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Advances in Micro Irrigation for Sugarcane under Water Sacristy Zone

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SUMMARY

Agriculture is backbone of Indian economy. Majority of population engaged in farming for livelihood. Among the cultivated crops, sugar cane is one of the most important cash crops. Decreasing availability of irrigation water is raising a big threat in sugarcane farming in dry zone of the country. To get the sustainable yield in this condition, application of micro irrigation is coming forward as a solution. The application of micro irrigation not only serve the purpose of water saving but also aid benefits of better weed control, fertiliser management and so on. Hence, use of micro irrigation can be considered as smart approach of farming in dry land agriculture.

INTRODUCTION

India is second largest in production of sugarcane in the world. Sugarcane is grown commercially country like Brazil, Australia, Russia, India, Cuba, China, Thailand, USA and Pakistan etc. The total geographical area of country is 328.7 million hectares, of which 141.4 million hectares is the reported net sown and 20.9 million hectors is the gross cropped area with a cropping intensity of 142% (2017). According to the World Bank collection of development indicators, agriculture irrigated land (% of total agricultural land) in India was reported at 36.8 per cent (2013). In India, Sugarcane is grown over an area of 45.17 lakh hectares with the production of 3099.84 lakh Tonnes and the productivity is about 67.57 Tonnes/ha. Utter Pradesh, Tamilnadu, Karnataka, Maharashtra, Andhra Pradesh, Bihar and Utterakhand are the commercially growing states in India. Sugarcane is perennial crop and duration of sugarcane ranges 12 to 18 month. In India, sugarcane is planted in spring (February-March), autumn (September-October) and adsali planting (July-August). Adsali Sugarcane is 16-18 month duration crop and grown in northern Maharashtra and parts of Andhra Pradesh and Karnataka.

Table No. 1 Area, Production and Productivity in major Sugarcane Producing States, 2017-18

States	Area (Million hectare)	% to All India	Production (Million tonnes)	% to All India	Productivity (Kg. / hectare)
Uttar Pradesh	2.23	47.21	177.06	46.98	79255
Maharashtra	0.90	19.06	83.13	22.06	92166
Karnataka	0.35	7.40	28.26	7.50	80751
Tamil Nadu	0.18	3.80	16.54	4.39	92002
Bihar	0.24	4.99	13.98	3.71	59202
Gujrat	0.18	3.85	12.05	3.20	66220
Haryana	0.11	2.41	9.63	2.56	84500
Punjab	0.10	2.03	8.02	2.13	83583
Andhra Pradesh	0.10	2.09	7.95	2.11	80283
Uttarakhand	0.09	1.90	6.30	1.67	70044
Madhya Pradesh	0.10	2.07	5.43	1.44	55408
Telangana	0.04	0.74	2.56	0.68	73086
Others	0.12	2.45	5.98	1.59	-
All India	4.73	100.00	376.90	100.00	79650

(Source : *Ministry of Agriculture & Farmers Welfare, Govt. of India*)

Water requirement of sugarcane crop is very high as compare to other agronomical crop is about 150-250 ha cm. At the time of limited source of water we should know the water requirement of sugarcane crop and critical

growth stages. Sugarcane has four important growth stages like germination phase, tillering (formative) phase, grand growth phase and maturity & ripening phase (Mall et al. 2016). But in our country most common method of irrigation is flood irrigation due to this irrigation method loss of thousand litre of water by evaporation and surface runoff. The water use efficiency of this irrigation method is less as compare to other methods irrigation. Sugarcane is perennial crop and the demand of water is throughout the life cycle, so proper management of water resources is very important issue.

Growers and Farmers all over the world are always looking at new, alternative, and more efficient methods of irrigation. Most irrigation systems perform at 60-80% uniformity and many have limitations. The adoption of irrigation in the cultivation of cane sugar provides improvements in the production environment (Carr & Knox, 2011), resulting in increases in the yield of stem and sugar (Dalri & Cruz, 2008). On the other hand, agricultural irrigation is a major source of consumption of water, so, the search for more efficient methods of irrigation is required to obtain more sustainable production environments. Subsurface drip irrigation is a modified form of conventional surface drip irrigation technology. For reducing the evaporation it uses water more efficiently than surface irrigation. The depth of lateral is depending upon soil composition and crop to be irrigated. The sub-surface drip irrigation is costly system that needs expert person and maintenance but SDI is effective irrigation method that transports the water directly to the root zone off crops. Subsurface drip irrigation is defined by ASAE S526.1 "Soil and Water Terminology" (ASAE 1999a) as Subsurface drip irrigation as "application of water below the soil surface through emitters, with discharge rates generally in the same range as drip irrigation." It referred to both SDI and sub-irrigation. SDI allows the farmer to optimize the growing environment and leads to increase quantity and quality of sugarcane crop. The depth and placement of SDI is totally depending on the soil profile and water requirement of crop. There are three different positions of placing the subsurface drip irrigation system such as shallow 0.5-10cm, medium 10-25cm and Deep – deeper than 25 cm.

