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## Effect of fertility levels and varieties of lentil (*Lens culinaris Medicus*)

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### Abstract

The present investigation was conducted with the effect of fertility levels and varieties on growth, yield and quality of lentil. A factorial experiment based on randomized block with three replications was conducted in 2016-17. The treatments consist of four fertility levels of  $F_1=10:50:10\text{NPK/ha}$ ,  $F_2=20:60:20\text{NPK/ha}$ ,  $F_3=30:70:30\text{NPK/ha}$ ,  $F_4=40:80:40\text{NPK/ha}$  and three varieties of lentil (PL-4, Rani K-75 and HUL-57) as test crop at Agricultural Research Farm of AKS University, Sherganj, Satna (M.P.). In field experiment finding application of NPK @ 40:80:40kg/ha caused higher growth of plants, besides yield attributes as well as seed yield (12.35 q/ha.) was observed in HUL-57 and followed by Rani K-75 and lowest seed yield PL-4 found to be more in comparison to other cultivars under investigation. Interactive use of fertility levels  $\times$  varieties were also found to be significant and maximum seed yield *i.e.*, (12.37 q/ha) was obtained when NPK @ 40:80:40kg/ha along with HUL-57 was used.

**Keywords:** fertility level, plant growth, variety and seed yield of lentil

### Introduction

Lentil (*Lens culinaris Medicus*) is the second largest producing in world. Lentil mostly cultivated state in India Uttar Pradesh and Madhya Pradesh is largest lentil growing region in India. The area, production and productivity during 2014-15 in India were 15 lakh ha, 9.5 lakh tonnes and 633.33 (Ministry of agriculture in India) respectively and in area, production and productivity during 2014-15 in Madhya Pradesh were 5.64 lakh ha, 2.87 lakh tonnes and 508.87 kg/ha. Lentil is one of the important grain legume crops. Lentil is a rich source of carbohydrate, protein, vitamin, minerals, dietary fibre with high energy value (de Almeida costa *et al.*, 2006) [2] and it contain substantial amount of oleic, linoleic and palmitic acid (Roy *et al* 2009) [3]. Lentil approximately contains about 25% protein, 11% water, 58% carbohydrate, 3% fibre and 3.3% ash. NPK improves the quality of lentil nitrogen plays a vital role in plant metabolism activity it is necessary for formation of amino acids and the building blocks of protein. The effect of excess nitrogen application accelerates the maturity of plant, improving grain quality and retarding excess vegetative growth. The per cent of nitrogen fixed was significantly affected by crop variety and number of nodules. Phosphorus increases grain and straw yield and attributed to more number of pods per plant and seed weight per plant involved in photosynthesis, respiration, energy storage and transfer, cell division and enlargement it has important role in the formation of root nodules and important role in nitrogen fixation. Phosphorus deficiency reduce the number of flowers on lentil. Potash is important in nitrogen fixation on lentil and it is important in protein, starch synthesis, water nutrient, sugar transport and crop quality improving on lentil. Consider as reaction catalyst and it affects the efficiency of various enzymes.

### Materials and Methods

The experiment was conducted at the Instructional cum research farm, AKS University, Sherganj, Satna (M.P.) for *rabi* season 2016-2017. The experimental site is situated at the latitude of 23°58' N and longitude of 80°81' east in mid northern part of Rewa. The experimental farm lies in humid sub-tropical with an average rainfall is 1077mm and mean temperature range from 21 °C to 31 °C during crop season A field experiment was conducted in factorial randomized block design using three varieties of lentil (PL-4, Rani K-75, HUL-57) and different NPK dose of  $F_1=10:50:10\text{NPK/ha}$ ,  $F_2=20:60:20\text{NPK/ha}$ ,  $F_3=30:70:30\text{NPK/ha}$ ,  $F_4=40:80:40\text{NPK/ha}$  as test crop at Agricultural Research Farm of AKS University, Sherganj, Satna (M.P.). The surface soil (0-15 cm) samples collected from the experimental farm were analyzed for physico-chemical properties as suggested by Jackson (1973). The soil was well drained, sandy loam in texture having pH 7.5, EC 0.16 dsm-1, organic carbon 0.30 g kg-1,

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available nitrogen 176.6 kg ha<sup>-1</sup>, available phosphorus 12.5 kg ha<sup>-1</sup> and available potassium 200 kg ha<sup>-1</sup>. NPK was applied through urea, single super phosphate, muriate of potash and elemental sulphur, respectively. As per treatments, basal dressing along with ½ dose of nitrogen, full dose of phosphorus and potash at the time of sowing and remaining ½ dose of N was applied at 30 days after sowing (DAS). The crop was sown in spacing (30x5 cm apart) on 15 November, 2016 and harvested on 17 March 2017 at maturity yield attributing characters.

