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Effect of Different Combinations of Nitrogen and Phosphorus on the Growth and Yield of Three Varieties of Lentil (*Lens culinaris* Medik)

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Abstract

Yield and yield components of three varieties of lentil (*Lens culinaris* Medik) Masoor - Local, Masoor-85 and Masoor-93 as influenced by N and P levels of 0-0, 25-60, 37-90 and 50-120 kg ha^{-1} was conducted under field conditions during 1997. The NP combinations significantly affected the yield, yield components and harvest index. The NP level of 50-120 kg ha^{-1} produced significantly higher seed yield (2265.37 kg ha^{-1}) due to more number of pods per plant (63.83), number of seeds per pod (1.70) and 1000-seed weight (19.55 g). Among the cultivars, Masoor-93 owing to more number of pods per plant and 1000 - seed weight gave significantly higher seed yield (2340.39 kg ha^{-1}) against the minimum of 1616.41 kg ha^{-1} in Masoor – Local. Based on the present findings the cultivar Masoor – 93 and NP level of 50-120 kg ha^{-1} seems to be the best combination for getting higher lentil seed yield (3068.32 kg ha^{-1}) under Faisalabad conditions.

Key words: Lentil (*Lens culinaris*), NP levels, yield, Varieties,

Introduction

Lentil (*Lens culinaris* M.), locally known as "Masoor" is an important rabi season pulse crop. It is a cheap source of vegetable protein and possesses a considerable amount of vitamin A and B along with iron, phosphorus and calcium and thus serves as a food of high calories and nutritive value. The average protein content of lentil seed is 23.7 per cent (Pellet and Shadarevian, 1970).

Lentil is grown on an area of 46.1 thousand ha with total annual production of 27.0 thousand tones resulting in an average yield of 585 kg ha^{-1}, which is very low than the world average lentil production of 951 kg ha^{-1} (Anonymous, 2002).

Lentil is mostly grown on lands with low fertility. Growing lentil without fertilizer application or at a very low rate is considered a major factor for low yield in Pakistan.

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Being a leguminous crop, lentil has ability to fix atmospheric nitrogen through nodulation. So, requirement for nitrogenous fertilizer is usually less, but a low quantity of N as starter dose is beneficial for the crop (Ojha *et al.*, 1977). However, it needs phosphorus in greater amount for optimum growth and development conducive to higher seed yield (Sharar *et al.*, 1976). Lentil gives higher yield when fertilized with phosphorus alone than that of nitrogen alone (Singh *et al.*, 1991).

Another reason for low lentil yield in Pakistan is the use of low yielding cultivars having low response to inputs and management practices, narrow adaptability to edaphic and climatic conditions and susceptibility to diseases. Varieties vary greatly in yield and yield components like number of branches per plant, number of seeds per pod and 1000-seed weight (Baidya, 1988) and (Hussain *et al.*, 2002). So the yield on per unit area basis can be increased by the judicious use of fertilizers and selection of high yielding and fertilizer responsive genotypes. The present experiment was, therefore, conducted to determine the effect of different NP levels on the growth and yield of three varieties of lentil under Faisalabad conditions.

Materials and Methods

The experiment to study the effects of different NP levels on growth and yield performance of lentil varieties was conducted at the Agronomic Research Area, University of Agriculture, Faisalabad. The experiment was laid out in a split plot design with four replications, measuring a net plot size of 1.80 x 6.50 m. The fertilizer combinations were randomized in the main plots and varieties in the sub plots. The cultivars were sown in 30 cm apart rows with a single row hand drill, using 25 kg seed ha^{-1} for Masoor-93, 20 kg seed ha^{-1} for Masoor-Local and Masoor-85, respectively. The whole of the nitrogen and phosphorus was applied at the time of sowing in the form of urea and single super phosphate, respectively. All other cultural practices, except under trial were kept normal and uniform for all the experimental units. The crop was harvested at its full maturity, dried and then threshed manually. Observations on desired agronomic parameters were recorded using standard procedures. Harvest index was computed by the following formula:

Harvest index = Economic yield / Biological yield x 100

The data collected were analyzed statistically using Fisher's analysis of variance technique and the least significant difference (LSD) test at 0.05 probability was used to compare the treatments' means (Steel and Torrie, 1984).

