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Cane Yield and Sugar Recovery of Sugarcane Variety Larkana-2001 under Different Fertilizer Sources

[1]G.M. Mahar, [2]U.A. Buriro, F.C. Oad and S.A. Shaikh
[1]Area Manager, Granulars, Pvt. Ltd., Jacobabad, Pakistan
[2]Sindh Agriculture University, Tandojam, Pakistan

Abstract: A field trial was conducted to assess the effect of different sources of fertilizers on the growth, cane yield and sugar recovery of promising sugarcane variety Larkana-2001, at Sugarcane Section, Agriculture Research Institute, Tandojam, Pakistan. The treatments included four fertilization sources (225-112-168 NPK kg ha^{-1}, effective microorganism (EM) material, 25 t ha^{-1} farm yard manure (FYM) and 25 t ha^{-1} press mud. The chemical source of fertilizer (NPK) at the rate of 225-112-168 kg ha^{-1} proved to be more effective to produce significantly greater plant height and thicker cane girth, more number of tillers, better brix, higher sugar recovery and maximum cane yield ha^{-1}. The crop fertilized with EM prepared material and 25 t ha^{-1} press mud ranked 2nd and 3rd for all the crop parameters. However, application of 25 t ha^{-1} farm yard manure was not much effective fertilizer source for crop growth and quality characters.

Key words: Sugarcane, fertilizer, press mud, EM technology, tillers, girth, brix, sugar recovery, yield

INTRODUCTION

Sugarcane is a management-responsive crop and produces maximum biomass by making best use of sunlight under a set of management practices. Soils differ considerably in their fertility and productivity. By adopting suitable soil, fertilizer and crop management practices, it is possible to raise productivity levels of a given soil. Usually, this is done by improving the physical and biological conditions of the soil through proper drainage, aeration, aggregation of soil particles, adding adequate quantity of bulky organic matter and applying fertilizers by proper placement in balance based on soil test values. Sugarcane can be grown an all types of soils ranging from sandy loam to clay loam. It, however, thrives best on well drained soils. It can also be raised successfully on lighter soils provided there is adequate irrigation facilities and on heavy clays with proper drainage and addition of organic matter. Saline, alkaline and acidic soils are not suitable for sugarcane. Generally, Pakistan soils are deficient in essentially required nutrient elements and soil deficiency is removed by different means. There are several organic and inorganic sources of soil fertility improvement. Green manuring, use of farm yard manure, use of pressmud, effective microorganism technology (EM Technology) has become now a days important in maintaining soil fertility. A number of experiments in various parts of the world have been conducted and promising results have been reported. The application of chemical fertilizers has vital importance with the conjugative use of organic fertilizers is also getting popularity in sugarcane crop. This is only possible if an optimum dose is searched out through experimentation. Besides the use of adequate and balanced fertilizer, awareness of suitable and improved sugarcane varieties to farmers is also necessary for getting high cane yield and high sugar recovery. Bahadur *et al.* (1980) reported that 135 kg N ha^{-1} is the economical dose for obtaining higher sugar recovery and cane yields. Increasing N rate upto 225 kg ha^{-1} significantly increased the commercial cane yield, while higher N levels gave a decreased of cane juice (Rawat *et al.*, 1989). Kannappan and Manickasundaram (1990) stated that high level of Nitrogen fertilizer gave the highest net return from cane yield. Verma (1999) treated sugarcane with 0, 150, 225 or 300 kg N ha^{-1} and observed that cane yield was highest with 300 kg N ha^{-1}. The cane and sugar yields increased with increasing inorganic fertilizer application due to increases in cane length, diameter and weight, however, Brix and Pol, juice decreased slightly and sugar recovery and commercial cane sugar indices improved with increasing inorganic fertilizer application. The application of 125 and 150% of the recommended inorganic fertilizer dosage resulted in an additional cost-benefit ratio of 3.17 and 3.38, respectively. The application of organic fertilizers was equivalent to 25% of the recommended inorganic N application rate and yield increased with the use of both organic and inorganic

Corresponding Author: G.M. Mahar, Area Manager, Granulars, Pvt. Ltd., Jacobabad, Pakistan

fertilizers. The application of press mud in addition with 100% recommended inorganic fertilizers resulted in the highest farm returns (Kumar *et al.*, 1996). Considering the above hypothesis, the present study was conducted to ascertain the comparative performance of various fertilizer (organic and inorganic) sources in relation to cane yield and recovery of sugarcane variety Larkana-2001 under agro-ecological conditions of Tandojam, Pakistan.