SDI (Subsurface Drip Irrigation) is a highly efficient irrigation system that uses buried drip tubes or drip tape to meet crop water needs. Since the water is applied below the soil surface, the effects of surface infiltration, such as crusting, saturated condition of ponds water, and water losses by evaporation and surface runoff are reduces. With an appropriately sized and well-maintained subsurface drip irrigation system, water application is highly efficient and uniform. Wetting occurs around the tube and water moves out in all directions. Moreover, water is applied directly to the root zone of the crop as opposed to the soil surface where most weed seeds dormant. As a result, germination of annual weed is reduced. This lowers the pressure on valuable crops. Furthermore, some crops may benefit from the additional heat provided by dry surface conditions, and produce more biomass. When managed properly the application of fertiliser can be optimised. Fields can still be worked when irrigation systems are installed.

Need of Subsurface Drip Irrigation

- To avoid damage to the drip laterals at the time of harvesting by mechanical or manual
- To facilitate the intercultural operation in sugarcane field
- To facilitate the drip lateral for many season.
- Water requirement of sugarcane crop is high as compared to other agronomical crops.

Advantages of Subsurface Irrigation

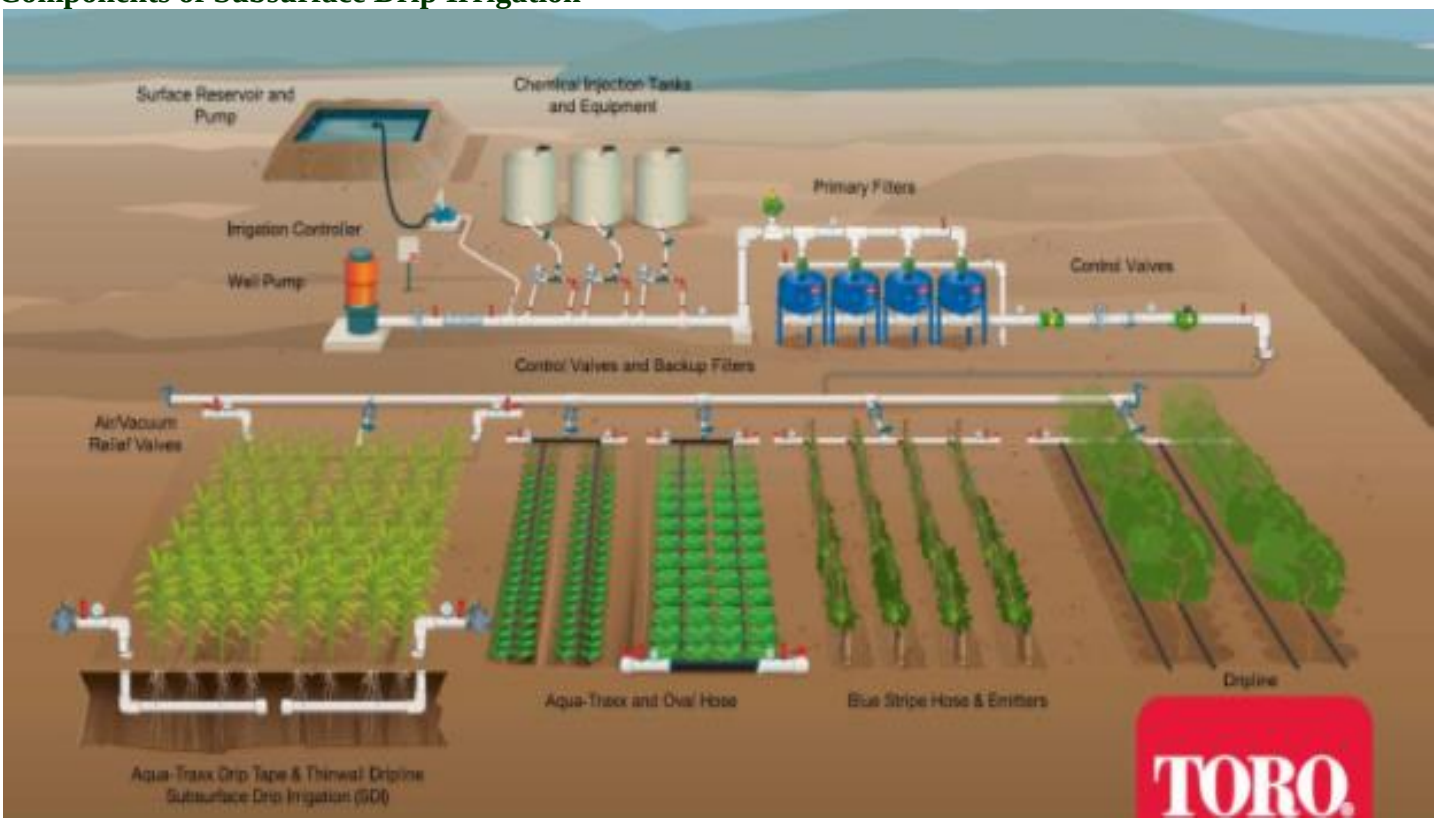
Increases crop production and quality: SDI applies water directly to the crop root zone, it supply uniform application of water and nutrient to crop that effect on growth and development corp. Results found that increase the crop yield and quality of produce.

