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ASSESSMENT OF COMPOST AS NUTRIENT SUPPLEMENT FOR SPRING PLANTED SUGARCANE (*SACCHARUM OFFICINARUM* L.)

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ABSTRACT

The sustainable agriculture production is only possible through good soil health attainted through balanced use of organic and inorganic fertilizers. The imbalanced fertilizer application is a major cause of low sugarcane yield and deterioration of soil. A field experiment was conducted to evaluate the effect of combined application of compost and inorganic fertilizers on spring planted sugarcane for two consecutive years (2013-14 and 2014-15) at the Research Farm, Shakarganj Sugar Research Institute (SSRI) Jhang, Pakistan. Experiment was comprised of different compost and fertilizer combinations viz. compost (1124 kg ha^{-1}) alone, fertilizer (168:112:112 kg NPK ha^{-1}) alone, compost (843 kg ha^{-1}) + fertilizer (42:28:28 kg NPK ha^{-1}), compost (562 kg ha^{-1}) + fertilizer (84:56:56 kg NPK ha^{-1}), compost (281 kg ha^{-1}) + fertilizer (126:84:84 kg NPK ha^{-1}) and compost (1124 kg ha^{-1}) + fertilizer (42:28:28 kg NPK ha^{-1}). The study was managed under randomized complete block design with three replications. Sugarcane variety S2003-US-114 (CPF-248) was used as medium for the trial. Results revealed the average maximum leaf area index (7.73), crop growth rate (11.19) and net assimilation rate (2.47) recorded from combined application of compost (1124 kg ha^{-1}) with fertilizer (42:28:28 kg NPK ha^{-1}). Highest average number of millable canes (14), cane length (260 cm), weight per stripped cane (0.86 kg), un-stripped cane yield (138.42 t ha^{-1}), stripped cane yield (116.27 t ha^{-1}) and sugar recovery (13.49%) were recorded in compost (1124 kg ha^{-1}) + fertilizer (42:28:28 kg NPK ha^{-1}) followed by compost (562 kg ha^{-1}) + fertilizer (84:56:56 kg NPK ha^{-1}) and fertilizer alone at (168:112:112 kg NPK ha^{-1}) during both the years. There was minute difference in yield among the years due to change in environmental conditions during both crop growing season. The average maximum benefit cost ratio 1.78 was also gained from compost (1124 kg ha^{-1}) + fertilizer (42:28:28 kg NPK ha^{-1}) application.

Key words: Sugarcane, Compost, NPK, Cane yield, Sugar recovery, Economic analysis.

INTRODUCTION

Sugarcane (*Saccharum officinarum* L.) is a major sugar and cash crop of Pakistan. It is mainly grown for making sugar and sugar related products. Sugarcane provides raw material for sugar, chip board, hard board, paper and alcoholic industry, additionally, it has also a pivotal role in agro-industrial economy of dear homeland (Naqvi, 2005). Sugarcane is mainstay of sugar industry. It has 3.4% and 0.7% contribution to value addition to agriculture and GDP, respectively. In Pakistan, sugarcane is sown on an area of 1.14 million hectares with production of 62.7 million tonnes with average yield of 54.91 t ha^{-1} which is lower than world's leading sugarcane producing countries like Brazil, India, China, USA and Australia (Govt. of Pakistan, 2015). Pakistan ranks 5th with respect to area, while, it ranks 8th with regards to sugar production globally (FAO, 2012). There are many causes of low yield of sugarcane but imbalanced application of fertilizers is the major cause of poor yield (Malik and Gurmani, 2005).

High nutritional requirements limit the sugarcane yield and also put the pressure of high cost of production on farmers (Gholve *et al.*, 2001). Similarly, the shorter availability of inorganic fertilizers (Khandagave, 2003) and depletion of soil nutrients and organic matters with continuous cropping also necessitates the conjunctive use of organic and inorganic fertilizers (Ibrahim *et al.*, 2008; Sarwar *et al.*, 2008). The use of high yielding varieties and mono-cropping caused the depletion of organic matter which ultimately limits the availability of both macro and micronutrients (Rakkiyappan and Thangavelu, 2000).

Integrated nutrient management involves the combined use of organic and inorganic fertilizers to increase soil fertility and crop productivity on sustainable bases and to prevent the loss of nutrients to environment. It is achieved through efficient management of all nutrient sources. Soil organic matter, animal manures, compost, green manures, plant residues and synthetic fertilizers are important source of nutrients for plants (Singh *et al.*, 2002). A balanced fertilization not only guarantee for optimal crop production but also gives higher benefits to the growers, thus is the best option to mitigate the hazardous effect of nutrient losses to the environment. Nutrient application varies with soil types, seasons and conditions (Ghaffar *et al*., 2011). A balanced NPK levels markedly increased the cane yield than the imbalanced levels. The optimum level of fertilizer @ 200+80+80 NPK kg ha^{-1}, was found economical after considering its effect on cane and sugar yield (Chohan *et al*., 2012). Compost is neutral in reaction with mean pH value of 6.7 and it contains mainly 17.5% organic carbon, 1.13% nitrogen, 0.083% phosphorus, and 6.33% potassium. Except pH and EC, total nitrogen, organic carbon, available P and available K values slightly increased due to the application of compost (Teshome *et al*., 2014).

