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IMPROVED MANAGEMENT STRATEGIES FOR SUSTAINED SUGARCANE PRODUCTIVITY AND SUGAR PRODUCTION IN INDIA

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Abstract

The sustainable sugarcane and sugar production is yet another viable, economical and environmentally sound approach based on the principles of "more with less" in agriculture. This also improves the productivity of water, land, labour status of cane growers in the country. Strategies for achieving these objectives involves usage of less seeds, less water and optimum utilization of fertilizers, land with organics and biofertilizers. This is also an alternate to conventional seed, water and space intensive sugarcane cultivation. Management strategies also involves raising of cane crop in problematic soils and water with minimum tillage practices also creates micro catchments for water harvesting. Trench method of cane planting with wider spacing (120–150 cm) by raising plantlets through space Transplanting method (STP) is an part of management strategies have been followed at U.P. Council of Sugarcane Research, Shahjahanpur, U.P. This provides more number of millable canes per unit area with better possibilities of multi – ratooning saving about 30% cost of cultivation as compare to plant cane. By this practices seed cost can be reduced upto 75% and water saved upto 40-45% (– 30 to 35000 per ha both). It is also easy to transport the young seedlings for longer distances with least mortality rate (1-2%). With these objectives an experiment during 2014 – 16 in spring season have been conducted at research farm of U.P. Council of Sugarcane Research, Shahjahanpur, U.P. funded by All India Co – ordinate Research Project (AICRP) on sugarcane. Two years mean data of the experiment revealed that application of 10 t/ha FYM/compost + recommended NPK fertilizers on soil test basis + biofertilizers (Azotobacter + P.S.B.) @ 10 kg/ha each recorded significantly better cane yield (113 t/ha) . Soil health and physico - chemical parameters were also improved by this treatment as compare to the treatment in which only recommended NPK fertilizers were applied through inorganics.

Key words: Sustainable, sugarcane and sugar production, management strategies, space transplanting (STP), biofertilizers, water harvesting.

Introduction

Sugarcane is rightly called as "Wonder cane" owing to its versatile utility and the vast capability to meet the demands of the burgeoning population. The consolidated efforts of the research network of AICRP on sugarcane have resulted in vertical growth in sugarcane productivity and production in the country. India is the second largest producer of sugarcane (18.18%) and sugar (15.81%) in the world, next to Brazil. However, the country is also largest consumer of sugar (15.93%) of the world and 7th largest exporter of sugar (2.80%) to 113 countries of world. The sugarcane productivity has increased from 48.0 t/ ha (1970-71) to about 71 t/ha (2015-16). The total cane production has gone up from 126 million tonnes (1970-71) to 352.16 million tonnes (2015-16). There are more than 50 million farmers growing sugarcane and another 50 million people depend on employment generated by the 526 sugar. In India, sugarcane is grown in two distinct agroclimatic regions *viz.*, tropical and sub-tropical regions. Maharashtra, Tamil Nadu, Gujarat, Karnataka and Andhra Pradesh are the important cane growing states in tropical region, where as sub – tropical region comprised of Uttar Pradesh, Haryana, Bihar, Uttarakhand and Punjab states. Uttar Pradesh leads in area (2.16 m. ha) of sugarcane cultivation in the country with a production of 134 m.t. cane and 87 lakh tonnes of sugar (2016 -17). Maharashtra state stands first in producing the highest average sugar recovery of 11.33% due to the prevalence of long hours of sunshine and cool night with clear skies that favour more sugar

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accumulation. In terms of productivity, Tamil Nadu leads with a cane yield of 104 t/ha followed by Karnataka (88t/ha), and U.P (73t/ha). Bihar has the lowest productivity among the major sugarcane growing states (Co operative sugar, 2016).

Successful sugarcane cultivation is highly influenced by a number of constraints that include resource, site – specific technology, climate, socio – economic and of other environment factors which hamper the cane productivity and sugar production to rise above a certain level. Under intensive cropping system sugarcane is being grown on un favourable soil conditions such as saline – alkali, water logged and drought affected soils leading to poor yield. Incidence of diseases and insect - pests are the major biotic constraints. The major abiotic stresses include limited availability to suitable soil, irrigation water and uncongenial temperature for high sucrose formation. Besides, depletion of water resources due to improper water usage and erratic rainfall behavior over the years also keeps the crops cultivation under high risk.

However, there is a tremendous scope to enhance the sugar and sugarcane production sustainably by adopting the package of improved technological strategies. Stepping up per unit productivity of both plant as well as ratoon cane crops to a maximum level of 250 t/ha is possible by following sound management practices which are discussed hereunder.

Methods and review of literature with improved management strategies

1. **Availability of quality seed cane:** Selection of improved varieties is one of the important contributory factors for increased sugarcane productivity. There is need for quick replacement of old cane varieties that are resistant to biotic stresses with tolerance to drought, water logging and salinity. Zone wise testing and release of varieties suitable for different agroclimatic region will pave way for stabilizing both sugar recovery and sugarcane production. Some of the advanced strategies for production of quality seed cane are tissue culture, poly bag technology of promising varieties for replanting of ratoons and filling of gaps. It is also useful for late planting of sugarcane after wheat harvesting in April–May. Other are raising seedlings through bud–chip and space transplanting technique.
2. **Methods of planting:** Ridges and furrow method, trench method, paired row method and ring or pit methods, are the planting method of sugarcane. In which ridges and furrows method is most common method in north region. In southern region mostly trench method is followed.
3. **Optimum use of irrigation water:** An estimate indicates the water need for sugarcane to be around 125 tonnes for the production of 1 tonnes of cane. Only 30-35% of the cane grown in India is raised with amended water supply and in future there is every possibility of further reduction in the availability owing to many reasons. Since efficient use of irrigation water is of paramount importance for sustainable agricultural development, drip irrigation system is gaining importance, where 40-60 percent water could be saved with 80-90 percent use efficiency.

