http://www.pjbs.org

PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences 3 (3): 483-484, 2000

Determination of Optimum Level of Phosphorus and its Effect on Growth, Yield and Quality of Ratoon Sugarcane (*Saccharum officinarum* L.)

Aman Ullah Chaudhry and F.A. Chattha
Department of Agronomy, University of Agriculture, Faisalabad 38040, Pakistan

Abstract: The various components of the sugarcane crop such as stripped cane yield, number of millable canes and unstripped cane yield were affected significantly by different levels of phosphorus. Phosphorus application in the range of 100-150 kg ha^{-1} along with 200 kg ha^{-1} and 150 kg K_2O ha^{-1} was found to be an optimum dose. Phosphorus application beyond the range of 100 to 150 kg ha^{-1} will not be profitable. Phosphorus had nonsignificant effect on the photo biomass and quality parameters.

Key words: Optimum, phosphorus, *Saccharum officinarum*

Introduction

Phosphorus is one of the major plant nutrients, which is applied in the form of chemical fertilizers. Phospholus deficiency in our soils has generally been recognized. The research work on sugarcane fertilization was confirmed to the application of NPK from various sources of organic and inorganic manures and fertilizers, the amount and time of application, fertilizer requirements of different varieties under different growing conditions and the need of micro nutrients in our soil (Malik, 1997).

As phosphorus plays a vital role in obtaining the maximum yield and in improving the sugar quality of sugarcane, the present study was planned to know the effect of different levels of phosphorus on growth, yield and quality of sugarcane under agro-ecological conditions at Faisalabad.

Materials and Methods

The proposed study was conducted at the Agronomic Research Area, University of Agriculture, Faisalabad, on sandy clay loam soil during 1998-99. An experiment was laid out in Randomized Complete Block Design with four replications and five treatments, using net plot size of 2.4 m × 19 m. Soil up to 30 cm was sampled before the start of the experiment and subjected to physio-chemical analysis. The data showed 0.73 percent N, 15.10 ppm P_2O_5 and 168.5 ppm K. At the time of harvesting climatic data of crop growing season showed that there was no fluctuation in climatic conditions except little in rain fall. Five different levels of phosphorus as 0, 50, 100, 150 and 200 kg ha^{-1} were used. In addition 200 kg N and 150 kg K ha^{-1} was also applied. Sources of N, P and K were urea, single superphosphate and muriate of potash, respectively. All other cultural practices such as irrigation, weeding were kept normal and uniform for all the treatments. Data were analyzed statistically using Fisher's analysis of variance technique (Steel and Torrie, 1984). The law of diminishing return was used to determine the optimum level of phosphorus by equating the inverse price ratio with marginal product (Sharma and Sharma, 1984).

Results and Discussion

Yield: The result in the Table 1, showed that different level of phosphorus fertilizer had significant effect on the striped cane yield. Data of Table 1 showed that, when phosphorus fertilizer was applied at 100 Kg ha^{-1} produced maximum stripped cane yield (71.62 t ha^{-1}) which was significantly different from the other treatments.

The minimum stripped cane yield (58.38 t ha^{-1}) was from control which was not significantly different from the other treatments when phosphorus was applied at 50 Kg ha^{-1}, at 150 Kg ha^{-1}, at 200 Kg ha^{-1} producing 62.66 t ha^{-1}, 62.00 t ha^{-1} and 59.38 t ha^{-1} respectively. The above results are also-supported by Pannu *et al*. (1985).

Optimum level: Optimum level of phosphorus was determined by equating the inverse price ratio with marginal products (Table 2), which showed that the optimum rate of phosphorus is in the range of 100-150 kg ha^{-1}.

The relationship between the stripped cane yield and various characters studied by the regression equation are presented in the Table 3. This regression equation can be used to estimate the yield in kg per hectare for some given values of these characters.

Yield components: The different levels of phosphorus significantly effected numbers of millable cane. Data regarding number of millable canes ha^{-1} are presented in the Table 1. The results showed that different levels of phosphorus had significant effect on the number of millable canes. In Table 1 it indicated that phosphorus application at 100 Kg ha^{-1} had significant effect from other treatments, which produces maximum number of millable canes (112390.35). Phosphorus application at 150 Kg ha^{-1} produces non significant effect and was at par with 50 Kg ha^{-1} and 200 Kg ha^{-1}. Control was significantly different from 100 Kg ha^{-1}, which produces minimum number of millable canes (80074.75). From the above data it is concluded that phosphorus application at 100 Kg ha^{-1} increased the number of millable canes and more increase in phosphorus had no response for more number of millable canes. These results are also supported by Mathur (1972). The different levels of phosphorus did not effect all other yield components (numbers of internodes percane, internodal length, cane length, canes diameter and weight per stripped cane).