The material from which compost is prepared contributes markedly towards the provision of nutrients. Compost provides growth promoting substances like hormones, vitamins and organic acids in addition to provision of important macro and micro nutrients (Harris *et al.*, 2001). The use of organic fertilizers along with the chemical fertilizers has proved highly beneficial for sustainable crop production. The use of organic fertilizers in combination with chemical fertilizers mitigates the deficiency of many micro and macro nutrients. In this regard the conjunctive use of organic waste materials along with inorganic fertilizers can be beneficial to combat nutrients deficiency with sustainable productivity (Meunchang *et al.*, 2005; Mathews and Thurkins, 2006). Therefore, this study was planned with following objectives. 1) To evaluate the effect of compost on the growth, yield and quality of spring planted sugarcane. 2) To formulate appropriate doses of compost in combination with NPK.

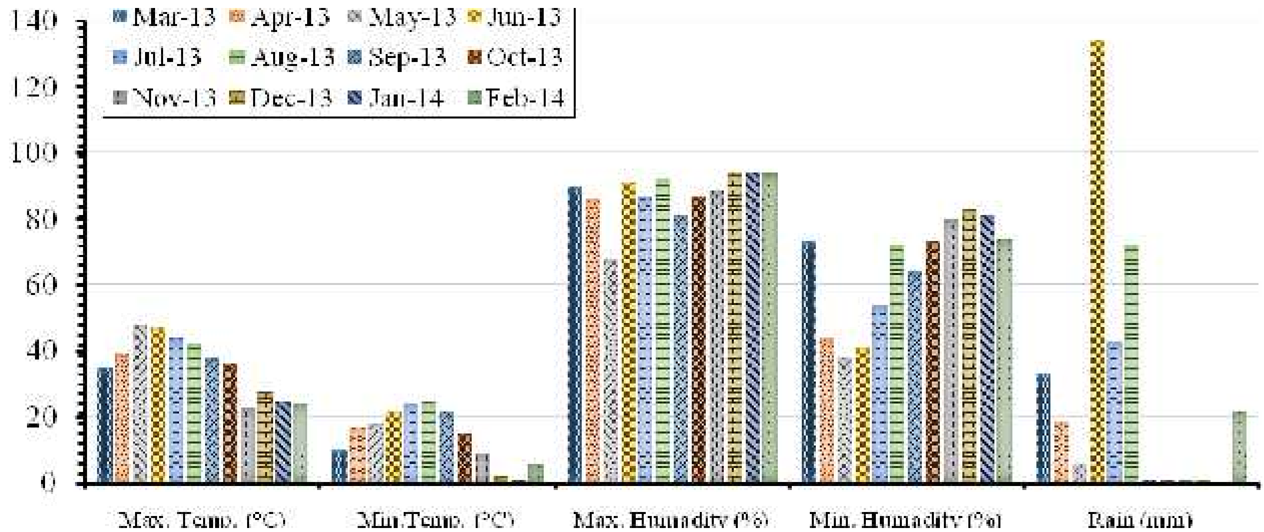
MATERIALS AND METHODS

The designed study was conducted for two consecutive years (2013-14 and 2014-15) at Research Farm, Shakarganj Sugar Research Institute, Shakarganj Mills Limited, Jhang. The climate of the region is semi-arid to sub-tropical. Normally, the temperature of this region ranges between 2 to 3°C in January and up to 48°C in June with mean annual rainfall of about 200-250 mm. The prevailing climatic conditions during both cane growing years are presented in Fig 1 (a&b). Weather data were obtained from meteorological unit of Shakarganj Sugar Research Institute, Jhang. The soil was sandy loam containing sand (44.22%), silt (35.5%) and clay particles (20.28%). To determine major physical and chemical properties of the experimental location, the composite soil samples were taken from soil depth (0-30 cm) at the start and end of crop. Collected samples were chemically analyzed by following the standard protocols and were presented in Table 1(Homer and Pratt, 1961). The locally prepared compost (Tiger compost) consisted of filter cake (56.23%), nitrogen source (16.67%), rock phosphate (20%), sludge (3.3%) microbial culture (2.67%), humic acid (1.07%) and ash (0.03%). The prepared compost provided organic matter 13%, nitrogen 6.12%, Phosphorus 9.53%, and Potash 9.11%.

The trial was laid out in Randomized Complete Block Design (RCBD) with three replications. The experiment consisted of following seven treatments viz. T_1 = control (no compost + no fertilizer), T_2 = compost alone at 1124 kg ha^{-1}), T_3 = fertilizer alone at 168:112:112 kg NPK ha^{-1}), T_4 = compost (843 kg ha^{-1}) + fertilizer (42:28:28 kg NPK ha^{-1}), T_5 = compost (562 kg ha^{-1}) + fertilizer (84:56:56 kg NPK ha^{-1}), T_6 = compost (281 kg ha^{-1}) + fertilizer (126:84:84 kg NPK ha^{-1}), T_7 = compost (1124 kg ha^{-1}) + fertilizer (42:28:28 kg NPK ha^{-1}). Urea, single super phosphate, and sulphate of potash were used as fertilizer source for NPK. Seed of sugarcane variety S2003-US-114 (CPF 248) was taken from Shakarganj sugar research institute and was planted on 25th February 2013 and 28th February 2014, respectively. The net plot size was 4.9 m × 9 m by using planting technique of 1.20 m apart deep trenches with double rows of cane sets at the rate of 75000 double budded sets ha^{-1}. The experiment was repeated on separate piece of land during both the years. All the crop husbandry practices were kept normal and uniform except treatments under study. During first year of experimentation fourteen irrigations were applied due to more rainfall, while, during second year sixteen irrigations were applied. Each irrigation was 3 acre inches, while, rouni irrigation was 4 acre inches. The crop was harvested manually at its full physiological maturity in the month of March during both the years. Leaf area index was measured nine times during crop life cycle, first leaf area index was measured after 60 days of sowing, then after every 30 days interval by using standard method (Watson, 1947). Crop growth rate and net assimilation were measured eight times during both the years of study and were determined by using the standard method (Hunt, 1978).

