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Impact of Humic Acid Levels on Yield Attributes of Sugarcane Chip Bud Settlings in District Mardan

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Abstract

The research was carried out at Sugar Crops Research Institute (SCRI) Mardan, Pakistan during 2013. The experiment was placed out in randomized complete block design (RCBD) with three replications. Chip bud settlings of sugarcane variety CP-1827 was transplanted in March 2014, within a plot size 10 m by 6.7m (67m^2) with 90 cm row to row distance and 60 cm plant to plant distance. Four levels of humic acid i.e control: 9.88: 14.82 and 19.76 kg ha^{-1} were compared during the study. The results investigated significant effects of different levels of humic acid upon all parameters except plant height and quality parameters like pol (%), brix (%) and sugar recovery was not significantly influenced by different levels of humic acid. While number of tillers m^{-2}, number of internodes length per tiller, stem diameter, internodes length, and cane yield had significantly influenced by different levels of humic acid specifically where humic acid was applied at the rate 19.76 kgha^{-1}. It was determined that the use of humic acid at the proportion of 19.76 kg ha^{-1} enhanced the number of internodes, stem diameter, and cane yield as compared with other levels of humic acid and hence recommended for obtaining higher cane yield from chip bud settling of sugarcane in agro ecological condition of Peshawar valley.

Keywords: *sugarcane, settlings, humic acid levels, yield attributes*

Introduction

Sugarcane (Saccharum officinarum L.) belongs to genus saccharum, family Poaceae, and is principally produced in the whole country. Being a cash crop, it is an imperative revenue cradle and occupation for the agricultural community of the country. Sugar, chip board, paper, fiber, insecticides and detergents are the main industrial stuffs produced from this crop [1]. Sugarcane is cultivated on about 20 million hectares in tropical and subtropical region of the world, producing up to 1.3 billon metric tons of crushable stems. Pakistan inhabits a significant point in cane making countries of the world. It grades 5th position in cane acreage, and 15th position in sugar production. In Pakistan sugarcane is cultivated over about 1057.5 thousand hectares with annual production of 58396.4 tons ha^{-1}, while in Khyber Pakhtunkhwa, it is cultivated on about 105.9 thousand hectares with an annual production of 4684.3 tons and cane yield of 44.23 tons ha^{-1} [2].

Humic acid is low cost commercial product of organic fertilizers containing most elements that enhance plant growth and development by progressing soil fertility and upsurge nutrients

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availability. It is produced through decay/oxidation of organic matter through microbial action and is naturally found in soil, peat, rivers, oceans and in lignite coals [3]. It has been broadly considered, [4] that the use of humic acid recovers physical, chemical and biological assets of soils [5]. The most common roles of humic acid are the improvement soil health and nutrient uptake by plants, mineral availability, fruit quality etc [6]. Humic acid based fertilizers rise crop yield [7], stimulate plant enzymes/hormones and improve soil fertility [8].

One of the main reason for the low production of sugarcane is deprived soil fecundity as well as the application method, although injudicious use of inorganic fertilizer alone on many crops. As a matter of fact research studies have shown beneficial effect of inorganic fertilizer in combination with organic fertilizers e.g. farm yard manure, green manure, poultry manure and humic acid etc [9].

Crop rotation, green manures, residue or animal manures incorporation, compost and humic acid application are the best strategies to accomplish agriculture production and yield in disapproving soil conditions by elevating their organic matter, numerous possibilities are found in literature for example, [10] these possibilities basically aim to improve soil conditions for growth and eminence of the sugar cane crops. The benefits of the use of humic acid have been reported worldwide since long [11] and [12] have been reported to promote growth and nutrient uptake due to the addition of humic acid substances. The plant takes more mineral elements due to healthier developed root system. In addition, the stimulation of ions uptake in the application of humic materials led many investigators to proposing that these materials affect membrane permeability [9]. The stimulatory effects of humic substances have been directly correlated with enhanced uptake of macronutrients such as nitrogen, phosphorous and sulfur and micronutrients, such as Fe, Zn, Cu and Mn. The indirect effects of humic compounds on soil fertility include: (i) Enhancement in the strength of soil microbes specifically beneficial microbes, (ii) Rise in the cation exchange capacity and the pH buffering capacity of the soil.

