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Response of lentil (lens culinaris Medick.) varieties to phosphorus application

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Abstract

A field experiment was conducted during rabi season of 2014-15 at the research farm of R.B.S College, Bichpuri, Agra.(U.P.) to evaluate the response of lentil varieties to phosphorus application. The results revealed that the height of plant at the successive stages of crop growth was increased with increasing levels of phosphorus up to 90 kg ha^{-1}, but the difference were recorded significant only up to 60 Kg P_2O_5 ha^{-1}. The increase in the grain yield was 30.50, 40.72 and 42.35 percent with 30 , 60 and 90 Kg P_2O_5 ha^{-1} , respectively over control. The increase in the straw yield was 49.50, 68.48 and 71.88 percent with 30 , 60 and 90 Kg P_2O_5 ha^{-1}, respectively over control. The growth , yield and quality of lentil crop improved by the phosphorus application. In general, MDL-94 and L-4147 varieties gave better performance with the soil application of 60 Kg P_2O_5 ha^{-1} and it may be recommended to the farmer's for obtaining better production of lentil crop in Agra region.

Key worlds: Yield, quality, nutrients content and uptake

Introduction

Lentil (Lens culinaris Medick.) occupies only 3.75 percent of the total area under pulse in India, contributing about 5.4% of the total pulse production. Nevertheless, it is an important component of various intensive cropping system followed in different parts of the country. The average productivity of lentil is very low (467 kg ha^{-1}) compared with the productivity of food grains (1196 kg ha^{-1}) as well as with the overall pulse productivity(552 kg ha^{-1}). The important factors responsible for poor yield in lentil are lack of high yielding varieties suited to various situations and poor management technology including nutrition (Anonymous, 2005). Lentil is generally grown after kharif crops like rice , maize, sorghum, arhar (early) etc. under irrigated and un-irrigated conditions, Rice-lentil, Arhar-lentil, late Jowar- lentil, are common and popular crop rotations in many parts of Uttar Pradesh. There is a great scope to boost up the per hectare yield in India. It has been observed that much higher yields are obtained, where improved agro-techniques have been used in crop production. Among different factors, which may boost up the productivity, suitable variety, sowing time, water and fertility management are of prime importance. Yield of late sown lentil is lower than normal sown lentil, low plant population with lower dose of phosphate fertilizer in late sown condition resulted in lower yield than generally obtained with higher plant population and using higher level of phosphate. Limited information is available on these aspects under agro-climatic condition of eastern U.P. The present investigation was therefore carried out to study the response of lentil varieties to phosphorus application.

Materials and Methods

The experiments were conducted at the research farm of R.B.S. College, Bichpuri, Agra during rabi of 2014-15. The soil was sandy loam in texture , having available N 190.10 kg/ha , P 11.25 kg / ha, K 185.10 kg / ha and Zn 0.46 ppm and soil pH 8.6 . The experiment was laid out in R.B.D with three replications. The treatment consisted of three level of varieties [V1(DPL-62), V2(L-4147) and V3 (MDL-

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94)] and four levels of phosphorus (control, 30,60 and 90 kg P_2O_5 ha^{-1}), The crop was sown on 23-10-2014. The sowing was done in furrow 5 cm deep at distance of 25 cm keeping 30 kg seed ha^{-1}used for all varieties. All agronomical practices like weeding, intercultural practices and irrigation were done according to need of the crop. Growth and yield attribute character parameter were recorded at the time of harvest of crop. The grain and straw samples were analyzed for their N and P contents by adopting standard procedures (Jackson 1973).

Results and Discussion

The data on grain yield of lentil as influenced by different varieties and phosphorus levels are summarized in Table 1. Perusal of data given in Table 1 indicates that the application of phosphorus exhibited pronounced effect on the grain yield (q ha^{-1}) during experimentation. The grain yield (q ha^{-1}) was increased with increasing levels of phosphorus up to 90 kg ha^{-1} but the difference was recorded significant only up to 60 kg phosphorus ha^{-1}. The maximum grain yield of 11.94 (q ha^{-1}) was recorded with 90 kg phosphorus ha^{-1}, as against as low 8.40 (q ha^{-1}) with no phosphorus (control). The percentage increase in the grain yield over control was 30.60, 40. 72 and 42.35 with the application of 30,60 and 90 kg P_2O_5 ha^{-1} respectively, over control(no phosphorus). These results are in favour of Chaudhary et al., (2000), Singh Pratap (2004), Dixit et al. (2011) and Lal et al., (2013). The results indicate that the varietal differences were found to be significant in respect of straw yield (q ha^{-1}). It is evident from data given in Table 1 that the straw production of lentil followed the same pattern, which was noted with grain yield lentil crop responded significantly to each increasing levels of phosphorus over control. As far as productivity of lentil crop in respect of straw out turn is concerned, it was to be 49.50, 68.48 and 71.88 percent with 30,60 and 90 kg phosphorus ha^{-1} respectively, over no phosphorus application (Control).