The quantitative parameters were recorded using the standard procedures at the time of harvesting. Number of millable canes in each plot was counted at harvest and then converted into number of millable canes m^{-2}. At harvest length of ten randomly selected canes from each treatment were measured and averaged. The randomly selected ten stripped canes from each treatment were weighed together then weight per stripped cane (kg) was calculated. All un-stripped canes from two lines of each plot were weighed (kg) before stripping and then transformed to tons per hectare. All stripped canes from two lines in each experimental unit were weighed and transformed to tons per hectare. Total brix (%), commercial cane sugar (%), sucrose content in cane juice (%) and sugar recover (%) were determined by the standard procedure (Spancer and Meade, 1963). Data regarding quantitative and qualitative characteristics were recorded and analyzed using Tukey's HSD technique and treatments means were compared at 0.05 probability level. Statistix 8.1 computer software program was used for statistical analysis.

(a) (2013-14)



(b) (2014-15)

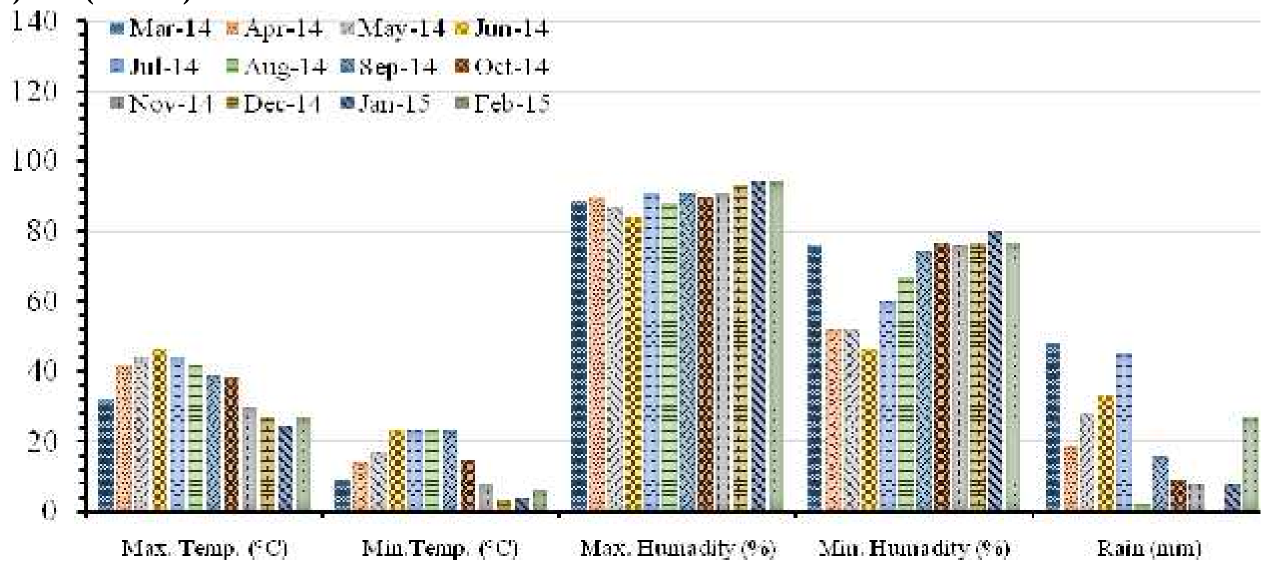


Fig 1: Meteorological data of sugarcane growing season during (a) 2013-14 and (b) 2014-15

Table 1. Soil Analysis

Treatments	pH	EC (dS m^{-1})	OM (%)	N (%)	P (ppm)	K (ppm)
Analysis before sowing of crop (Each value is average of two years)						
Composite Sample	7.89	1.79	0.66	0.043	4.60	123
Analysis after harvest of crop (Each value is average of two years)						
T_1	7.88	1.81	0.60	0.038	4.41	120
T_2	7.82	1.68	0.72	0.042	4.53	134
T_3	7.86	1.73	0.64	0.041	4.49	127
T_4	7.85	1.69	0.63	0.040	4.51	125
T_5	7.85	1.70	0.73	0.044	4.59	131
T_6	7.87	1.71	0.70	0.039	4.51	126
T_7	7.83	1.70	0.72	0.043	4.51	135

T_1: Control (no compost + no fertilizer), T_2: Compost alone at 1124 kg ha^{-1}, T_3: fertilizer alone at 168:112:112 kg NPK ha^{-1},T_4: Compost (843 kg ha^{-1}) + fertilizer (42:28:28 kg NPK ha^{-1}), T_5: Compost (562 kg ha^{-1}) + fertilizer (84:56:56 kg NPK ha^{-1}), T_6: Compost (281 kg ha^{-1}) + fertilizer (126:84:84 kg NPK ha^{-1}), T_7: Compost (1124 kg ha^{-1}) + fertilizer (42:28:28 kg NPK ha^{-1}).

RESULTS

Compost and fertilizer application markedly affected growth parameters of the crop. All the treatments significantly affected the leaf area index (LAI) and crop growth rate (CGR) except control. Maximum improvement for leaf area index and crop growth rate was recorded with compost (1124 kg ha^{-1}) + fertilizer (42:28:28 kg NPK ha^{-1}) application during both the cane growing years with non-significant difference. However, minimum improvement for leaf area index and crop growth rate was recorded in treatment with no compost and no fertilizer application. Leaf area index and crop growth rate values steadily increased in all the treatments and reached at maximum value at 180 and 210 days after sowing (DAS), respectively; thereafter, LAI and CGR declined until harvest (Fig. 2 & 3). Similarly, the highest average net assimilation rate was recorded with compost (1124 kg ha^{-1}) + fertilizer (42:28:28 kg NPK ha^{-1}) application, however, there was considerable difference recorded among treatment means in this regard (Fig. 4).