MATERIALS AND METHODS

The variety Larkana-2001 was tested under different fertilizer sources for growth, cane yield and sugar recovery, at the experimental fields of Sugarcane Section, Agriculture Research Institute, Tandojam, Pakistan during 2006. The experiment was laid out in a four replicated randomized complete block design. The fertilizer sources tested were: 225-112-168 kg NPK ha^{-1}, Effective Microorganism (EM) prepared material, (Farm yard manure) FYM. 25 t ha^{-1} and press mud 25 t ha^{-1}. These doses were selected with recommendations of the Department of the Soil Science, Sindh Agriculture University, Tandojam. Due to deep rooted crop, a well-worked friable fully pulverized seedbed was prepared through deep plowing followed by precise levelling. The ridges and furrows were prepared at the distance of 100 cm. The treated sets with Vitavax at the rate of 120 g per 100 L were placed in the furrows at 3-4 inches depth. The irrigation was applied at 7-10 days interval in summer (April-August) and 10-15 days interval in winter (November-March). The weeds were controlled with the use of Gezapex Combi at the rate of 1 to 1.5 kg $acre^{-1}$. First light earthing was done after 90 days of planting and second after 150 days of sowing. A comprehensive approach of IPM consisting of cultural, biological and chemical method of control of insect pests and diseases was adopted to maintain the pest population level below the economic injury level. However Furadan 3G was applied against the borers. The harvesting of sugarcane crop was done when the 1/3rd leaves of the basal portion of the cane became dry and show the tendency of dropping on the ground. Scientifically, the crop becomes mature when the brix is above 20% irrespective of any variety. The data collected were analyzed statistically using analysis of variance and LSD test was applied to discriminate the superiority of the means of different treatments as suggested by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Cane length (cm): Among the yield influencing characters, cane length has the key position that affect cane index and yield per unit area. The sugarcane crop fertilized with inorganic (chemical) fertilizers (NPK) at the recommended rate of 225-112-168 kg ha^{-1} produced canes of maximum length (220.75 cm), while the sugarcane when fertilized with inorganic fertilizer prepared by EM technology produced next higher cane length of 207.20 cm. The cane length on average was found considerably lower (201.25 cm), when the crop was fertilized with Farm Yard Manure at the rate of 25 t ha^{-1}. The canes of minimum cane length (196.50 cm) appeared from the plots, where sugarcane was fertilized with organic fertilizer (Press mud) at the rate of 25 t ha^{-1}. It can be observed that although there has been considerable development in producing alternate sources of fertilizers other than chemical fertilizers, but yet the performance of chemical fertilizers is far better than other organic and inorganic sources of fertilizers. Similar results have also been reported by Shukla *et al.* (1995) that application of N fertilizer in more balanced proportion was better than farm yard manures, while Kumar *et al.* (1996) and Abbasi (2005) also observed greater cane length under chemical sources of fertilizers in sugarcane.

Cane girth (cm): The recommended rate of 225-112-168 NPK kg ha^{-1} produced thicker canes (2.93 cm) followed by EM prepared material having average cane girth of 2.76 cm. The application of Farm Yard Manure at the rate of 25 tons ha^{-1} relatively reduced cane girth (2.68 cm). The thinner (2.64 cm) canes were recorded from the plots, where sugarcane was fertilized with organic fertilizer (Press mud at the rate of 25 t ha^{-1}). It is further obvious from the results that cane girth had considerable association with the cane length and both the cane length and cane girth were influenced by the fertilizer sources in a parallel way. The differences, however, in cane girth were statistically negligible when EM prepared material, FYM and press mud were compared, whereas highly significant differences were noted when these three treatments were compared with application of NPK fertilizers. The present results are in agreement to those of Kumar *et al.* (1996) and Abbasi (2005) who stated that increased cane girth was relatively associated with application of optimum NPK fertilizers rather than organic fertilizer sources.

Tillers $stool^{-1}$: Tillers $stool^{-1}$ significantly were higher (5.91) in the plots were recommended inorganic fertilizer source (225-112-168 NPK kg ha^{-1}) was incorporated, followed by application of press mud (5.16 tillers $stool^{-1}$) and EM prepared material (4.93 tillers $stool^{-1}$). However, the lowest number of tillers $stool^{-1}$ (4.91) were recorded from the sugarcane crop fertilized Farm Yard Manure

Table 1: Cane parameters of Larkana-2001 variety as affected by organic and inorganic sources of fertilizers

