	66	20	1	3.30
11	Nov.	4.2	5.0	50	20	2	5.00
12	Dec.	2.5	3.0	30	20	2	3.00

Note: From June to October irrigate as per need in the rainy season.

VI. Interculture and Weed Control

Hoeing is done first by a week or so after planting in order to break the surface crust, else light irrigation is followed by the same period in order to help emergence of sprouts. After the sprouts are out, the hoeing by bullock drawn implements is followed to control weeds as well as for loosening surface soil. If the weeds are more, the hoeing is followed by hand weeding. One to two hand weedings and one hoeing are given within 6 – 8 weeks after planting by which time first top dressing of nitrogen fertilizer is given. Before next nitrogen fertilizer application (12 – 16 weeks after planting), one more hand weeding followed by hoeing is usually necessary. By this time, first light earthing up takes place. Later on till final earthing up, one hoeing is again usually necessary. The final earthing up is done at 20 – 24 weeks after planting after final top dressing of fertilizers for getting better suppression of late tillers, prunning of non-functional roots, weed control and avoid lodging. After earthing up, the sugarcane planted in furrows will come on ridges.

Due to non-availability of labourers for hand weeding, chemical weed control is now becoming popular. Spraying of Atrazine @ 2 kg a.i./ha at pre-emergence and 2,4-D sodium salt @ 1 kg a.i./ha at post emergence (8 to 10 weeks after planting) control weeds effectively. Trash mulch @ 5 tonnes/ha at 45 days after planting is useful to control weeds and avoid cost on hand weeding/hoeing.

VII. Maturity and Harvesting

- Cane should be harvested only when it is mature. Practical tests to judge maturity are (a) general yellowish colour of whole crop, (b) cessation of growth, (c) swelling of eye buds, (d) metallic sound of cane, (e) breaking of cane at the nodes and (f) Brix saccharometer reading between 21 and 24.
- Irrigation should be withheld for about 10 to 15 days prior to harvesting.
- Harvesting should be done with sharp cane cutting knife and very close to ground.
- The cane should be crushed within 24 hours to get high recovery.
- Average yield of suru/ratoon crop is 100 t/ha, pre-seasonal crop is 125 t/ha and that of adsali is 150 t/ha. With best management practices, potential yield of 200 t/ha (suru/ratoon crop), 250 t/ha (pre-seasonal crop) and 300 t/ha (adsali crop) can be harvested.

VIII. Integrated Pest and Disease Management

A) Integrated pest management

1. Wooly aphids

- Use paired row planting which facilitates spraying dusting.
- Do not use infested planting material.
- Dipping of setts in Malathion (50 EC) 30 ml in 10 litres of water for 10 to 15 minutes.
- Release of Crysoperla carni parasite @ 2500 eggs or larva/ha (available at Vasantdada Sugar Institute, Manjri Bk., Pune).
- If the incidence is more than 15%, spraying with Endosulfan (35 EC) 15 ml or Chloropyriphos (20 EC) 15 ml or Dimethoate (30 EC) 10 ml in 10 litres of water. Dusting with 2% Methyl parathion dust @ 40 kg/ha is recommended in fields where spraying is not possible due to dense population.
- Repeat spraying or dusting after 15 days.
- Burn the infested trash immediately after harvesting to reduce incidence on ratoon crop.

2. Stem borer

- Late planting of seasonal cane after February should be avoided.
- Trash mulching @ 5 tonnes/ha in alternate rows after germination (3 weeks after planting) helps to prevent the larval entry in shoot near the soil.
- Light earthing up and final earthing up also helps to reduce the incidence.
- Removal of dead hearts and destruction of larvae with cycle spoke in small areas is feasible.
- Release of an egg parasite, Tricogramma chilonis @ 5 lakhs eggs per hectare from January to May is useful in reducing incidence (egg

parasites available at Vasantdada Sugar Institute, Manjri Bk.,Pune).

- Soil application of 6 G lindane (16.6 kg/ha) or 4:4 G Sevidol (25 kg/ha)15 days after planting gives satisfactory control.

3. White fly

- Late planting of seasonal cane after February should be avoided.
- Clipping and disposal off 2 to 3 affected leaves with eggs and nymphs followed by two sprays with Endosulfan (35 EC) 30 ml or Dimethoate (30 EC) 27 ml in 10 litres of water.
- Good drainage helps to reduce the incidence.
- Release of Chrysoperla @ 1000 adults or 2500 eggs/ha during initial stage of infestation.