Table 1: Comparison of means of yield, yield components and photo biomass

P_2O_5 treatments (kg ha^{-1})	Stripped cane yield (t ha^{-1})	No. of millable canes	Unstripped cane yield
0	58.38b	80074.50c	75.25c
50	62.66b	96217.10c	76.26bc
100	71.12a	112390.35a	86.50a
150	62.00b	99780.70b	81.04ab
200	59.38b	89640.65bc	74.14bc

Any two means not sharing a common letter differ significantly at 5 percent probabilitty level

Table 2: Average marginal product and inverse ratio at different levels of phosphorus application

	P_2O_5 applied (kg ha^{-1})				
	0	50	100	150	200
Yield obtained	58380	62650.00	71120.00	62000.00	59370.00
Total product due to P_2O_5	-	4270.00	12740.00	36020.00	990.00
Average product	-	85.40	127.40	24.13	4.95
Marginal product	-	85.40	169.40	-182.40	-52.60
Inverse price ratio	38.10	38.10	38.10	38.10	38.10

Table 3: Simple regression equation and correlation coefficient for yield and yield components

Yield components	Regression equation	Correlation	F.value	prob	coefficient of determination (%)
No. of millable cane ha^{-1}	Y = 12.34 + 0.0005 (X1)	0.8261	38.69*	0.000	68.25
Trash weight	Y = 82.29-7.42 (X2)	-0.1565	0.4522^{N-S}	0.5098	2.45
Tops weight	Y = -15.91 + 27.33 (X3)	0.5333	7.152*	0.0155	28.43
Cane length	Y = 109.63-26.79 (X4)	-0.1200	0.2629^{N-S}	0.6143	1.44
Cane diameter	Y = -23.75-57.85 (X5)	0.3909	3.05^{N-S}	0.0976	14.50
No. of internodes $cane^{-1}$	Y = 88.25-1.34 (X6)	-0.2107	0.836^{N-S}	0.3725	4.44
Internodal length	Y = 3Z.29 + 2.89 (X7)	0.1915	0.6849^{N-S}	0.4187	3.66
Weight per stripped cane	Y = -13.75 + 71.35 (X8)	0.2085	0.8183^{N-S}	0.3776	4.34
unstripped cane yield	Y = -2.526 + 8.36 (X9)	0.8507	47.14**	0.000	72.37
Harvest index	Y = -63.675 + 4.072 (X10)	0.5476	7.711*	0.0124	29.99
Sucrose	Y = 92.07-7.08 (X11)	-0.1003	0.1827^{N-S}	0.6741	1.05
C.C.S.	Y = 77.53-4.19 (X12)	-0.0638	0.7361^{N-S}	0.7892	0.407

* = Significant ** = Highly S ignificant N-S = Non Significant

Photo biomass production: The photo biomass production is determined by the parameters like tops weight, trash weight, harvest index and unstripped cane yield in sugarcane crop. Data regarding the unstripped cane yield is presented in the Table 1, which indicated that different levels of phosphorus had significant effect on the unstripped cane yield. The treatments where phosphorus was applied at 100 Kg ha^{-1} produced maximum unstripped cane yield and is significantly different from control, 50 and 200 Kg ha^{-1} P_2O_5 but was at par with the treatment, which was fertilized at 150 Kg ha^{-1}. The minimum unstripped cane yield was from control and was not significantly different from the treatments having phosphorus at 50 Kg ha^{-1} and at 200 Kg ha^{-1}. The different levels of phosphorus did not effect the other parameters.

Quality parameters: The different levels of phosphorus did not significantly effect quality parameters (sucrose percentage and commercial cane sugar percentage). The above results are supported by Khan (1990). It could be concluded from these studies that the present recommendation of Punjab Agriculture department of 85 kg ha^{-1} for ratoon crop is lower as these results showed that it is still profitable to apply P_2O_5 upto 150 kg ha^{-1}.

References

Khan, K.M., 1990. Effect of NPK application and seeding density on cane yield and quality of autumn planted sugarcane variety COJ-64. M.Sc. Thesis, University of Agriculture, Faisalabad, Pakistan.

Malik, K.B., 1997. Profitability of sugarcane cultivation. Department of Agriculture, Government of Pakistan, pp: 35-38.

Mathur, B.K., 1972. Response of NPK fertilizers on sugarcane crop agronomical view. Indian Sugar, 21: 809-815.

Pannu, B.S., Y.P. Dang, L.S. Verma and S.S. Verma, 1985. Effect of phosphorus and potassium on yield and quality of sugarcane. Indian Sugar, 35: 263-265.

Sharma, A.N. and V.K. Sharma, 1984. Elements of Farm Management. 1st Edn., Prentice Hall of India (Pvt.), New Delhi, India, pp: 30-39.

Steel, R.G.D. and J.H. Torrie, 1984. Principles and Procedures of Statistics. McGraw Hill, Singapore, pp: 232-251.