The aim of the study was to regulate the most apposite method for the use of humic acid for sugar cane yield and yield components. In this regard, humic acid fertilizer application in the production of sugar cane which is known to be more efficient in terms of production would serve as a resource.

Objectives

1. To judge the consequence of humic acid and inorganic fertilizer on yield and quality of sugarcane.
2. Judicious use of inorganic fertilizer in combination with humic acid chip bud settling of sugarcane.

Materials and Methods

The research was passed out to assess the influence of various levels of humic acid on the yield and quality of sugar cane chip bud settling, at Sugar Crops Research Institute Mardan, Pakistan during 2013 -2014. The experiment was set out in randomized complete block design with three replication and four levels of humic acid i.e. (control, 9.88, 14.82, 19.76 kg/ha) were used. The bud chip nursery of sugarcane variety 1827 was prepared in January, 2014 and transplanted in March, 2014 with plot size (67 m^2).

Number of tillers m^{-2} was noted by counting the number of tillers in three central rows of each plot, and then converted to tiller m^{-2}. Data on plant height was recorded by randomly selected five plants from each treatment and measured its height from base to tip and then averaged to get plant height. Number of internodes per tiller was found by randomly selecting five tillers in each plot and internodes in each tiller were counted and then averaged. Five tillers were randomly selected in each plot and then diameter of stem in centimeter was calculated with the help of Varner caliper and averaged. Internodes length was measured as length of the internodes in five randomly selected plants in centimeter in each plot and averaged. Cane yield was calculated by actually weighed the cane per plot without trash and converted to tons of cane per ha as follows:

TCH = Xx10000 1000

Where "X" is the yield in kg per plot

Data on Juice brix referred to the total solids content present in the juice expressed in % brix includes sugars as well as non-sugars. It was calculated by measuring the brix (total soluble solids) in the canes in laboratory with the help of a hydrometer. Pol% was determined by adding 1-4 g of lead sub acetate mixed into 100 ml of extracted juice. The juice was then filtered into volumetric flask through filter paper and pol percentage was recorded with help of polari meter.

Sugar recovery percentage was calculated by the following formula:

Recovery % = [POL% - 0.5(C, brix - pol %)] x 0.7

Statistical Analysis

The collected data was statistically analyzed using analysis of variance techniques suitable for randomized complete block design. Means were compared using least significant difference (LSD) at 5% probability level (Jan et al., 2009).

Results

Number of Tillers M-2

Data concerning number of tiller m^{-2} of sugarcane is shown in figure 1. Statistical analysis of the data designated significant influence on number of tiller m^{-2} by different levels of humic acid. It is obvious from the mean value that high number of tiller m^{-2} (19) was recorded by the application of humic acid at the rate of 19.76 $kgha^{-1}$, followed by humic acid applied at the rate 14.82 $kgha^{-1}$ (16.66) whereas, lower number of tiller m^{-2} (12.33) was recorded by humic level of 9.88 $kgha^{-1}$.

Internodes Length (Cm)

Statistical analysis of data presented that internodes length was significantly affected by different levels of humic acid. Mean values of the data presented that higher internodes (13 cm) length was found in the plots where humic acid was applied at the rate 19.76 $kgha^{-1}$ followed by plots where humic acid was applied at the rate of 14.82 kg ha^{-1} (11.60 cm). Whereas, lower internode length of (10.87 cm) was recorded in plots supplied at the rate 9.88 $kgha^{-1}$ humic acid.

Number of Internodes Per Plant

Statistical analysis of the data revealed that humic acid levels significantly influenced number of internodes per plant. Higher number of internodes per tiller (21) was recorded for humic acid applied at the rate of 19.76 kgha^{-1} followed by 14.82 kgha^{-1} which produced (20) number of internodes per plant, whereas lower number of internodes (17) were recorded by (control) showed in figure 3.

Plant Height (Cm)

Data concerning plant height of sugarcane was not significantly affected by the application of different rates of humic acid showed in figure 4. It is evident from the mean value that there was no significant variation for the plant height among the treatments. However the highest value (162.23cm) was recorded for the humic acid applied at the rate 19.76 kgha^{-1} followed by 14.82 kg ha^{-1} (154.67cm) whereas, shorter plant height (131cm) was recorded by the application of humic acid at the rate of 9.88 kg ha^{-1}.