Water saving techniques:Water is applied direct in root zone of sugarcane crops which reduce the evaporation and surface runoff (Lamm *et al*. 1995). Estimated that subsurface drip cultivation reduces the amount of water required for irrigation by 25 %)

Efficient fertigation: Fertigation is defined as application of fertilizer through irrigation is known as fertigation. In SDI system application fertilizer directly to root zone of plant system and root easily consume the more nutrient. It minimizes the losses by volatilization and leaching of fertilizer. It helps uniformly and equally distribution of fertilizer in field.

Reduce soil erosion: SDI is totally underground irrigation system. Due to this system the sufficient soil moisture available in the soil. Soil moisture holds to the soil particles and develops vigorous root system under the soil. The erosion of soil due to surface runoff and wind is reduces due to SDI.
Energy saving: This system operates at low pressure and delivers small flow rates. The energy used by pumping system depends on a combination of various factors, including flow rate, pumping depth, pressure at the pump, time of operation and pumping plant efficiency.
Control weeds population: Weed biomass explained 31% of the variation in yield loss due to weeds (calculated from yield in herbicide-treated control plots and in weedy control plots) reported by P. Milberga and E. Hallgrenb, 2003. Subsurface drip irrigation system helps to control the weed population in growing field because water applies directly to root zone of crop.
Less labour requirement: After SDI installation, the labour required to operate the system is less as compared to traditional surface irrigation methods. SDI is itself fully atomized system, which could consider labour fewer requirements.
Life span of the system: The initial cost of SDI is high but duration and working efficiency is more as compare to other methods. After the SDI installation we can use the system many seasons around 10-15 years.
Use of farm machinery: At time of surface irrigation to carry out intercultural operation in the field is difficult. But SDI system is below the soil surface and these major advantages of this system to take various intercultural operations like hoeing, weeding, earthing-up and also use farm machinery tractor, mechanical harvester etc.
Water use efficiency (WUE): WUE refers to the ratio of water used in plant metabolism to water lost by the plant through transpiration. In SDI system the application of water to directly in root zone of crops. The maximum water intake to the crops root zone that result is increase water use efficiency and reduces the water losses due to the evaporation. Subsurface drip irrigation can generally achieve 95 to 98% water use efficiency.
Less pest and diseases: There may be less pest and disease damage to SDI systems from insects and microbes than for DI systems. However, this must be tempered with the fact that pest and disease damage to SDI systems may take more effort to detect and to repair.

Components of Subsurface Drip Irrigation



Typical Subsurface Drip Irrigation Layout (Source: Toro)

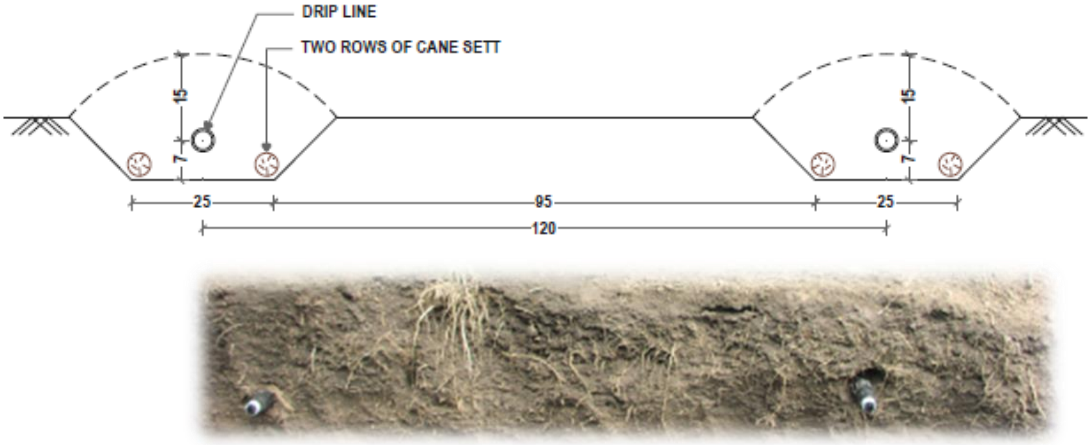
- Pumps
- Filters
- Mains and Sub-mains
- Lateral Dripper Tape
- Emitters
- Pressure regulator valves
- Zone valves
- Air and vacuum release valves
- Flushing manifold
- Pressure gauges
- Flow meter
- Fertiliser injector
- Backflow preventer, check or one way valve

Sugarcane planting methods

Selection of suitable planting method is an important for better yield and minimizes the cost of seed material of sugarcane. Different methods of sugarcane planting are enlisted below.