## Result and Discussion

### Growth parameters

Fertility levels of lentil N<sub>30</sub>P<sub>70</sub>K<sub>30</sub> maximum plant height at harvest stage was 61.84 cm, the number of branches at 90 DAS were 12.13/plant, respectively. The number of nodules was 16.76/plant and N<sub>40</sub>P<sub>80</sub>K<sub>40</sub> maximum fresh weight, dry weight. Such increases in growth parameters may be growing to the significant role of applied NPK in augmenting the metabolic activities, photosynthesis by way of root enlargement and better microbial activities. Nitrogen plays a vital role in plant metabolism, increased plant height, P is involved in photosynthesis, respiration, energy storage and transfer, cell division and enlargement. K is important in nitrogen fixation on lentil. The varieties developed from different parental origins are the important factors which effect on the growth of plants. Amongst the lentil varieties, PL-4 resulted in maximum plant height (58.69 cm), branches (10.52/plant, number of pods/plant HUL-57 recorded significantly highest pods count (136.91/plant) as against PL-4 (128.30 pods/plant). Similarly N<sub>40</sub>P<sub>80</sub>K<sub>40</sub> produced significantly higher 142.31 pods/plant in comparison to only

124.35 pods/plant under lowest fertility (N<sub>10</sub>P<sub>50</sub>K<sub>10</sub>). Highest pods count (146.89/plant). With the decrease in NPK level, the formation was also decreased in each variety of lentil. Thus the minimum pods formation was only 120.17/plant in case of PL-4 under lowest fertility (N<sub>10</sub>P<sub>50</sub>K<sub>10</sub>). The seed yield increased highest fertility level (N<sub>40</sub>P<sub>80</sub>K<sub>40</sub>) raised the yield parameter significantly (12.37 q/ha), whereas it was 9.11 q/ha under the lowest fertility level (N<sub>10</sub>P<sub>50</sub>K<sub>10</sub>). Among the varieties, the yield of Rani K-75 and HUL-57 was increased significantly ranging from 10.72 to 12.35 q/ha, whereas the yield due to PL-4 was 9.48 q/ha. Amongst the treatment interactions, HUL-57 grown with highest fertility level resulted in highest grain yield (13.86 q/ha), followed by HUL-57 grown with the N<sub>30</sub>P<sub>70</sub>K<sub>30</sub> fertility level (13.10 q/ha). The grain yield decreased with the decrease in NPK levels under each of the varieties. Thus, the significantly lowest yield (8.00 q/ha) was secured from PL-4 grown with lowest NPK level. The remarkable increase in plant height and formation of higher number of branches/plant due to higher doses of phosphorus associated activities of Rhizobium and PSB bio fertilizers supplying additional nutrients and solubilized phosphorus may be as a result of acceleration of cell elongation and cell division. The present findings confirm with those of several research workers (Sayed, 1999; Saha *et al.*, 2004, Singh *et al.*, 2011, Saket *et al.*, 2014, Singh and Singh, 2017) [5, 4, 7, 6, 8]. Based on the experimental results it may be concluded that N<sub>40</sub>P<sub>80</sub>K<sub>40</sub> kg / ha. is the best for maximizing seed yield in lentil and among the varieties HUL- 57 where found superior PL-4 and Rani K-75 in respect of seed yield HUL- 57 can be grown with 12.35 q/ha to obtain the highest seed yield.