Stem Diameter (Cm)

Data regarding stem diameter is presented in figure 5. Statistical analysis of the data indicated that stem diameter was significantly affected by the application of different level of humic acid. It was evident from the mean value that greater (2.71 cm) stem diameter was recorded by the application of humic acid at the rate of 19.76 kgha^{-1} followed by (2.70 cm) which was recorded in plots receiving 14.82 kg ha^{-1} of humic acid by the application of 14.82 kgha^{-1}, while the plots with no humic acid (control) treatment has lower stem diameter (2.33 cm).

Brix Percentage (%)

Statistical analysis of the data (figure 6) showed that brix % was not significantly influenced by the different level of humic acid. However higher brix % (20.12) was recorded during (control) followed by 9.88 kgha^{-1} whereas, lower brix % (19.55) was recorded in 14.82 kgha^{-1} of humic acid.

POL Percentage (%)

Statistical analysis of the data showed that pol % in sugar cane was not significantly affected by application of different level of humic acid presented in figure 7. It is clear from the mean value that higher pol % (17.69) was recorded by 14.82 kgha^{-1} humic acid followed by no humic acid (control) (17.62) whereas, lower (16.86) pol % was recorded in 19.76 kgha^{-1} of humic acid.

Recovery Percentage (%)

Data recorded on the recovery % is presented in figure 8. Analysis of variance of the data showed that the recovery % in sugarcane was not significantly affected by different level of humic acid. However higher sugar recovery % (11.63) was obtained in 14.82 kg ha^{-1} humic acid followed by no humic acid (control) (11.58) whereas, lower sugar recovery % (11.11) was recorded 19.76 kgha^{-1} humic acid. Recovery % depends on the genetic makeup of cultivar.

Discussion

Appreciable concentration of humic acid absorption leads to increased nutrient uptake of plant which ultimately intimated to sufficient sprouting of tillers and development of cane. Such evidences are reported by [3], that application of significant humates in different varieties of wheat showed notable and healthy tillers production.

Though inter node length is varietal trait, but humic acid utilization can inclined its performance through better management. Generally, inter node length increased progressively with increase humic acid levels, as humic acid is rich in organic substances containing mostly humus and peat which directly enhanced the internode growth both length and diameter. These results are in line with [8] who reported maximum and vigorous inter node production in maize crop by the application of humic acid concentrations @ 22 $kgha^{-1}$. Application of humic acid at various growth stages of sugar cane enhanced good and vigorous stand with prominent plant height. The firmed height of the cane may be due to continuous uptake of humic acid level which led to proper crop growth and development of crop.

The increased in stem diameter is represented by the research conducted by [12] who showed the application of humic acid at initial growth stages produced strong and elongated stems with maximum diameter in tomato. They further reported that this increased in stem diameter might be due to significant translocation of NPK levels due to humic acid and photosynthesis storage from source to sink which improved sugarcane stem diameter with increased macronutrient efficiency. The strong affinity of source and sink developed the stem thickness. These results are similar to those of [1] who reported strong source sink relationship by the application of humic acid in cane. Brix % is the varietal character that does not highly affected by the organic and inorganic fertilizer.

Literature Cited

[1] Malik, N, A. 1993. Response of sugarcane cultivars to different doses of NPK fertilizer in Somalia. Pak. Sug. J. 7(1):11-13.

[2] MNFSR 2012. Ministry of national food agricultural and livestock (Economic Wing) Islamabad page: 27-28.

[3] Doran, I., C. Akinci and M. Yildirim. 2003. Effects of delta humates applied with different doses and methods on yield and yield components of DIYARBAKIR-81 wheat cultivars. 5th Field Crops Congress. Turkey. 2: 530-534.

[4] Nardi, S., D.Pizzeghello and S. G. Pandalai. 2004. Rhizosphere: A commotion between plant and soil. Recent Research Development in Crops Sci. 1 (2): 349-360.

[5] Keeling, A. A., K. R. Michelson and C. P. Beckwith. 2003. Crop and environment Research, Harper Adams University College, Newport, Sgropshir Bio Resource Tech., 90(2): 127-137.

