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Short Communication

Growth and Yield of Lentil as Affected by Phosphorus

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ABSTRACT

A field experiment was conducted to evaluate the growth and yield response of lentil to phosphorus. The treatments included parameters such as number of branches plant^{-1}, plant height, number of pods plant^{-1}, seed pod^{-1}, 1000-seed weight were , or kg P_2O_5 at sowing. Flowering and maturity of the crop was significantly affected by different rates of phosphorus. Maximal dose of phosphorus proved better than others attributed to higher seed yield of 1250 kg ha^{-1}.

Key Words: Growth; Yield; Lentil; Phosphorus; Seed

INTRODUCTION

Lentil (*Lens culinaris* medic) locally known as Masoor is an important rabi crop. It contains 23.25% protein, 59% carbohydrates, 1.8% oil, 0.2% ash and traces of iron calcium, phosphorus and magnesium. Lentil also provides a considerable amount of vitamin A and B. It occupied an area of 56.5 thousand hectare with an annual production of 40.5 thousand tonnes, thus giving an average seed yield of 651 kg ha^{-1} which is very low as compared to world average of 657 kg ha^{-1} (Government of Pakistan, 2000). High yielding varieties have provided us the potential for obtaining higher yield under varied conditions. Higher yield along with good quality seed can be produced by proper packages of agronomic practices. Lentil in our country has usually been restricted to poor soil and barani conditions. This crop is usually grown on marginal lands without any fertilizer application which is one of the most important causes of low yield in the country. Soil fertility and fertilizer have major role in obtaining higher yield. Through the process of symbiosis, lentil plants are able to fix atmospheric nitrogen. According to an estimate it can fix 8-14 kg N ha^{-1}. The nitrogen requirement of this legume crop is low as compared to non-legume crops. However, the crop needs P for obtaining good quality lentil. It is, therefore, important to determine a suitable dose of phosphorus for higher yield of lentil. In view of this, present study was designed to see the effect of different levels of phosphorus on lentil yield under irrigated conditions at Faisalabad.

MATERIALS AND METHODS

The present study was carried out at the Agronomic Research Area, University of Agriculture, Faisalabad on sandy loam soil containing 0.038%N, 6.8 ppm P and 141 ppm K. The experiment was laid out in a randomized complete block design with four replications. The net plot size was 2 x 8 m. The crop was sown in the second week of October 19 on a well prepared seedbed with the help of single row hand drill in 30 cm apart rows, using 20 kg ha^{-1} seed rate. Treatments included in this study were: Control, 25, 50 and 75 kg P_2O_5 ha^{-1} at sowing. A basal uniform dose of nitrogen at the rate of 30 kg ha^{-1} was applied to all plots at sowing. All other agronomic practices were kept uniform. Following observations were recorded: Number of branches plant^{-1} at harvest; plant height at maturity (cm); number of pod plant^{-1}; number of seeds pod^{-1}; 1000-seed weight (g); seed yield ha^{-1} (kg) and harvest index (%).

Statistical analysis. The data collected were analysed statistically using Fisher's analysis of variance technique and LSD test at 5% probability level was applied to compare the difference among the treatment means (Steel & Torrie, 1984).

RESULTS AND DISCUSSION

Number of branches plant^{-1} at harvest. Number of branches plant^{-1} were significantly affected by different rates of phosphorus application (Table I). Minimum number of branches per plant (6.93) were recorded in control and maximum number of branches (15.87) were recorded from 75 kg P_2O_5 ha^{-1} treatment. This may probably be due to the cumulative effect of phosphorus on the processes of cell division and balanced nutrition.

Plant height at maturity (cm). Minimum plant height (34.12 cm) was recorded in case of control, whereas, maximum plant height (49.92 cm) was obtained with the application of 75 kg P_2O_5 ha^{-1}. Maximum plant height might be due to stimulated biological activities in the presence of balanced nutrient supply. These results are in accordance to the findings of Saleh (1976) and Dadson and Acquach (1984).

