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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): 523-524, 2000

Effect of Different Phosphorus Levels on Growth and Yield Performance of Lentil (*Lens culinaris* Medic)

Muhammad Maqsood, Muhammad Shahid Ibni Zamir, Riazat Ali, Aftab Wajid and Nadeem Yousaf
Department of Agronomy, University of Agriculture, Faisalabad, Pakistan

Abstract: The investigation was conducted to determine the effect of different levels of phosphorus fertilizer on growth and yield performance of Lentil (*Lens culinaris* medic) CV. Masoor-85. Flowering and maturity of the crop was significantly affected by different rates of phosphorus. Maximum 1000-grain weight (19.38 g) was recorded with the application of 75 kg P_2O_5 ha^{-1}. Application of 75 kg P_2O_5 resulted in higher yield of 1250 kg ha^{-1}.

Key words: Pakistan, Phosphorus, Lentil, Yield

Introduction

Lentil (*Lens culinaris* medic) locally known as Masoor, is an important Rabi crop. In Pakistan, it is grown on an area of 64.8 thousand hectares with a production of 37.1 thousand tonnes and average yield of 571 kg ha^{-1} (Anonymous, 1998) which is very low due to many reasons. Among these minimum phosphorus application to lentil crop per hectare. Effect of phosphorus fertilization was significant on number of pods per plant and grain yield (Singh *et al*., 1983).

Lentil contains 20 to 25 percent protein, 59 percent carbohydrates, 1.8 percent oil and contents of iron, phosphorus, calcium and magnesium. Lentil also provides a considerable amount of vitamin A and B. It provides balance human diet and is a good substitute for animal protein. It is drought resistant crop. The crop needs phosphorus for obtaining good quality lentil.

Thus the maximum yield can only be obtained by applying the optimum phosphorus dose per hectare. This study was, therefore, designed to determine the optimum phosphorus level in order to maximize grain yield of lentil CV, Masoor-85.

Materials and Methods

The study was carried out to determine the effect of rate of phosphorus application on the growth and yield of lentil CV. Masoor-85 applied at the time of sowing. The experiment was conducted at the Agronomic Research Area, University of Agriculture, Faisalabad on a sandy loam soil containing 0.038 percent N, 6.8 ppm P and 141 ppm K status. The experiment was laid out in a randomized complete block design with four replications. The net plot size was 2 m x 8 m. The crop was sown in the second week of October on a well prepared seedbed with the help of single row hand drill in 30 cm apart rows, using 20 kg seed rate ha^{-1}. The treatments were 0 P_2O_5 kg ha^{-1}, 25 P_2O_5 kg ha^{-1}, 50 P_2O_5 kg ha^{-1} and 75 P_2O_5, kg ha^{-1}.

A basal 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 during the experimentation. The observations recorded were plant height at maturity (cm), number of pods per plant, number of seeds per pod, 1000-seed weight (g) and grain yield t ha^{-1}. The data collected were analysed statistically by Fisher's Analysis of Variance and treatment means were compared for significance at 5 percent probability level using LSD test (Steel and Torrie, 1986).

Results and Discussion

In this study an attempt was made to see the effect of rate of phosphorus application on the growth and yield of lentil (*Lens culinaris* M.) cultivar "Masoor-85" under irrigated conditions at Faisalabad. The data pertaining to various parameters alongwith statistical analysis is discussed is the following paragraphs.

Number of factors such as varietal and edaphic factors are involved which contribute toward the plant height in case of lentil crop. The data presented in table revealed that there were highly significant effects when phosphorus was applied with different rates. Minimum plant height was recorded in case of control treatment where no fertilizer was applied (F_0), where as maximum plant height was recorded with the application of 75 kg P_2O_5 ha^{-1} (F_3). Which was maximum than all other treatments viz. F_2 (50 P_2O_5 ha^{-1} at sowing) and F_1 where (25 kg P_2O_5 ha^{-1}). The 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 Muhammad (1964) and Sharer (1968).

Pods per plant is an important parameter determining the seed yield of the crop. It is clear from the data given in Table 1 that pods per plant were greatly affected by the effect of different rates of phosphorus application. The minimum number of pods i.e. 37.50 were found in case of control treatment where no fertilizer was applied (F_0). The maximum number of pods per plant were recorded with the application of 75 kg P_2O_5 ha^{-1} at sowing (F_3) which gave more number of pods than F_2 50 kg P_2O_5 ha^{-1} at sowing and F_1 (25 kg P_2O_5 ha^{-1} at sowing). Where 53.37 and 47.17 number of pods were recorded respectively.

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 Muhammad (1964), Sharer (1968) and Gill (1979).

The average number of seed per pod have ultimate effect on the seed yield in case of lentil crop. The data in table revealed that there was significant differences among various treatment means when phosphorus was applied at varying rates. The comparison between individual treatment means indicated the minimum number of seeds (1.39) in case of control treatment where no fertilizer was applied (F_0). Where as 1.89 seeds per pod were found with the application of 75 kg P_2O_5 ha^{-1} at sowing (F_3) which were maximum then number of seeds recorded as a result of F_2 (50 kg P_2O_5 ha^{-1} at sowing) and F_1 (25 kg P_2O_5 ha^{-1} at sowing).

It is evident from the results that 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 photosynthesis from the stalks, leaves and other growing parts to the economically important organs like seed making them plump and bold.

Table 1: Effect of different phosphorus levels on growth and yield performance of lentil.

Treatments P_2O_5 kg ha^{-1}	Plant height at maturity (cm)	No. of pods per plant	No. of seed per pod	1000-seed weight (g)	Grain yield kg ha^{-1}
F_0 = 0 (Control)	34.12d	37.50d	1.39d	17.29 c	798.61 d
F_1 = 25	40.63 c	47.17c	1.56c	18.86 b	923.61 c
F_2 = 50	44.36 b	53.37 b	1.72 b	19.27 a	1111.11 b
F_3 = 75	49.52 a	62.37 a	1.89 a	19.38 a	1250.00 a

Any two means not sharing a letter differ significantly at 5% level of probability (LSD)

The ultimate yield of legume crop depends not only upon the number of pods and seed per pod but also on the seed size and weight. Data presented in table revealed that effect of rates of phosphorus application was highly significant towards 1000-seed weight. Minimum 1000-seed weight i.e. 17.29 was recorded in case of F, where no fertilizer was applied and this treatment differ significantly from all other treatments. Maximum 1000-seed weight i.e. 19:38 was recorded with the application of 75 kg P_2O_5 ha^{-1} at sowing. (F_2) which remained statistically at par with F_2 (50 kg P_2O_5 ha^{-1} at sowing) and it was maximum than all other treatments. 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.

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. A study of the data of seed yield alongwith analysis of variance presented in table indicated that there was a highly significant effect of rate of different phosphorus application on the seed yield in case of lentil. However, highest seed yield ha^{-1} was recorded with the application of 75 kg P_2O_5 ha^{-1} at sowing) treatments.

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 Muhammad (1964), Ali *et al*. (1981) and Singh and Singh (1992).

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