[6] Mauromicale, G., M. G. L. Angela and A. L. Monaco. 2011. The effect of organic plementation of solarized soil on the quality of tomato. Scientia Hort. (2): 189-196.

[7] Mohamed, A., A. Barky, Y. R. Soliman and S. A, M, Mousse. 2009. Important micronutrients Organic manure and bio-fertilizer for improving maize yield and it components grown in desert sandy soil. Res. J. Agri. Sci. 5(1): 16-23.

[8] Sari, M. S., M. Sharif, Z. Ahmed and M. Akhlaq. 2005. Influence of different levels of humic acid application by various methods on the yield and yield components of maize sarhad J. Agri., 21(1): 75-81.

[9] Zientara, M. 1995. Effect of sodium hamates on membrane potential in internode of Nitellopsis obtuse. Acta societatis botanicorum polonaise, 52: 271-277.

[10] Delfine, S., R. Tongnetti, E. Desiderio and A. Alvino. 2005. Effect of foliar application of Na Humic acids on growth and yield of durum wheat. Agro Sustain. Dev, 25(2)

[11] Fegbenarro J. A. A. Agboda 1993. Effect of different levels of humic acid on the growth and nutrient uptake of teak seedlings. Journal of plant nutrition, 6: 1465-1483.

[12] David P. P., Nelson P. V., D. C. Sanders 1994. A humic aid improves growth of tomato seedling in solution culture. Journal of plant nutrition, 17: 173-194.

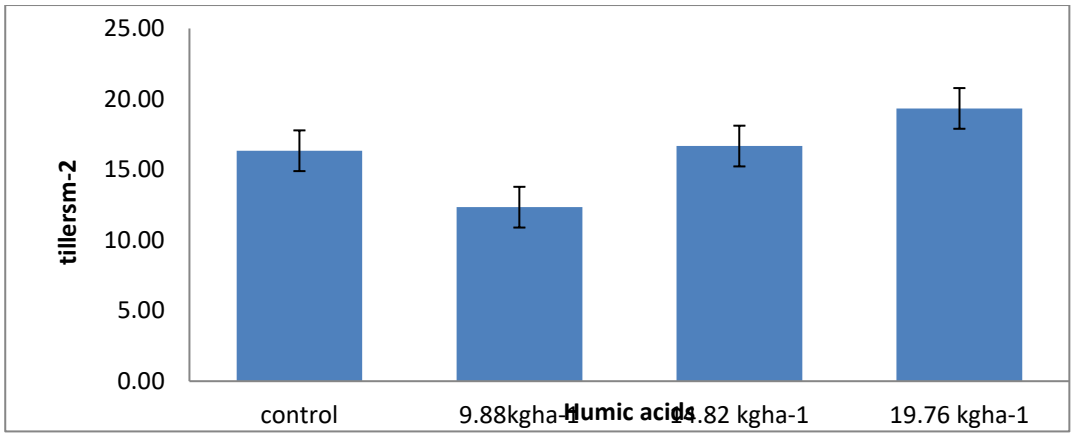

Figure 1: Effect of Different Humic Acid Levels in Sugar Cane on Number of Tiller M^{-2}. Vertical Bars Represent LSD.