Treatment means revealed that application of compost and fertilizer markedly improved the quantitative traits of sugarcane crop during both the cane growing years (Table 2). The maximum number of millable canes were observed where compost (1124 kg ha^{-1}) + fertilizer (42:28:28 kg NPK ha^{-1}) was applied followed by compost (562 kg ha^{-1}) +fertilizer (84:56:56 kg NPK ha^{-1}) and fertilizer alone at 168:112:112 kg NPK ha^{-1}). There was remarkable difference among the years. Similarly, the maximum improvement in cane length was recorded with compost (1124 kg ha^{-1}) + fertilizer (42:28:28 kg NPK ha^{-1}) as compared to other treatments. However, the treatment with no compost and no fertilizer application caused a marked reduction in number of millable canes and cane length during both the years of study. Application of fertilizer and compost, significantly, affected the weight per stripped cane (Table 2). The maximum value of weight per stripped cane was recorded with combined application of compost (1124 kg ha^{-1}) + fertilizer (42:28:28 kg NPK ha^{-1}) during both the cane growing years with a minute difference among the years of the study. The results indicated that treatment with no compost and no fertilizer application caused a substantial reduction in stripped cane weight. The influence of compost and fertilizer application on stripped and unstripped cane yield was found significant during both the cane growing years (Table 2). Higher unstripped and stripped cane yield were noted in those plots where compost (1124 kg ha^{-1}) + fertilizer (42:28:28 kg NPK ha^{-1}) was applied but it was at par with T_3 = fertilizer alone at 168:112:112 kg NPK ha^{-1}) and T_5= Compost (562 kg ha^{-1}) + fertilizer (84:56:56 kg NPK ha^{-1}). However, the treatment with no compost and no fertilizer application caused a marked reduction in unstripped and stripped cane yield. There was significant difference among the growing years in this regard.

Although, results varied among different treatments, application of compost and fertilizer markedly improved the qualitative traits as compared to control (Table 3). The increase in brix (%) and sucrose contents (%) were observed with combined application of compost and fertilizer. For sugarcane crop maximum improvement in brix (%) and sucrose contents (%) were recorded from plots where compost (1124 kg ha^{-1}) + fertilizer (42:28:28 kg NPK ha^{-1}) was applied. However, the minimum improvement in brix (%) and sucrose contents (%) were recorded in treatment with no compost or no fertilizer application. Sugar recovery (%) was improved by fertilizer and compost application. The maximum increase in sugar recovery (%) was recorded with compost (1124 kg ha^{-1}) + fertilizer (42:28:28 kg NPK ha^{-1}) application, however, there was no marked difference in treatments was found in this regard except control (Table 3). Year difference regarding quality parameters of cane was found non-significant. The maximum benefit cost ratio was observed with combined application of compost (1124 kg ha^{-1}) + fertilizer (42:28:28 kg NPK ha^{-1}), followed by fertilizer alone at 168:112:112 kg NPK ha^{-1} and compost (562 kg ha^{-1}) + fertilizer (84:56:56 kg NPK ha^{-1}) during both the study years (Table 3).

