COMPARATIVE EFFICIENCY OF SOLID AND LIQUID FERTILIZERS IN SUGARCANE

By

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ABSTRACT

The respected field study comprising of five treatments of different solid and newly introduced liquid fertilizers was carried out at Sugarcane Research Institute, Faisalabad during two successive growing seasons of 2004-2005 and 2005-06. Experiment was planned to explore the effect of both fertilizer forms (solid and liquid) on the qualitative and quantitative characteristics of spring planted sugarcane variety SPF-245 that was used in the reported investigation. The results obtained showed that germination, CCS and sugar recovery, were not significantly effected while tillers per plant, number of millable canes, cane yield, and sugar yield were significantly effected by various fertilizer combinations in different treatments. Higher number of millable canes (110.20), cane yield (72.93 t/ha) and sugar yield (9.14 t/ha) were observed in that treatment where solid fertilizers in vogue were applied while other treatments, except control, produced lower results with respect to these parameters.

Keywords: Sugarcane, fertigation, fertilization, number of millable canes, cane yield.

INTRODUCTION

Sugarcane is considered a heavily soil nutrient exhaustive crop than other cash crops because of its higher dry matter production per unit area. Being a long duration crop, it depletes the fertility of soil to the maximum. Thus it should be grown on soils with balanced nutrients supply for obtaining good cane yield as 125 t/ha of sugarcane remove 84-100 kg of nitrogen, 56-67 kg of phosphorus and 168 kg of potash from soil (Barnes, 1970).

As per hectare yield of sugarcane has been increased in sugar producing countries during last few years, the use o balanced fertilizers particularly macro nutrients and generally micro nutrients have become increasing important. The forms of nutrients in soil solution as well as in solid state on soil colloids can not be considered a permanent source of profitable agriculture as depletion occurs through continuous cropping. So a balance between soil nutrients depletion and their restoration is utmost to prevent soil degradation and improve its fertility status. This emphasizes the need or supplementing the soils' supply of nutrients in order to have profitable yields. An adequate fertilizer application schedule for sugarcane production will prevent the drain of foreign exchange earnings involved at present on the import of sugar. This situation demands an increase in sugarcane yield by improving soil fertility status through different fertilizers in its various forms.

Keeping in view the role of fertilizers and importance of soil fertility in sugarcane, a number of persons conducted their research work, which is briefly discussed in the following lines. Bokhtiar *et al.,* (2001) found that 85 tones of cane crop absorbs 122 kg N, 24 kg P_2O_5, 142 kg K_2O and 48 kg S per hectare from soil. Sugumannan and Denil (1976) concluded that nitrogen application increased the total cane weight as well as sugar yield per acre. Khan and Sindhu (1967) found that yield from an application of 100 lbs. N/acre gave 11% and 48% more cane than 50 lbs. N/acre than where no fertilizer was applied. Panhwar *et al.,* (2003) determined the effects of soil and foliar application of zinc sulphate in combination with half and full recommended NPK rates on the growth, yield and quality of sugarcane. They recorded that foliar application of zinc sulphate had more beneficial

effects than soil application. Kudachikar *et al.,* (1992) applied all combinations of foliar sprays 2% $FeSO_4$, 2% $ZnSO_4$, 2% $ZnSO_4$ and 1% $MnSO_4$ at 30, 45 and 60 days after sowing. They observed that application of $FeSO_4$ and $MnSO_4$ significantly improved juice quality. Similarly, Palanivel (1990) applied 5 tonnes FYM/ha alone or with either soil applied 0, 100 or 200 kg Fe SO_4/ha or foliar application of 1.5% $FeSO_4$ at fifteen days or monthly intervals alone or in combination with 1% urea and 1% $ZnSO_4$ and reported 3.9, 6.9, 7.9, 11.5, 9.8 and 13.0 t/ha higher cane yield, respectively than control.

Considering the importance of liquid fertilizers along with solid fertilizers, the described field study was conducted to determine efficiency and feasibility of ideas, which are neither novel nor orthodox about these fertilizers in sugarcane.

MATERIALS AND METHODS

The proposed study, "Comparative efficiency of solid and liquid fertilizers in sugarcane" was conducted at Sugarcane Research Institute, AARI, Faisalabad during the two consecutive crop seasons 2004-06. A spring planted recommended sugarcane variety SPF-245 was sown in the second fortnight of March every year in deep trenches and harvested in the same week of same month in the next year. The experimental site was laid out in randomized complete block design statistically in which each treatment was replicated thrice while sowing was done @ 70,000 DBS/ha in a net plot size of $125m^2$. The soil of experimental field was loam with soil reaction (7.8), salinity ($0.51dsm^{-1}$), organic matter (0.78%), nitrogen (0.04%), phosphorus (6.20 ppm), potash (75 ppm), sand (40%), silt (35%), clay (25%) and saturation percentage (38).