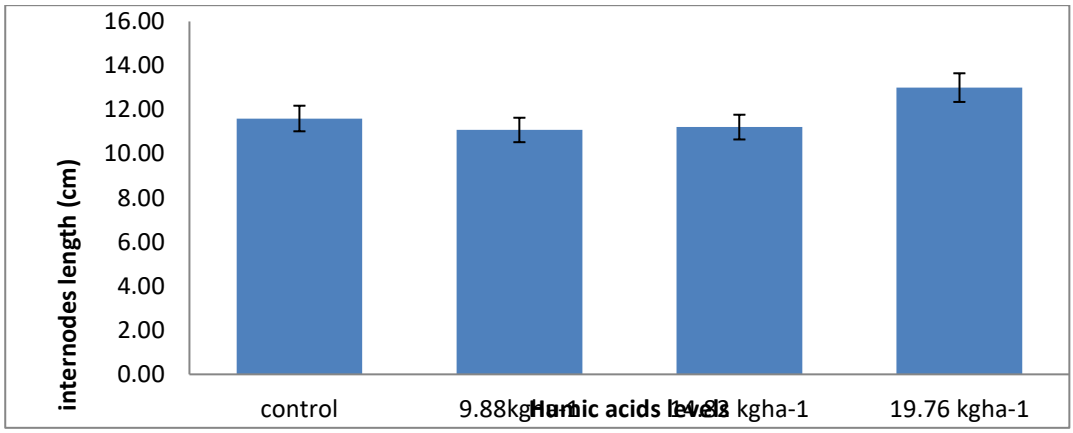

Figure 2: Effect of Different Humic Acid Levels in Sugarcane on Internodes Length (Cm). Vertical Bars Represent LSD.

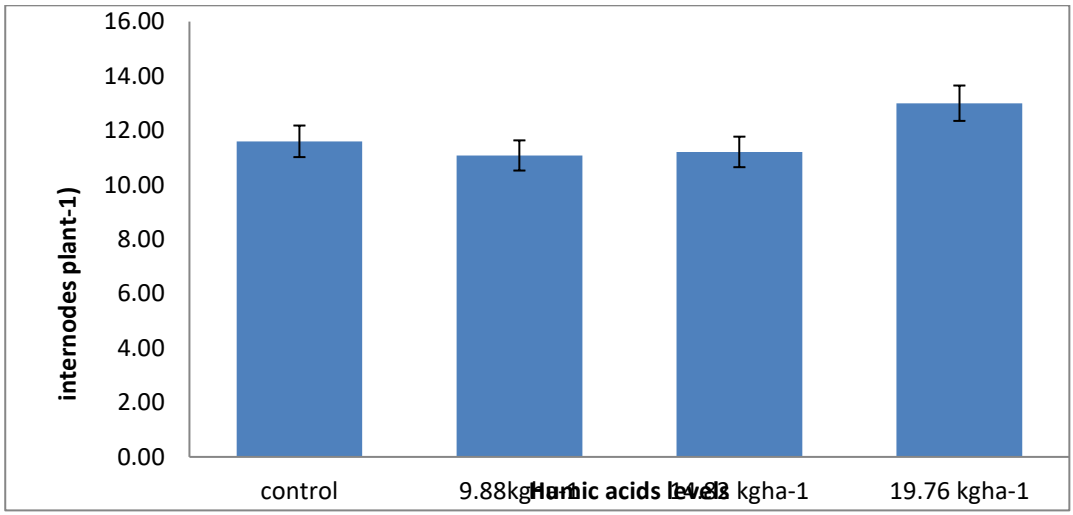

Figure 3: Effect of Different Humic Acid Levels on Sugarcane on Number of Internodes $Plant^{-1}$. Vertical Bars Represent LSD.

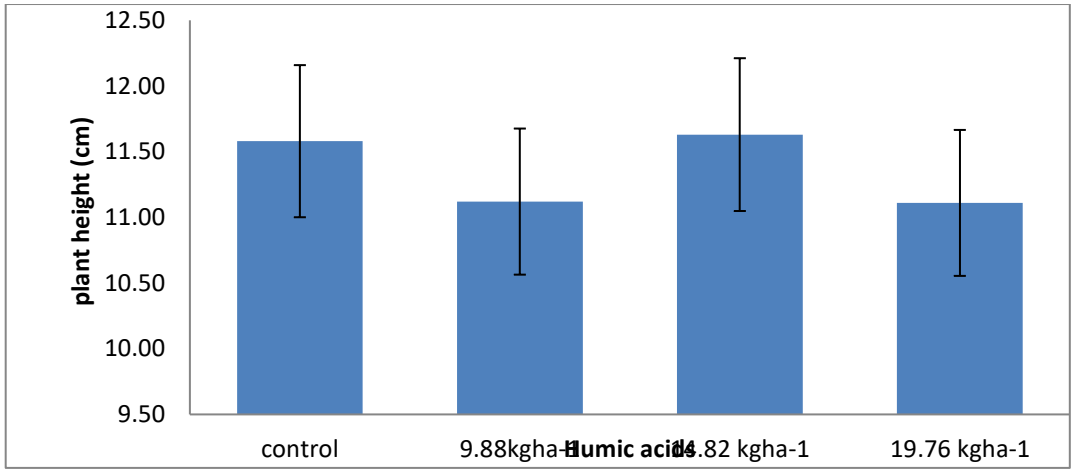

Figure 4: Effect of Different Humic Acid Levels in Sugarcane O Plant Height (Cm). Vertical Bars Represent LSD.