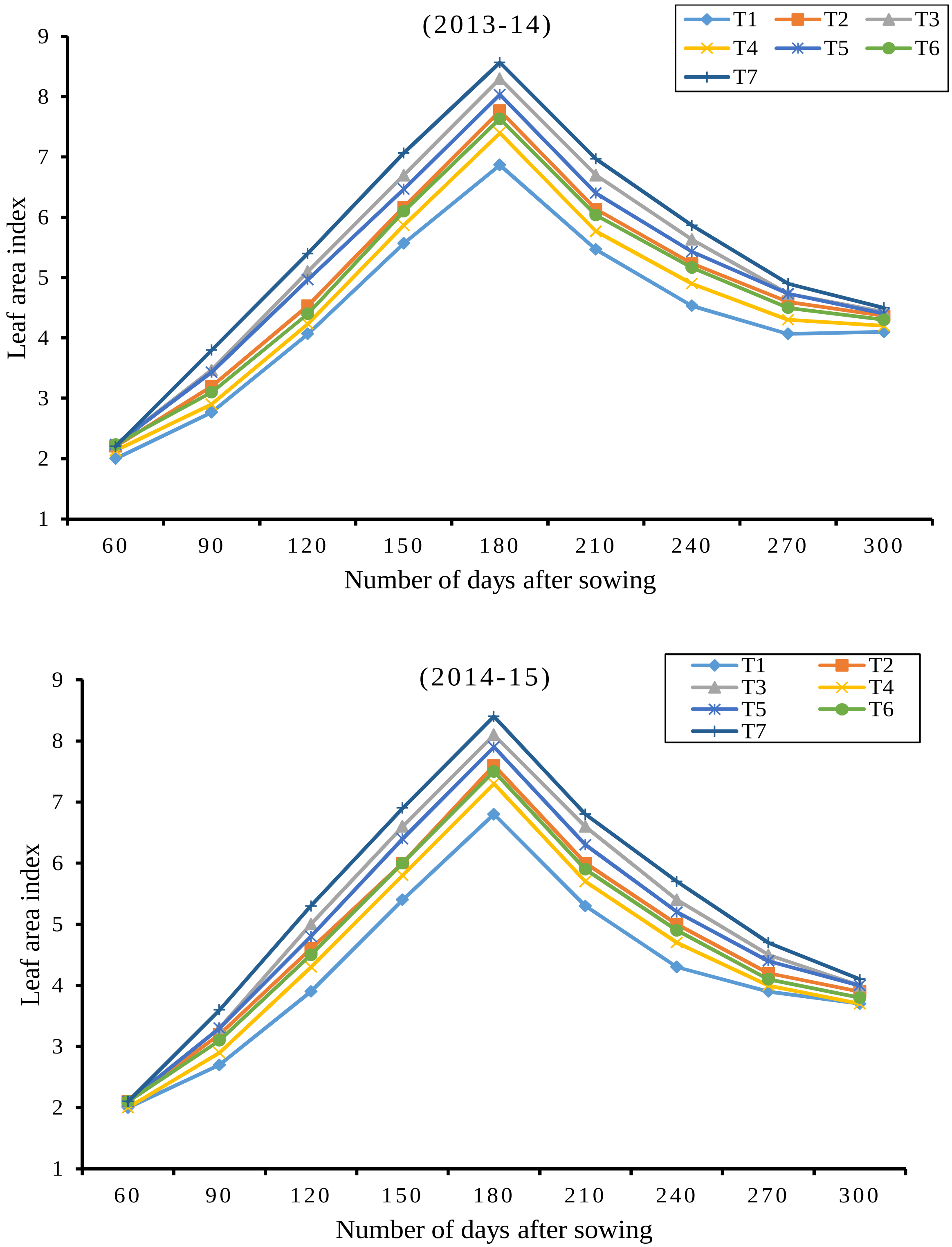


Fig 2: Influence of various inorganic fertilizers and compost levels on leaf area index of spring planted sugarcane

T_1: Control (no compost + no fertilizer), T_2: Compost alone at 1124 kg ha^{-1}, T_3: fertilizer alone at 168:112:112 kg NPK ha^{-1}, T_4: Compost (843 kg ha^{-1}) + fertilizer (42:28:28 kg NPK ha^{-1}), T_5: Compost (562 kg ha^{-1}) + fertilizer (84:56:56 kg NPK ha^{-1}), T_6: Compost (281 kg ha^{-1}) + fertilizer (126:84:84 kg NPK ha^{-1}), T_7: Compost (1124 kg ha^{-1}) + fertilizer (42:28:28 kg NPK ha^{-1}).