Table I. Yield and yield component as affected by different phosphorus levels

Treatment	Phosphorus (kg ha$^{-1)}$	Plant height (cm)	No. of branches plant^{-1}	No. of pods plant^{-1}	No. of seeds pod^{-1}	1000-grain weight (g)	Harvest index (%)	Seed yield (kg ha^{-1})
T_1	0	34.12 d	6.93 d	37.50 d	1.39 d	17.29 c	36.85 d	198.61 d
T_2	25	40.76 c	10.14 c	41.17 c	1.56 c	18.86 b	40.22 c	923.61 c
T_3	50	44.36 b	12.54 b	53.37 b	1.72 b	19.27 a	42.10 b	111.11 b
T_4	75	49.92 a	15.87 a	62.37 a	1.89 a	19.38 a	43.68 a	1250.00 a

Any two mans not sharing a letter differ significantly at probability level of 1 percent and 5 percent

Number of pod plant^{-1}. The data in Table indicate that pods per plant were significantly affected by the effect of different rates of phosphorus application. The minimum number of pods i.e. 37.50 were found in of control. The maximum number of pods per plant (62.37) were recorded with the application of 75 kg P_2O_5 ha^{-1}. Reason might be the liberal availability of plant nutrients which stimulated the plants to produce more pods per plant as compared to other treatments as phosphorus powerfully encourages flowering and fruiting. These findings are in accordance with the results of Saleh (1976) and Jayapaul and Ganesaraja (1990).

Number of seeds pod^{-1}. The number of seeds per pots differed significantly by phosphorus treatments (Table I). The minimum (1.39) and maximum (1.89) number of seeds were recorded from 0 and 75 kg P_2O_5 ha^{-1} application. Due to more availability of nutrients by increasing the level of P_2O_5 ha^{-1} increased the number of seeds per pod. It appears that there was a regulatory system through which it was possible to direct and concentrate available nutrient to permit development of more number of pods plant^{-1} and seeds pod^{-1}. Phosphorus aids in transferring photosynthates from the stalks, leaves and other growing parts to the economically important organs like seed making them plump and bold. These results are strongly in agreement with the findings of Subramanian and Radhak (1981), Jayapaul and Ganesaraja (1990) who reported that application of 80-120 P_2O_5 kg ha^{-1} increased the number of pods plant^{-1}.

1000-seed weight (g). Data presented in Table I revealed that effect of rates of phosphorus application was highly significant towards 1000-seed weight. Minimum (17.20 g) and maximum (19.38 g) 1000-seed weight were recorded in case of control and 75 kg P_2O_5 ha^{-1} application. Increase in 1000-seed weight might be due to the influence of cell division, phosphorus contents in the seed as well as the formation of fat and albumin. The results are in line with those of Subrmanian and Radhak (1981) and Shamim and Naimat (1987) and Ali *et al*. (1979) who reported that seed yield of good quality lentil by the application of 30 + 120 + 60 kg NPK ha^{-1}.

Seed yield ha^{-1} (kg). Seed yield ha^{-1} is the out put of different treatment applied as well as the effect of different agronomic practices and environment. Thus, seed yield is controlled by large number of internal and external factors and any variation in them is liable to bring about variations in total seed yield. There was a highly significant effect of rate of different phosphorus application on the seed yield (Table I). However, highest seed yield ha^{-1} was recorded with the application of 75 kg P_2O_5 ha^{-1}. These results are in line with the findings of Singh *et al*. (1999) and Chaubey *et al*. (1999) who reported that with application of 0-90 kg P_2O ha^{-1} seed yield increased significantly. Increased seed yield could be due to balanced nutrient supply which was maximum when phosphorus was applied at the time of sowing and it enabled the plants to produce better growth and seed yield. It was clear that there was a trend of increasing seed yield ha^{-1} beyond control to 75 kg P_2O_5 ha^{-1} at sowing (F_3) which was due to poor development of yield components. These results are quite similar to those of Ali *et al*. (1981), Dadson and Acquach (1984), Chiezey *et al*. (1992), Pasricha and Aulakh (1992) and Singh *et al*. (1992).

Harvest index (%). Data showed highly significant effect of different rates of phosphorus application. Calculated values of harvest index and analysis of variance revealed that there was an increasing trend in the harvest index values with the application of phosphorus. Minimum harvest index (36.65%) was recorded in case of control treatment where no fertilizer was applied (F_0) whereas, maximum harvest index i.e. 43.69% was recorded with the application of 75 kg P_2O_5 ha^{-1} (F_3). Higher harvest index value may be due to balanced nutrition. The low harvest index at low level of P_2O_5 ha^{-1} might be due to poor development of plant t different growth stages.

CONCLUSION

This led to the conclusion that under suitable climatic conditions of experimentation 25 kg P_2O_5 ha^{-1} was optimum dose for getting good seed yield of lentil.

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