**Table 1:** Growth parameters of lentil as influenced by fertility levels and varieties

Treatments	Plant height (cm) at harvest	Branches/plant 90 DAS	Root nodules/plant at 45 DAS	Fresh weight/plant (g) at 90 DAS	Dry weight/plant (g) at 90 DAS	No of Pods/plant	No of Seeds/pod	Seed yield(q/ha)
<b>Fertility levels (kg/ha)</b>								
N <sub>10</sub> P <sub>50</sub> K <sub>10</sub>	49.13	7.83	10.71	8.12	1.68	124.36	1.30	9.11
N <sub>20</sub> P <sub>60</sub> K <sub>20</sub>	59.87	9.89	13.96	8.90	1.79	128.48	1.37	10.46
N <sub>30</sub> P <sub>70</sub> K <sub>30</sub>	61.84	12.13	16.76	10.22	2.09	135.26	1.44	11.46
N <sub>40</sub> P <sub>80</sub> K <sub>40</sub>	57.80	9.04	12.62	11.20	2.19	142.31	1.47	12.37
S.Em±	2.10	1.04	1.08	0.10	0.044	0.57	0.017	0.075
C.D. (P=0.05)	6.22	3.05	3.17	0.29	0.130	2.07	0.051	0.221
<b>Varieties</b>								
PL-4	58.69	10.52	14.40	9.31	1.83	128.30	1.34	9.48
Rani K-75	57.97	9.63	13.48	9.59	1.92	132.60	1.39	10.72
HUL-57	54.82	9.02	12.65	9.93	2.07	136.91	1.46	12.35
S.Em±	1.85	0.90	0.95	0.087	0.038	0.50	0.015	0.065
C.D. (P=0.05)	NS	NS	NS	0.25	0.112	2.07	0.044	0.191
Interactions	NS	NS	NS	NS	NS	NS	NS	Sig.

**Table 2:** Plant height (cm) of lentil at different growth intervals as influenced by fertility levels, varieties and their interactions

Treatments	Plant height (cm)			
	30	60	90 DAS	At harvest
<b>Fertility levels (kg/ha)</b>				
N <sub>10</sub> P <sub>50</sub> K <sub>10</sub>	6.80	20.33	47.51	49.13
N <sub>20</sub> P <sub>60</sub> K <sub>20</sub>	7.47	22.75	58.22	59.87
N <sub>30</sub> P <sub>70</sub> K <sub>30</sub>	8.29	24.69	61.17	61.84
N <sub>40</sub> P <sub>80</sub> K <sub>40</sub>	7.64	22.69	55.93	57.80
S.Em±	0.26	0.70	2.33	2.10
C.D. (P=0.05)	0.77	2.06	6.84	6.22
<b>Varieties</b>				
PL-4	7.93	23.08	57.67	58.69
Rani K-75	7.72	22.62	56.53	57.97
HUL-57	7.00	22.15	54.43	54.82

S.Em±	0.23	0.61	2.01	1.85
C.D. (P=0.05)	0.67	NS	NS	NS
Interactions	NS	NS	NS	NS

**Table 3:** Number of branches/plant of lentil at different growth intervals as influenced by fertility levels, varieties and their interactions

Treatments	Number of branches/plant			
	30	60	90 DAS	At harvest
<b>Fertility levels (kg/ha)</b>				
N10P50K10	3.21	6.78	6.82	7.83
N20P60K20	4.19	8.11	8.89	9.89
N30P70K30	4.53	10.96	11.13	12.13
N40P80K40	3.69	7.98	8.38	9.04
S.Em±	0.28	0.78	0.99	1.04
C.D. (P=0.05)	0.83	2.28	2.89	3.05
Varieties				
PL-4	4.23	7.65	9.77	10.52
Rani K-75	3.76	7.90	8.44	9.63
HUL-57	3.72	8.31	8.76	9.02
S.Em±	0.24	0.67	0.85	0.90
C.D. (P=0.05)	NS	NS	NS	NS
Interactions	NS	NS	NS	NS

**Table 4:** Number of seeds/pod of lentil as influenced by fertility levels, varieties and their interactions

Fertility levels (kg/ha)	Varieties			Mean
	PL-4	Rani K-75	HUL-57	
N10P50K10	1.22	1.31	1.38	1.30
N20P60K20	1.34	1.34	1.42	1.37
N30P70K30	1.40	1.44	1.50	1.44
N40P80K40	1.41	1.46	1.54	1.47
Mean	1.34	1.39	1.46	
	Fertility levels	Varieties	Interaction	
S.Em±	0.017	0.015	0.030	
C.D. (P=0.05)	0.051	0.044	NS	

**Table 5:** Seed yield (q/ha) of lentil as influenced by fertility levels, varieties and their interactions

Fertility levels (kg/ha)	Varieties			Mean
	PL-4	Rani K-75	HUL-57	
N10P50K10	8.00	9.04	10.31	9.11
N20P60K20	8.84	10.41	12.14	10.46
N30P70K30	10.14	11.15	13.10	11.46
N40P80K40	10.96	12.29	13.86	12.37
Mean	9.48	10.72	12.35	
	Fertility levels	Varieties	Interaction	
S.Em±	0.075	0.065	0.130	
C.D. (P=0.05)	0.221	0.191	0.383	

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