The quality of produce was judge in term of percent protein content and its production (kg ha^{-1}). Data presented in table 1 shows that variety V_3 (MDL-94) has highest percent protein content in grain than other varieties . However differences amongst varieties were non- significant. With respect to protein production (kg ha^{-1}) Variety V_3 (MDL-94) proved superior followed by V_2 (L-4147) while varieties V_1 (L- 4147) and V_1 (DPL-62) were at par in this respect. A perusal of data given in Table 1 revels that the application of phosphorus marked significant improvement in percent protein content and its production. The highest percent protein content was recorded with 90 kg P_2O_5 ha^{-1} which was at par with 30 and 60 kg P_2O_5 ha^{-1} but all doses of phosphorus were significantly superior over control. The protein production (kg ha^{-1}) was increased with increasing levels of phosphorus up to 90 kg ha^{-1} . The increase in protein content (%) was to the extent of 3.28 , 4.15 and 5.34 % due to 30 , 60 and 90 kg P_2O_5 ha^{-1} as compared to control, respectively. These results are in favour of Singh et al., (2005), Tripathi et al., (2006) and Lal et al., (2013).

The percent content of nitrogen at harvest was determined for grain and straw separately. The data

Table 1: Grain yield, straw yield (q ha^{-1}), protein content and protein production of lentil in relation to by different varieties and levels of phosphorus

Treatment	Grain yield (q ha^{-1})	Straw Yield (q ha^{-1})	Protein content (%) in grain	Protein production (kg ha^{-1})
Varieties				
V_1	8.90	17.20	15.60	192.10
V_2	9.75	19.69	15.45	220.24
V_3	10.68	20.70	16.10	265.80
S.Em±	0.04	0.04	0.16	1.20
C.D. at 5%	0.12	0.12	0.46	3.50
Levels of phosphorus				
P_0	8.30	13.10	15.10	170.10
P_1	10.23	16.85	15.55	220.60
P_2	11.20	19.40	16.15	245.10
P_3	11.87	20.08	16.00	260.10
S.Em±	0.05	0.05	0.140	1.20
C.D. at 5 %	0.15	0.15	0.40	3.50

Table 2: Nitrogen content (%), Nitrogen uptake (kg ha^{-1}) in grain and straw in relation to different varieties & levels of phosphorus

Treatments	N content (%)		N Uptake (kg ha^{-1})	
	Grain	Straw	Grain	Straw
Varieties				
V_1	2.05	0.44	15.92	8.17
V_2	1.97	0.47	16.80	9.70
V_3	2.11	0.50	18.48	10.35
S.Em±	0.04	0.04	0.05	0.05
C.D. at 5%	0.11	0.11	0.12	0.12
Levels of phosphorus				
P_0	1.95	0.45	13.50	6.05
P_1	2.03	0.47	16.88	8.45
P_2	2.05	0.52	18.90	10.47
P_3	1.94	0.50	19.50	10.40
S.Em±	0.03	0.04	0.03	0.004
C.D. at 5 %	0.09	0.11	0.09	0.11

Table 3: Phosphorus content (%) , phosphorus uptake (kg ha^{-1}) in grain and straw

Treatments	P content (%)		P Uptake (kg ha^{-1})	
	Grain	Straw	Grain	Straw
V_1	0.19	1.03	1.94	1.75
V_2	0.21	1.01	2.14	3.35
V_3	0.24	0.110	2.33	7.86
S.Em±	0.003	0.030	0.012	0.006
C.D. at 5%	0.008	0.08	0.04	0.017
Levels of phosphorus				
P_0	0.20	0.094	1.44	1.25
P_1	0.22	0.105	1.88	2.03
P_2	0.24	0.110	2.18	2.30
P_3	0.20	0.115	2.18	2.44
S.Em±	0.005	0.010	0.06	0.040
C.D. at 5 %	0.015	0.02	0.17	0.010

given in Table 2 revels that the different varieties had a significant effect on nitrogen content (%) in straw and its uptake in grain and straw. The variety V3 (MDL-94) is higher nitrogen content and its uptake in grain and straw then the other cultivars. There was no significant variation of nitrogen in grain. Data given in Table 3 clearly indicate that nitrogen content increased with every increase in the level of phosphorus up to 90 kg ha^{-1}. The differences in all the levels of phosphorus over its lower level were non-significant. The uptakes of N in grain, straw and total produce were increase significantly up to 60 kg P_2O_5 ha^{-1}. However difference between 60 and 90 kg P_2O_5 ha^{-1} were non- significant. The increase in uptake of nitrogen were 15.92, 16.80 and 18.48 kg ha^{-1} in grain of V1,V2 and V3 varieties, respectively, similar to these findings Lal et al., (2013).

It is evident from Table 3 that the variety V3 (MDL-94P) proved better in case of phosphorus content and its uptake by grain and straw of lentil in this experimentation. The phosphorus uptake was also recorded highest with V3 variety of lentil crop. It is also noted that phosphorus content and its uptake increased with increasing level of phosphorus in grain and straw of lentil crop. The maximum phosphorus content and uptake was noted under highest level P3 (90 Kg P_2O_5) of phosphorus. Similar to these findings Kumawat and Kumawat (2009) and Singh et., al (2010).

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