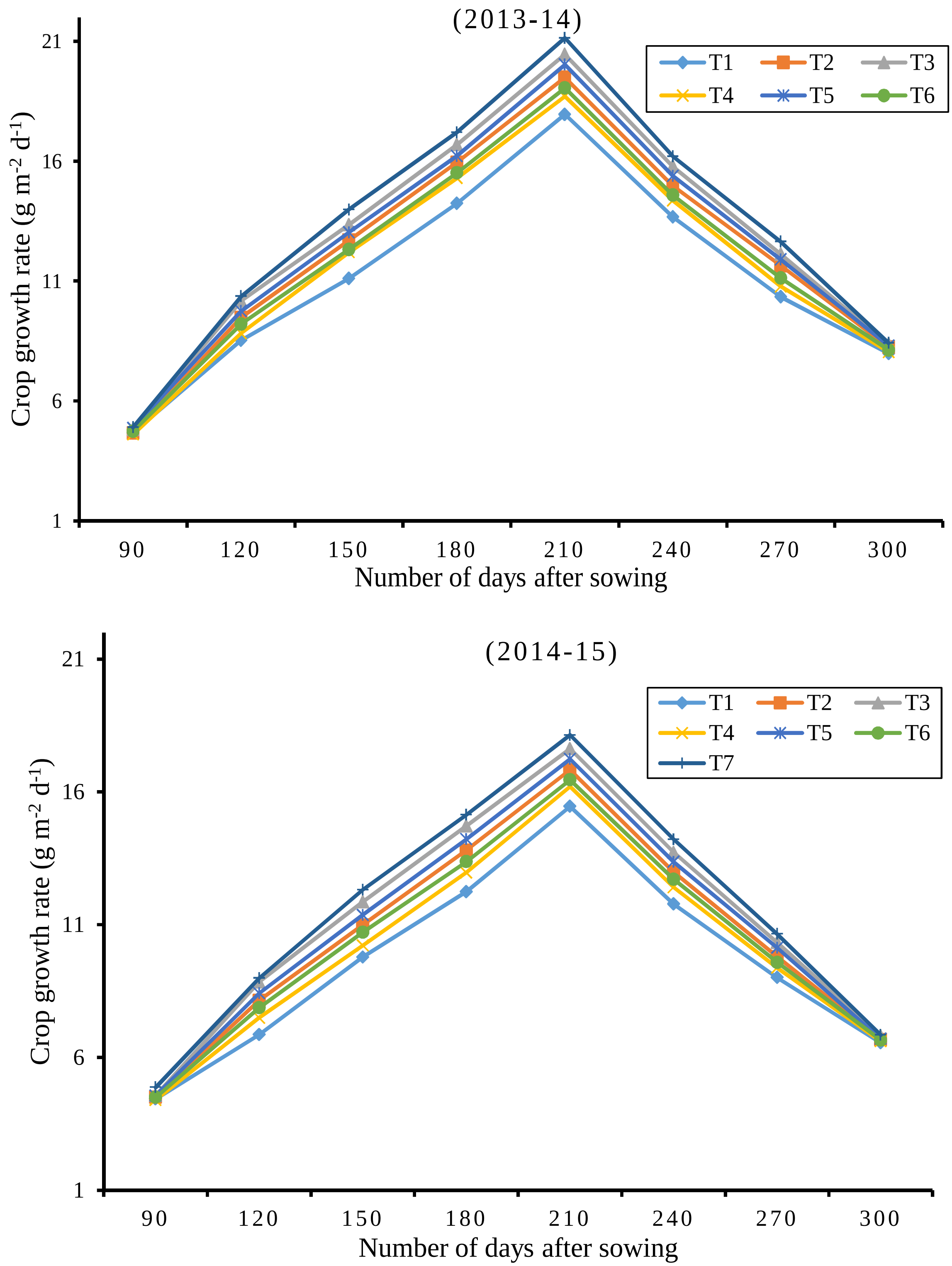


Fig. 3: Influence of various inorganic fertilizers and compost levels on the crop growth rate (g m^{-2} d^{-1}) of spring planted sugarcane

T_1: Control (no compost + no fertilizer), T_2: Compost alone at 1124 kg ha^{-1}, T_3: fertilizer alone at 168:112:112 kg NPK ha^{-1}, T_4: Compost (843 kg ha^{-1}) + fertilizer (42:28:28 kg NPK ha^{-1}), T_5: Compost (562 kg ha^{-1}) + fertilizer (84:56:56 kg NPK ha^{-1}), T_6: Compost (281 kg ha^{-1}) + fertilizer (126:84:84 kg NPK ha^{-1}), T_7: Compost (1124 kg ha^{-1}) + fertilizer (42:28:28 kg NPK ha^{-1}).

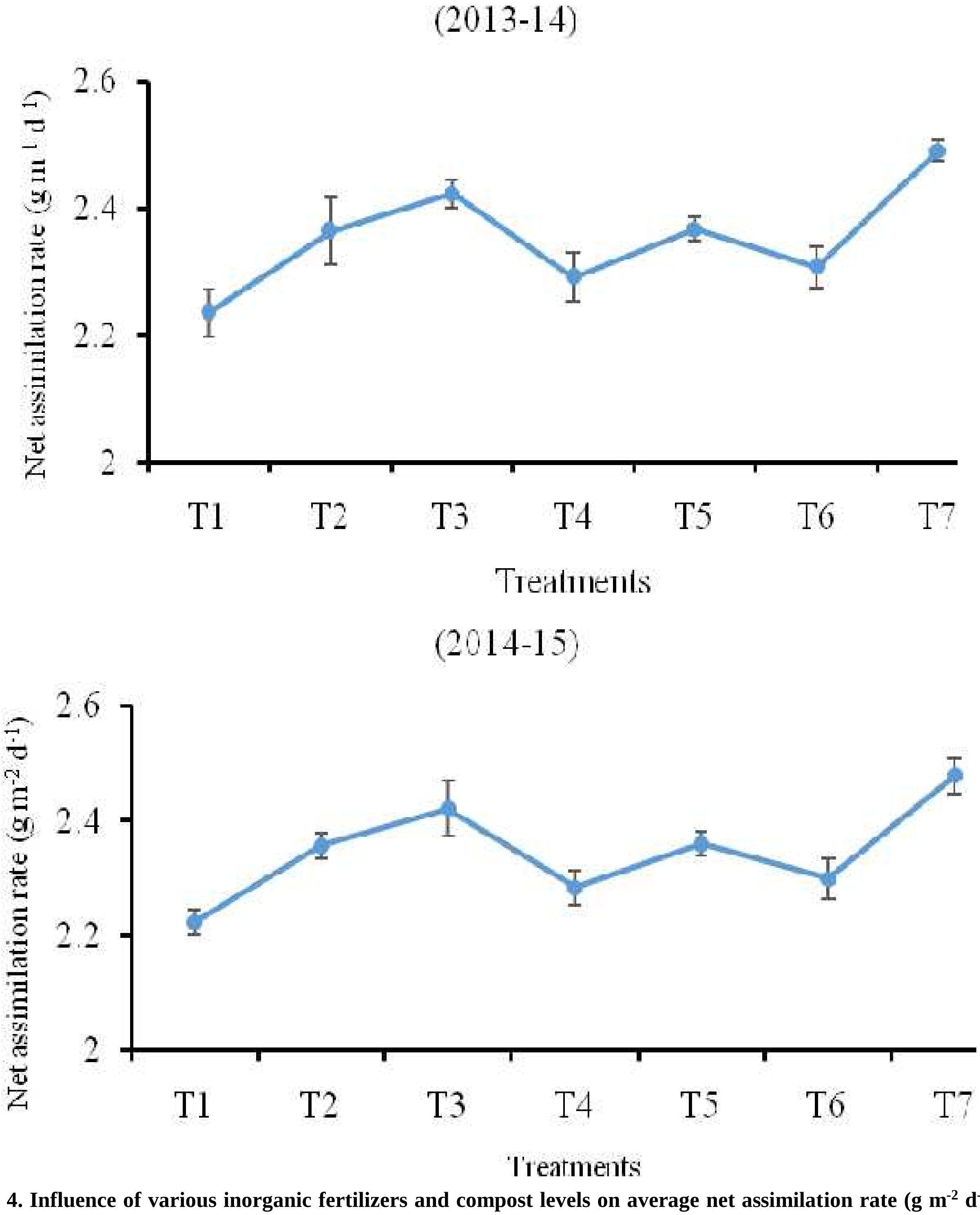


Fig. 4. Influence of various inorganic fertilizers and compost levels on average net assimilation rate (g m^{-2} d^{-1}) of spring planted sugarcane