   Drip irrigation is the highly efficient method of applying water directly to the rootzone. Irrigation scheduling through drip can be managed precisely to meet crop water demands, holding the promise of increased yield and quality (Desai *et al*., 2008; Mishra and Paul, 2009). Research evidence revealed that drip irrigation at 80% PE (Pan Evaporation) had increased the cane yield by 26.4%, Commercial cane sugar by 35.8% and saved water by 17.1% over that of surface irrigation. The water expense efficiency was 52.9% higher than that of surface irrigation (table 1).

   The research findings of Mahesh (2015) revealed that sub – surface drip fertigation (SSDF) with 100% RDF with water soluble fertilizers (WSF) or combined normal fertigation of 75% RDF with WSF + 25% RDF with normal fertilizers (NF) through SSDF registered higher cane yield, net income and marginal return as compared to surface drip fertigation (SDF) and fertigation with N.F.
4. **Efficient weed management:** In sugarcane, weeds have been estimated to cause 12 to 72% reduction in cane yield depending upon the severity of infestation. Because of wider space between rows, slow crops growth at initial stages, abundant supply of water and nutrients, minimal land preparation for ratoon crop etc. due to which the weeds tend flowrish well in the field.

   Integrated weed management (INM) like rotational use of herbicide groups to minimize the risk of herbicide resistance developing in weeds, using appropriate cultural practices like trash mulches in

Table 1: Effect of drip irrigation on cane yield, quality and water use efficiency in sugarcane.

Irrigation schedule	Cane yield (t/ha)	CCS (t/ha)	Juice (%)	CCS (%)	WUE (kg/mm)
Surface irrigation	88.74	8.75	35.98	9.67	51.6
100% PE drip	128.29	12.81	38.60	9.77	75.7
80% PE drip	112.21	11.88	37.98	10.42	78.9
60% PE drip	101.54	10.07	36.18	9.68	89.0
S.Em	2.98	0.40	0.64	0.21	-
CD at 5%	8.62	1.22	1.93	0.65	-

ratoons to suppress weeds using machinery to control weeds and applying a combined dose of pre - mergence and post emergence herbicides with no residual effect can suppress the impact of weed menace in sugarcane crop and it will reduce the weed seed bank before seeds set in cane fields and adjacent areas.

5. **Integrated nutrient management (INM):** Sugarcane crop produces huge quantity of biomass and for the production of 100 tonnes of cane removes 208 kg N, 53 kg P, 280 kg K, 30 kg S; 3-4 kg Fe, 1-2 kg Mn, 200 ppm Cu and 200ppm B.

   Based on the experiment results , the fallowing INM practices are recommended for the maximizing the yield and quality of sugarcane.

   Application of 10t/ha FYM / compost + Inorganic fertilizers NPK on soil test basis + biofertilizers (Azotobacter + P.S.B.) @ 10 kg /ha each produced significantly higher cane yield (113 t/ha) than that of other treatments (Yadav *et. al*., 2017). Manimaran and Kalyana sundaram (2006) reported that greater availability of nitrogen through sunhemp, biofertilizers and inorganic nutrients increased the nitrogen uptake by sugarcane. Singh *et al.,* (2007) also reported the higher N uptake when pressmud was applied as source of nutrients. The results of the study by Keshavaiah *et al*., (2012) inferred that neither organic nor inorganic sources alone could meet the nutrient requirement of sugarcane crop.

6. **Intercultural operations:** It is important to remove the lower dry and green leaves through detrashing operation. The Detrashing aims to maintain the field clean with enhanced air movement within clumps for congenial micro climate, reduction in post and disease incidence and several other benefits. Trash mulching helps to tide over drought, conserves moisture, reduce weed population and minimize shoot borer incidence. The mulching practice restores the soil with its physical, chemical and biological properties is primarily done to check loding of cane.

7. **Ratoon crop management:** Ratooning is an integral part of sugarcane cultivation practiced in almost all the sugarcane growing countries of world. In India, nearly 15-30% of the cane area is always under ratoon. Selection of suitable varieties with high ratooning ability, avoiding of trash burning in situ in the field, stubble shaving operation, off-barring or shoulder breaking, gap filling and effective and timely use of fertilizers are the important points to be taken into account for enhancing the ratoon cane yield.

8. **Sustainable Sugarcane Initiative (SSI):** Raising nursery using single budded chips, transplanting young seedlings, maintaining wide spacing (5×2 feet), providing sufficient moisture and avoiding inundation of water and practicing. Intercropping for effective utilization of land the practical approach for the sustainable sugarcane production.

9. **Mechanization for sugarcane:** This aims to achieve field capacities that assure timeliness in seed bed preparation and to bring precision in seed, fertilizer, pesticides, irrigation and harvesting. This helps in increasing productivity with reduced unit cost of production and reduced drudgery to men and women who work in crop cultivation.

Conclusion

As a cash crop and a provider of income and employment, sugarcane based agriculture has an important role to play in the economic growth and development of under – skilled rural people, mechanization and improved management strategies etc. could be made effectively possible. Utilizing these eco-friendly and economically viable strategies will go a long way in sustaining sugarcane productivity and economizing water under conditions of ever – depleting water resource in the country.

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