Results and Discussions

The data for yield and yield components are presented in Table 1. Plant height was influenced significantly by NP combinations and the increase was significant at each increased NP level. The NP level of 50-120 kg ha^{-1} produced plants of maximum height. Significant increase in plant height with fertilizer application has also been reported by Sharar *et al.* (1976). The cultivar Masoor-Local produced significantly taller plant than Masoor-85 and Masoor-93.The differences between Masoor-85 and Masoor-93 were not significant. These differences can be attributed to their inherent growth potential and environmental adaptability. Similar results have been reported by Hussain *et al.* (2002).

The number of pods per plant was affected significantly by the various NP combinations. The NP level of 37-90 kg ha^{-1} did not differ significantly from NP levels of 25-60 and 50-120 kg ha^{-1}. The difference between control and 25-60 NP kg ha^{-1} were also not significant. Application of 50-120 kg NP ha^{-1} produces the maximum pods per plant. Differences in pod number per plant due to fertilizer application has also been observed by Sharar *et al.*(1976) and Mandal and Majumdar (2001).All cultivars produced statistically similar number of pods per plant. Maximum and minimum number of pods per plant was produced by Masoor-93 and Masoor-Local, respectively. These results are contrary to those of Bahl and Jain (1977). These contradictory results can be attributed to differences in the genetic make up of the cultivar, fertility status of the soil and environmental conditions. Interactions between the factors was not significant.

Number of seeds per pod was significantly increased by NP application over control. Application of NP fertilizers at the rate of 50-120 kg ha^{-1} produced the maximum seeds per pod but remained statistically similar to NP level of 37-90 kg ha^{-1}. The differences in seed number per pod due to application of different NP levels had been due to changes in nutrient supply. The results are supported by the findings of Sharar *et al.* (1976) and Hussain *et al.* (2002). Varieties also differed significantly from each other regarding seed number per pod. Masoor-85 produced the maximum seeds per pod, while Masoor-93 gave the minimum seeds per pod. These differences can be attributed to differences in genetic traits of crop plants. Differences in seeds per pod among the various genotype had also, been reported by Hussain *et al.* (2002).Interaction between NP applications and varieties was also found to be significant. Masoor-85 fertilized at the rate of 50-120 kg NP ha^{-1} produced the maximum seeds per pod.Whereas, Masoor-93 at control gave the minimum seeds per pod.

Table 1 revealed that 1000-seed weight was influenced significantly by the various NP combinations. Control gave the minimum seed weight and remained statistically at par with 25-60 kg NP ha^{-1}. The differences among NP levels of 25-60, 37-90 and 50-120 kg ha^{-1} were also not significant. These results are supported by those of Kumar *et al.* (1993) and Hussain *et al.* (2002). Masoor-93 produced significantly the heaviest grains, whereas the Masoor-85 produced the lightest grains and it did not differ significantly from Masoor-Local. The variation among cultivars can be attributed to their variable sink capacity. Similar results have also been reported by Baidya (1988) and Hussain *et al.* (2002). Interaction between varieties and NP applications was also significant. The application of NP fertilizer at the rate of 50-120 kg ha^{-1} to Masoor-93 produced significantly the heaviest seed. While Masoor-Local with out fertilizer produced the lightest seed.