4. Pyrilla

- Release of minimum 1000 viable cocoons of Epiricania parasite in July/August and 4000 – 5000 viable cocoons per hectare during September to November.
- Paired row method of planting provides space for supervision and to undertake control measures.
- In dense grown cane need base dusting of 2 per cent methyl parathion @ 40 kg/ha.
- Where Epiricania parasite is established do not burn trash and avoid use of insecticides.

5. Scale insects

- Select pest free setts for planting.
- Dipping of setts in Malathion (50 EC) 30 ml in 10 litres of water.
- Remove the lower 2 – 3 dry leaves at four months of age of crop and spray Dimethoate (30 EC) 27 ml in 10 litres of water or Monocrotophos (36 WSC) 28 ml in 10 litres of water.

6. Termites

- Destroy the termitoria along with queen.
- Dipping of setts in Malathion (50 EC) 30 ml in 10 litres of water.
- Drenching of 20 EC Chloropyriphos @ 5 lit in 1000 lit of water/ha.

7. White grub

- Deep ploughing.
- Soil application of 10 G Phorate @ 25 kg/ha or 2% Methyl parathion dust @ 100 kg/ha.

8. Rodents

- Clean the bunds.
- Apply Bromadiolone cakes (0.005%), 1500 gm/ha in the burrows. Apply the cake continuously for two days.
- Rodenticide application is necessary in September-October and January-February for effective control.

B) Integrated disease management

1. Whip smut :

- Sett treatment with hot water treatment in combination with Bavistin 10 g or Bayleton 5 g, in 10 litres of water for 10 to 15 minutes.
- Rouging and burning of affected clumps .

2. Grassy shoot disease

- Hot water treatment or moist air treatment followed by dipping of setts in Streptocycline or Tetracycline 1 g, in 10 litres of water for 10-15 minutes.
- Regular rouging of diseased stool.

3. Wilt disease

- Sett treatment with hot water treatment in combination with Bavistin 10 g or Bayleton 5 g, in 10 litres of water for 10 to 15 minutes. .

IX. Management of Ratoon Crop

- Instead of burning of trash after the harvest of previous cane crop, it should be spread evenly in between the rows or in alternate row of the ratoon crop.
- Decomposing culture @ 10 kg/ha along with 80 kg Urea/ha and 100 kg Single super phosphate should be used on trash for fast decomposition of trash.
- Stubbles above the ground level needs to be shaved within 10-15 days after harvest of plant crop. Infected stubbles should be removed and burned.
- Gaps in ratoon needs to be filled with the saplings raised in poly bags by single eye bud method.
- The hard and compact mass of soil near the root zone should be loosened by breaking the soil by plough near the root.
- Fertilizer doses must be given at 10 – 15 cm depth as per the schedule given below.

Sr No	Time of application	Kg/ha		
		N	P_2O_5	K_2O
1	Within 15 days after harvest of previous crop and before first irrigation	35	70	70
2	6 weeks after first dose	140	-	-
3	12 weeks after first dose	35	-	-
4	At earthing up	140	70	70
	Total	350	140	140

- After the harvest of plant cane within two weeks all the operations mentioned above should be completed and immediately after the fertilizer application first irrigation mush be given. Afterwards, as per the requirement of the crop and the soil, irrigations should be given.

- Early earthing up at 2 to $2^{1/2}$ months age and final earthing up at $3^{1/2}$ to 4 months age should be done, which enables to maintain the tillers at the optimum level and reduces weeds.
- Usually in ratoon, iron clorosis is observed. In such case 0.5% Ferrous sulphate (50 g Ferrous sulphate in 10 litres of water), 0.5% Zinc sulphate (50 g Zinc sulphate in 10 litres of water)and 2% Urea (200 g Urea in 10 litres of water)s hould be sprayed on the crop for 3 to 4 times at an interval of 8 to 10 days.
- Ratoon matures at about 12 months age. If harvested at this age, it gives good yield and good recovery. On an average the yield of 100 – 120 tonnes/ha can be obtained by adopting these ratoon management practices.

X. References

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