T_1: Control (no compost + no fertilizer), T_2: Compost alone at 1124 kg ha^{-1}, T_3: fertilizer alone at 168:112:112 kg NPK ha^{-1}, T_4: Compost (843 kg ha^{-1}) + fertilizer (42:28:28 kg NPK ha^{-1}), T_5: Compost (562 kg ha^{-1}) + fertilizer (84:56:56 kg NPK ha^{-1}), T_6: Compost (281 kg ha^{-1}) + fertilizer (126:84:84 kg NPK ha^{-1}), T_7: Compost (1124 kg ha^{-1}) + fertilizer (42:28:28 kg NPK ha^{-1})

Table 2. Influence of compost and NPK application on quantitative parameters of spring planted sugarcane

Treatments	No. of millable canes (m^2)		Cane length (cm)		Weight per stripped cane (kg)		Un-stripped cane yield ($t\ ha^{-1}$)		Stripped cane yield ($t\ ha^{-1}$)	
	2013-14	**2014-15**	**2013-14**	**2014-15**	**2013-14**	**2014-15**	**2013-14**	**2014-15**	**2013-14**	**2014-15**
T_1	6.00 ^{d}	5.33 ^{d}	143.33 ^{d}	122.67 ^{d}	0.65 ^{c}	0.64 ^{d}	44.01 ^{d}	38.27 ^{e}	34.40 ^{e}	30.18 ^{d}
T_2	12.00 ^{bc}	11.33 ^{bc}	229.00 ^{bc}	213.67 ^{abc}	0.83 ^{ab}	0.81 ^{ab}	116.87 ^{bc}	111.11 ^{bc}	96.75 ^{bc}	91.40 ^{bc}
T_3	13.67 ^{ab}	13.00 ^{ab}	260.33 ^{ab}	234.33 ^{ab}	0.85 ^{a}	0.84 ^{ab}	136.01 ^{ab}	129.46 ^{ab}	112.90 ^{ab}	107.20 ^{ab}
T_4	10.67 ^{c}	10.00 ^{c}	202.33 ^{c}	186.00 ^{c}	0.75 ^{b}	0.74 ^{c}	94.86 ^{c}	86.65 ^{d}	77.07 ^{d}	70.97 ^{c}
T_5	12.33 ^{abc}	12.00 ^{abc}	241.33 ^{ab}	229.67 ^{ab}	0.84 ^{ab}	0.83 ^{ab}	122.03 ^{ab}	117.83 ^{abc}	101.26 ^{abc}	97.70 ^{ab}
T_6	11.67 c	11.00 bc	223.67 ^{bc}	203.33 ^{bc}	0.82 ^{ab}	0.80 ^{b}	112.04 ^{bc}	106.20 ^{c}	92.00 ^{cd}	87.22 ^{bc}
T_7	14.00 ^{a}	13.67 ^{a}	268.33 ^{a}	251.00 ^{a}	0.86 ^{a}	0.85 ^{a}	141.61 ^{a}	135.22 ^{a}	118.90 ^{a}	113.64 ^{a}
HSD at $P \leq 0.05$	1.80	2.10	39.00	41.33	0.09	0.05	24.16	19.52	19.29	21.96
Year mean	11.48	10.91	224.05	205.81	0.80	0.79	109.63	103.53	90.47	85.47

T_1: Control (no compost + no fertilizer), T_2: Compost alone at 1124 kg ha^{-1}, T_3: fertilizer alone at 168:112:112 kg NPK ha^{-1}, T_4: Compost (843 kg ha^{-1}) + fertilizer (42:28:28 kg NPK ha^{-1}), T_5: Compost (562 kg ha^{-1}) + fertilizer (84:56:56 kg NPK ha^{-1}), T_6: Compost (281 kg ha^{-1}) + fertilizer (126:84:84 kg NPK ha^{-1}), T_7: Compost (1124 kg ha^{-1}) + fertilizer (42:28:28 kg NPK ha^{-1}).

Table 3. Influence of compost and NPK application on quality parameters and economics of spring planted sugarcane.

Treatments	Brix (%)		Sucrose content in cane juice (%)		Commercial cane sugar (%)		Sugar recovery (%)		Benefit cost ratio	
	2013-14	**2014-15**	**2013-14**	**2014-15**	**2013-14**	**2014-15**	**2013-14**	**2014-15**	**2013-14**	**2014-15**
T_1	18.12 ^{c}	17.21 ^{c}	14.76 ^{c}	13.94 ^{c}	10.61 ^{b}	9.99 ^{b}	9.98 ^{b}	9.39 ^{b}	0.77	0.69
T_2	20.00 ^{ab}	19.91 ^{ab}	17.98 ^{ab}	16.81 ^{ab}	13.81 ^{a}	12.42 ^{a}	12.98 ^{a}	11.68 ^{a}	1.62	1.55
T_3	20.46 ^{ab}	20.23 ^{ab}	18.28 ^{a}	17.83 ^{ab}	13.99 ^{a}	13.53 ^{a}	13.15 ^{a}	12.72 ^{a}	1.67	1.61
T_4	18.97 ^{bc}	18.84 ^{b}	16.24 ^{bc}	16.00 ^{b}	12.11 ^{ab}	11.86 ^{ab}	11.38 ^{ab}	11.15 ^{ab}	1.33	1.25
T_5	20.13 ^{ab}	20.00 ^{ab}	18.12 ^{ab}	17.44 ^{ab}	13.94 ^{a}	13.17 ^{a}	13.10 ^{a}	12.38 ^{a}	1.60	1.56
T_6	19.89 ^{ab}	19.63 ^{ab}	17.56 ^{ab}	16.35 ^{ab}	13.34 ^{ab}	11.97 ^{ab}	12.54 ^{ab}	11.25 ^{ab}	1.46	1.40
T_7	20.94 ^{a}	20.57 ^{a}	18.49 ^{a}	18.20 ^{a}	14.02 ^{a}	13.81 ^{a}	13.18 ^{a}	12.98 ^{a}	1.80	1.75
HSD at $P \leq 0.05$	1.57	1.44	1.907	1.873	3.053	2.006	2.876	1.890		
Year Mean	19.79	19.49	17.35	16.65	13.12	12.40	12.33	11.65		