The data pertaining to the seed yield given in table 1 revealed that various NP combinations significantly affected the seed yield. There had been a consistent and significant increase in seed yield with the increase in NP application. Application of 50-120 kg NP ha^{-1} gave the maximum seed yield and it was followed by NP level of 37-90 kg ha^{-1}. The control produced the minimum seed yield of 1414.63 kg ha^{-1}. Increase in seed yield by NP application has also been reported by various workers before Sharar *et al.* (1976), Singh *et al.* (1991), Shah *et al.* (2000), Mandal and Majumdar (2001) and Hussain *et al.* (2002). Significant differences were also observed among the varieties. Masoor-93 produced significantly more seed yield than other varieties. Masoor-85 and Masoor-Local did not differ significantly from each other. Variable yield potential among lentil genotypes has also been reported by Sadiq *et al.* (1998) and Hussain *et al.* (2002). Interaction between NP levels and varieties was also significant. Masoor-93 fertilized @ 50-120 kg NP ha^{-1} produced significantly the higher seed yield, while Masoor-Local with out fertilizer application produced the minimum seed yield.

The application of NP fertilizers significantly influenced the harvest index. The NP level of 37-90 kg ha^{-1} gave the maximum harvest index value but it did not differ significantly from 50-120 kg NP ha^{-1}. The differences between control and 25-60 kg NP ha^{-1} were not significant. Significant effects of NP application on harvest index have also been reported by Mandal and Majumdar (2001). All cultivars differed significantly from one another regarding harvest index. The Masoor-93 produced significantly highest harvest index value than other cultivars. Similar results have been reported by Sadiq *et al.* (1998), Hussain *et al.* (2002) and Shah *et al.* (2000). Interaction between the factors was also significant. Masoor-Local without NP application gave the minimum harvest index while, Masoor-93 fertilized @ 37-90 kg NP ha^{-1} gave the maximum harvest index value.

Table 1: Agronomic traits of three lentil cultivars as affected by NP application.

Treatments	Plant height (cm)	No. of podes plant^{-1}	No. of seeds pod^{-1}	1000- seed weight(g)	Seed yield (kg ha^{-1})	Harvest index (%)
A. NP levels (kg ha^{-1})						
F_1(0-0)	47.07d	39.92c	1.54c	18.37b	1414.63d	40.34b
F_2(25-60)	52.86c	48.47bc	1.64b	18.96ab	1737.11c	42.25b
F_3 (37-90)	58.72b	58.25ab	1.67ab	19.39a	2013.09b	47.14a
F_4(50-120)	63.28a	63.83a	1.70a	19.55a	2265.37a	46.43a
B. Varieties						
V_1 (Masoor-Local)	57.88a	48.23^{ns}	1.66b	17.00b	1616.41b	33.49c
V_2 (Masoor-85)	54.51b	52.94	1.74a	16.93b	1616.46b	44.52b
V_3(Masoor-93)	54.06b	56.67	1.51c	23.27a	2340.39a	54.11a
C. Interaction						
F_1V_1	50.72^{ns}	38.40^{ns}	1.58ef	16.35e	1196.05f	27.16f
F_1V_2	45.85	39.42	1.68cd	16.77de	1276.55f	37.23de
F_1V_3	44.62	41.92	1.36g	22.00c	1771.30de	56.63a
F_2V_1	56.61	42.70	1.67cd	17.07de	1607.45e	33.88e
F_2V_2	51.27	49.06	1.76abc	17.28de	1559.76f	49.85b
F_2V_3	50.68	53.66	1.50f	22.55c	2044.13c	43.03cd
F_3V_1	60.33	55.46	1.77ab	17.69d	1631.76e	32.60ef
F_3V_2	57.73	57.62	1.70bcd	16.87de	1932.12cd	41.85bc
F_3V_3	58.07	61.65	1.54f	23.60b	2477.81b	59.99a
F_4V_1	63.83	56.37	1.65de	16.90de	2030.38c	40.35d
F_4V_2	63.16	65.67	1.81a	16.79de	1697.43e	42.14d
F_4V_3	62.85	69.45	1.66de	24.96a	3068.32a	56.79a

Means sharing letters in common do not differ significantly at 5% probability level.

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