Single row spacing: Sugarcane planted at wide row spacing, in row spacing system, sugarcane planting 120-150 cm row to row and 50-60 cm plant to plant distance. Single lateral is placed on single row for irrigation.

Paired row system of planting: In paired row system, two sugarcane rows are brought together followed by a wide gap before the next set of two rows. The paired rows may be at 120-150 cm distance between two paired rows. The same number of rows per hectare remains the same. In this method place the lateral tube between the two rows of sugarcane. Benefit of this method is single lateral irrigate two rows of canes ant it maximum area with minimum lateral of subsurface irrigation.



One drip line for two rows of cane
Pair to Pair at 4' (120cm)

Irrigation scheduling

Sugarcane is perennial crop and the water requirement is more as compare to other agronomical crops. Proper management of irrigation water scheduling and proper method of irrigation that results to getting maximum yield in limited water resources. Requirement of water during the sensitive growth stages or life phases of crop. Water is an important factor for growth and development of cops. Water requirement of sugarcane crop is about 1400 to 2500 mm in his life cycle. The system is very efficient, with typical application efficiencies in the order of 95%. Give the water through subsurface drip system one day after for 2 hr to sugarcane crop.

Subsurface drip irrigation for sugarcane

Fertilizer scheduling

Sugarcane is long duration crop, the demands high sunshine, fertilizer and moisture for better yield. Nutrients like nitrogen (N), phosphorous (P), potassium (K) and sulphur (S) these are the major or essential nutrients and required in large quantity for sugarcane crop. The application of fertilizer in split doses however, the requirement of crop is throughout the life cycle.

The recommended fertilizer dose for sugarcane is different for different season of sugarcane plantation, for sure sugarcane the fertilizer dose is 350:115:115 kg NPK respectively and 400:170:170 kg NPK for ratoon sugarcane. Nutrients apply through subsurface drip irrigation the losses of fertilizer is less as compared to other irrigation method and efficiency of nutrient is high under the SDI system. This system usually includes a fertigation tank to store the fertilizer and a device to inject the fertilizer into the pipeline. Injection can be done either with an electric injection pump or with a venturi device that does not require electricity. Fertilizers apply in 30 split doses on 15 days interval to sugarcane crop for higher production and sugar recovery.

Precaution taken after installation of SDI system

- Check the SDI system time to time.
- Infrequently application of acid and chlorine may help to avoid the precipitate formation. Don't give acid and chlorine treatments at a time.
- High pH of water will lean to formation of participated that causes to block the laterals so check the water pH in specific interval.
- Apply rodenticide in soil for control of rats because rodent is destructive pest not only laterals of system but also sugarcane crops.
- Check whether all components of the subsurface drip irrigation system are installed properly and are working efficiently.
- Regularly clean the sand and screen filters for efficient working of system.

Installation cost of SDI

The initial investment of SDI is higher and cost will vary due to water source, quality and filtration need, choice of material, soil characteristic and degree of automation desired. System cost, including installation, may range from Rs. 40,000-50,000/-.

Research consistently shows yield and quality of produce improves when a buried drip system is used. Normal life span of a SDI system is considered to be 10 to 15 years. The system may remain under the ground for many years.

Subsidy on subsurface drip irrigation

The information related to the subsidy given to Indian farmers and producers is as follows. However, you can contact local gardening and agricultural departments to get information about the current subsidy found on

the agricultural drip system. In India, arrangements for subsidy in drip system are available in Centrally Sponsored and State Government Schemes. As per the Central Government guidelines the subsidy allotted to small and marginal Farmers 55% subsidy amount and other Farmers have 45% subsidy.

CONCLUSION

Sugarcane is water loving plant. But at present situation availability of irrigation water is lowering at robust rate in the country. This scenario tend to mark an adverse impact on sugarcane farming in country. To cope this water scarcity situation, application of micro irrigation proven to be most reliable approach. Application of micro irrigation in sugarcane saves water up to 30% of flood irrigation. Application of micro irrigation also improves the water use efficiency of plant which is ultimately responsible for getting higher yield with limited application of water. By keeping this in mind Government also promoting the use of micro irrigation in other field crops and horticultural crops.

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