Treatments	Cane length (cm)	Cane girth (cm)	Tillers stool^{-1}	Cane yield (t ha^{-1})	Brix (%)	Sugar recovery (%)
225-112-168 NPK (kg ha^{-1})	220.750^{a}	2.930^{a}	5.910^{a}	106.700^{a}	19.120^{a}	10.560^{a}
EM prepared material	207.200^{b}	2.760^{ab}	4.930^{c}	91.980^{b}	18.310^{ab}	9.130^{b}
FYM (25 t ha^{-1})	201.250^{c}	2.680^{b}	4.910^{c}	85.060^{c}	17.530^{b}	8.870^{b}
Press mud (25 t ha^{-1})	196.500^{c}	2.640^{b}	5.160^{b}	87.700^{c}	18.200^{b}	9.320^{b}
SE±	2.224	0.057	0.012	0.971	0.218	0.114
LSD (5%)	6.668	0.170	0.364	2.912	0.656	0.345
LSD (1%)	9.187	0.235	0.501	4.013	0.905	0.479
CV (%)	2.150	4.190	4.630	6.100	2.390	2.430

Values followed by similar letter(s) do not differ significantly at 0.05 probability level

(FYM) at the rate of 25 t ha^{-1}. It can be seen from the results that number of tillers stool^{-1} was remarkably higher in case of chemical fertilizers (NPK) as well as when fertilized with press mud. This indicated that variety Larkana-2001 responded well to press mud in relation to development of tillering capacity. Uddin *et al.* (1996) and Abbasi (2005) also reported that NPK fertilizers has better performance for sugarcane tillering as compared to green manuring or any other organic source of fertilizer.

Cane yield (t ha^{-1}): The crop fertilized with NPK fertilizers (inorganic source) at the recommended rate of 225-112-168 NPK kg ha^{-1} produced maximum cane yield (106.71 t ha^{-1}), while, crop fertilized with EM prepared material ranked second with average cane yield of 91.98 t ha^{-1}, followed by press mud at the rate of 25 t ha^{-1} which exhibited a cone yield of 87.70 t ha^{-1}. However, the minimum cane yield of 85.06 t ha^{-1} was observed in the plots, where Larkana-2001 was fertilized with farm yard manure (FYM) at the rate of 25 t ha^{-1}. It is further obvious from the results that cane yield had considerable association with the cane length and cane girth. Yadav *et al.* (1996), Uddin *et al.* (1996), Lara *et al.* (1996) and Abbasi (2005) also reported that the cane yield was significantly greater when commercial chemical NPK fertilizers were applied as compared to other organic fertilizer sources.

Brix (%): The brix content in juice was remarkably higher (19.12%) in case of sugarcane crop fertilized with inorganic fertilizers (NPK) at the recommended rate of 225-112-168 kg ha^{-1}. The brix content in the juice of sugarcane variety Larkana-2001 was found relatively less (18.31%) when the crop fertilized with EM prepared material, which was closely followed by the value of 18.20% under press mud application at the rate of 25 t ha^{-1}. However, the lower brix content of 17.53% in cane juice was recorded from the plots fertilized with Farm Yard Manure (FYM) at the rate of 25 t ha^{-1}. It was observed that the results for brix percentage were quite changed as was in the case of other crop growth and cane yield contributing characters. For all these characters, press mud and FYM treatments showed relatively inferior results, while NPK fertilizers proved their superiority in relation to fulfillment of nutrient requirements of the crop. These results are is confirmation with those reported by Dey *et al.* (1996) that more brix percentage was obtained under recommended inorganic fertilizer sources as compared to organic fertilizers.

Sugar recovery (%): It was maximum (10.56%) in the cane juice collected from the plots fertilized with 225-112-168 NPK kg ha^{-1}, followed by the crop fertilized with press mud and EM prepared material where mean sugar recovery was 9.22 and 9.13%, respectively. However, the sugar recovery was minimum (8.87%) in the plots fertilized with Farm Yard Manure. The trend of effectiveness regarding sugar recovery was closely associated with the results obtained in case of brix content. Moreover, it was observed that the sugarcane variety Larkana-2001 responded well to NPK chemical fertilizer as compared to rest of the fertilizer sources. However, the results were also promising in case of EM prepared material and press mud for all the growth and yield contributing characters. Kumar *et al.* (1996) and Abbasi (2005) also observed non-significant variation in sugar content under application of organic and inorganic fertilizer sources.

CONCLUSIONS

The sugarcane variety Larkana-2001 responded well chemical fertilizers as compared to rest of the fertilizer sources. However, the results were also promising in case of EM prepared material and press mud for all the growth and yield contributing characters, but poor results were experienced in case of farm yard manure.

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