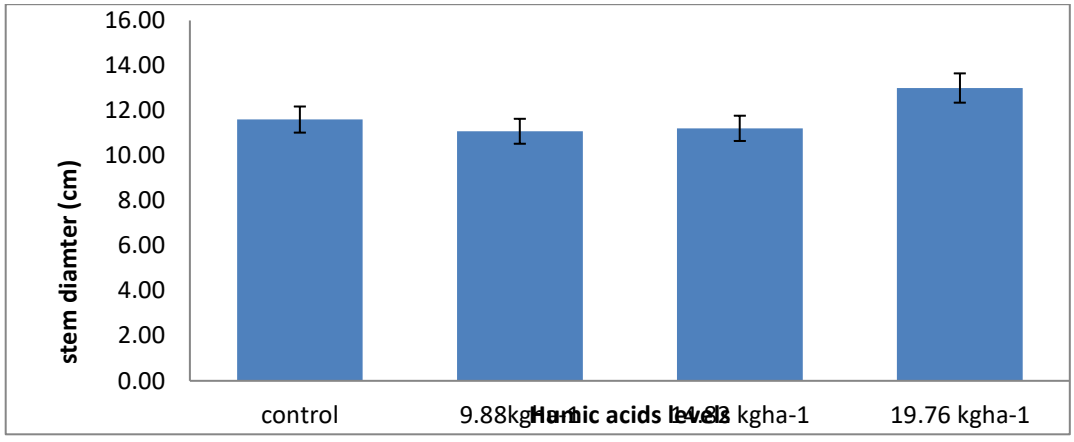

Figure 5: Effect of Different Humic Acid Levels in Sugarcane on Stem Diameter (Cm). Vertical Bars Represent LSD.

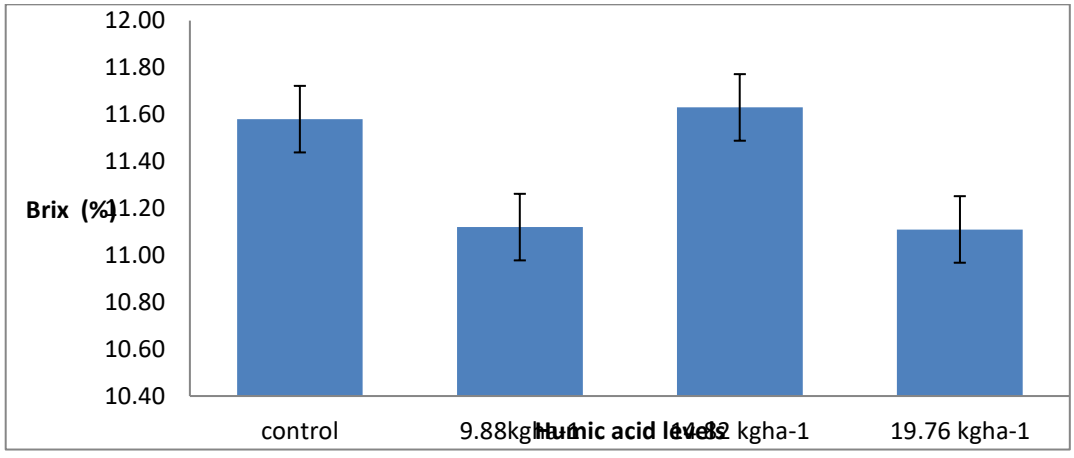

Figure 6: Effect of Different Humic Acid Levels in Sugar Cane on Brix, Vertical Bar Represent LSD.