T_1: Control (no compost + no fertilizer), T_2: Compost alone at 1124 kg ha^{-1}, T_3: fertilizer alone at 168:112:112 kg NPK ha^{-1}, T_4: Compost (843 kg ha^{-1}) + fertilizer (42:28:28 kg NPK ha^{-1}), T_5: Compost (562 kg ha^{-1}) + fertilizer (84:56:56 kg NPK ha^{-1}), T_6: Compost (281 kg ha^{-1}) + fertilizer (126:84:84 kg NPK ha^{-1}), T_7: Compost (1124 kg ha^{-1}) + fertilizer (42:28:28 kg NPK ha^{-1}).

DISCUSSION

The study was done to investigate the potential of compost and fertilizer alone and in different combinations on the growth, yield and quality of spring planted sugarcane. All nutrient combinations, significantly, improved growth, yield and quality of spring planted sugarcane when compared with control. The increase in growth and yield attributes might be due to the improved soil chemical and physical conditions (Table 1) and more root proliferation which resulted in better nutrient availability. Sarwar *et al*. (2010) found that compost application increased soil pH, EC, organic matter, Ca^{2+}, Mg^{2+}, K^{1+} and P while C: N ratio was narrowed in acidic soil. Hence, there was a general increase in nutrient supplying capacity of soils. Similar findings were reported by Yang *et al*. (2004). They found an increase in length and volume of root with the application of integrated use of fertilizers and compost. These results are also supported by previous findings of Bokhtiar and Sakurai, (2005), they found that application of 25% less than recommended dose of chemical fertilizer (N138, P40, K40 kg ha) with compost (15 t ha^{-1}) for plant crop (first crop) and ratoon cane crop increased growth and yield of sugarcane without deterioration of soil fertility. Boateng *et al*. (2006) also reported that application of compost 2 t ha^{-1} + 30-20-20 kg NPK ha^{-1} increased the growth and yield attributes of sugarcane because of the complementary and synergistic effects of the organic and inorganic fertilizers. The combination of compost with chemical fertilizer enhanced the biomass and yield of both plant and ratoon crops (Sarwar *et al*., 2008).

Substantial increase in quantitative parameters like number of millable canes, cane length (cm), weight per stripped cane (kg), unstripped and stripped cane yield were recorded with combined application of compost and fertilizer. Better cane yield by the application of compost and fertilizer (NPK) primarily related to better cane length, number of millable canes and weight per stripped cane. Better growth and cane yield were observed during 2013-14 than second year which might be due to the more rain fall and favorable climatic conditions (Optimum temperature and humidity) for cane growth (Fig. 1). Cane compost is a good source of nutrients (Bokhtiar *et al.,* 2001), as it ameliorate the soil properties (Razzaq, 2001). The increase in cane and sugar yield attributes are due to more leaf area (fig. 2) which captured more light, hence, enhanced photosynthetic activities and accumulation of assimilates. Bangar *et al.* (2000) also reported that application of compost and nitrogen substantially soar the leaf area and improved the photosynthetic activities, which resulted in better cane and sugar yield. Use of compost can be beneficial to improve organic matter status in soil because compost is rich source of nutrients with high organic matter content (Table 1). Similarly, Sarwar *et al.* (2007) reported that the use of compost replenish the nutrients and organic matter content of soil loss due to exhaustive crops. Varied doses of multinutrients considerably increased the number of millable canes from 3.94 to 7.33 (Siddiqi *et al*., 2006). Patel *et al*. (2013) found that for securing higher yield and remuneration in rice-sugarcane cropping sequence, application of 25% N through compost + 25% N through poultry manure + 50% N through inorganic fertilizers gave net return and B:C ratio close to that obtained with 100% recommended fertilizers alone and improved the soil health in terms of positive nutrient balance. Application of compost and fertilizer (NPK) markedly improved the qualitative traits as compare to control (Table 3).

Owing to genetic makeup of crop the increase in qualitative parameters might be due to better uptake, availability of nutrients and the improvement in soil characteristics like organic matter, CEC by the use of compost (Table 1). Integration of 50% fertilizer (NPK) with 50% organic compost markedly increased the growth yield and quality of many crops like sugarcane, sorghum, millet (Ridine *et al*., 2014). All the fertilizers levels were found highly profitable over the control. This trend of data indicates that the use of fertilizer in balanced amount will always remain profitable for the sugarcane growers. The existing profitability levels can considerably be improved with the use of NPK fertilizers in balanced amount. The results are in accordance with Gurmani *et al*. (2003) and Khan *et al*. (2005).

Conclusion: The combined application of compost (1124 kg ha^{-1}) with fertilizer (42:28:28 kg NPK ha^{-1}) was found economical after considering its effect on quantity and quality of sugarcane. Successful combined use of compost with fertilizers (NPK) helped in reducing the cost of production and excessive use of synthetic fertilizers. This strategy contributed for cheaper, better and improved cane production.

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