All the recommended cultural and agronomic operations including weed control, inter culture, earthing up and plant protection measures were followed simultaneously during the course of study except fertilization. The fertilizers were applied according to treatments which were T_1 (0-0-0 NPK kg/ha as control), T_2 (168-112-112 NPK Kg/ha as standard), T_3 (all the liquid + solid fertilizers including nitro-20 + nutricalcium + phosphoric acid + NPK-C, 3 sprays @ 2 L/spray/100 L water at 10 days interval. After tillering completion total 6L/300L water), T_4 (168 Kg N/ha + 257 L/ha phosphoric acid + 112Kg K_2O/ha) and T_5 (nitro-20+nutricalcium +3 sprays of NPK-C+112 Kg P_2O_5/ha +112 Kg K_2O/ha).

The data regarding quantitative traits as germination, tillering, number of millable canes, cane yield and sugar yield were recorded before and after harvest respectively. While commercial cane sugar of composite cane samples from each replication were recorded in laboratory as mentioned by Anonymous (1970). Then the collected data were analysed statistically by using the analysis of variance method and LSD at 5% and 1% probability levels was applied to compare differences among treatment means as suggested by Steel and Torrie (1980).

RESULTS AND DISCUSSION

The results regarding the studied parameters along with their statistical interpretations embodied in Table-1 and are discussed briefly under following headings.

Germination

It is considered most critical physiological phase as without it there is no plant. The data given in Table-1 indicated that the differences among various treatments for setts germination were non-significant. However, the highest (56.71%) and lowest (52.42%) germination was recorded in first and fifth treatments respectively. The non-significant effect of fertilizers on germination was also studied by Chattha (2002). These facts indicate inherent germination potential of cane setts.

Tillers per plant

Tillering potential of cane determines the ultimate crop stand and it makes up deficiencies in germination as indicated by the data presented in Table-1. The relatively poor germination was compensated by high tillering but better germination reduced tillering. A perusal of data indicated maximum number tillers per plant in the treatment where solid fertilizers were used and it was followed by third treatment where mostly liquid fertilizers were applied. But the plants of first treatment produced minimum tillers that received no fertilizer. The results coincide with Majeedano *et al.,* (2003) who claimed significant differences for tillering among fertilizer treatments in their study.

Number of millable canes

It is the interaction of germination, tillering and resistance against insect pests and disease attack. The data embodied in Table-1 indicated statistically significant differences for number of millable canes. The maximum number of canes (110.20) was observed in second treatment, which was followed, in descending order by third treatment where all newly introduced liquid and solid fertilizers were applied. The second treatment was statistically at par with third treatment while third treatment was at par with fourth. Similar results were reported by Kee *et al.,* (1999).

Cane yield

It is the most desirable character from farmer's point of view. Cane yield is the product of genetic potential of a variety and environmental conditions through agronomic management. The yield data revealed that the differences among the treatments under test were significant. The highest value of cane yield (72.93 t/ha) was noticed in second treatment, which is followed by third treatment in descending order. The second and third treatments, that received complete solid and mostly liquid fertilizers respectively, were statistically at par. Similarly the treatment receiving no fertilizer produced lowest yield which was followed by fifth and fourth treatments in ascending order. A similar experiment with this trend was conducted by Ali *et al.,* (1997).

Sugar yield

It is the function of stripped cane yield and corresponding commercial cane sugar percentage. A glance at the data given in Table-1 revealed that maximum sugar yield (9.14 t/ha) was noted in second treatment and minimum (6.42 t/ha) in first treatment while remaining three treatments produced results between these limits. Similar results were reported by Ali *et al.,* (1997).

CCS%

The real cane quality is reflected by its CCS%. It stands the factor of prime importance both from miller's and breeder's point of view as it is clear from the results reported in this paper. The data regarding CCS% as influenced by different cane varieties are given in Table-1. Statistically non-significant CCS% was recorded. The lowest CCS (12.08) was observed in fifth treatment. Similarly highest value (12.58) was recorded in control where no fertilizer was applied.

Sugar recovery

High recovery at a given stage determines cane maturity. The data pertaining to sugar recovery presents same trend as in case of CCS. The standard fertilizer treatment gave the highest sugar recovery after control while the treatment where complete package of liquid and solid fertilizers was applied followed it in descending order. This explanation is in harmony with those reported by Abd-El-Gawad *et al.,* (1992).

Table-1 Quantitative and qualitative effects of different fertilizers

Treatments	Germination (%)	Tillers plant^{-1}	Millable canes (000/ha)	Cane yield (t/ha)	Sugar yield (t/ha)	CCS%	Sugar Rec. %
T_1	56.71	1.34 c	92.63 d	51.01 d	6.42 e	12.58	11.83
T_2	53.71	1.58 a	110.20 a	72.93 a	9.14 a	12.52	11.77
T_3	55.08	1.55 ab	107.90 ab	70.14 a	8.65 b	12.34	11.60
T_4	55.32	1.52 ab	104.90 b	64.18 b	7.81 c	12.18	11.45
T_5	52.42	1.46 b	99.60 c	57.49 c	6.95 d	12.08	11.35
LSD at 5%	N.S.	0.09481	3.169	3.122	0.4041	N.S	N.S
LSD at 1%	N.S.	0.1306	4.367	4.301	0.5567	N.S	N.S

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