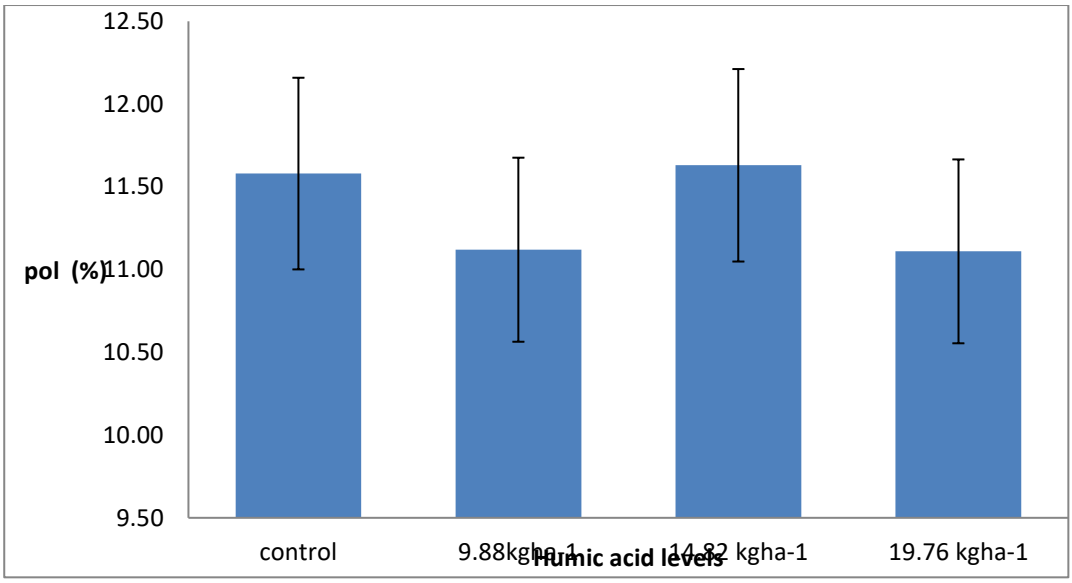

Figure 7: Effect of Different Humic Acid Levels in Sugar Cane on POL (%). Vertical Bars Represent LSD.

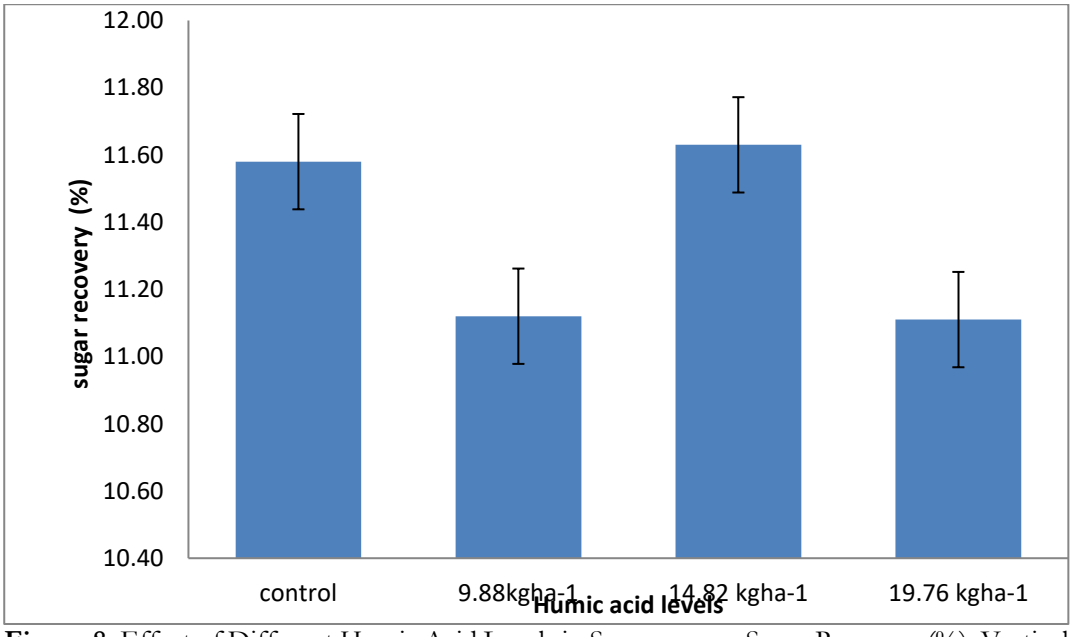

Figure 8: Effect of Different Humic Acid Levels in Sugarcane on Sugar Recovery (%). Vertical Bar Represent LSD