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Effect of foliar application (nitrogen and phosphorus) on different agronomic and economic character in lentil (*Lens culinaris* M.)

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Abstract: A field experiment was conducted during *rabi* (Winter) season of 2006-07 N.D. University of Agriculture and Technology, Kumarganj, Faizabad (U.P.) to study the performance of lentil variety Narendra Masoor -1 to foliar nutrition of nitrogen & phosphorous. The experiment was laid out in randomized block design with 4 replications & 10 treatments consisted of various concentration of urea and DAP, which where applied to lentil crop as foliar application at various growth stages of crop. A uniform dose of N P K & S @ 20:40:20:20 Kg ha^{-1} was applied through basal application to entire experimental crop. All the treatments showed their superiority in respect to seed and straw yield over control treatment. The highest seed yield was observed when two spray of 2% urea each at branching and pod formation stage was applied to lentil corp.

Key words: Lentil, Foliar nutrition, Basal application

Introduction

Pulses being rich in quality protein, minerals and vitamins are inseparable ingredient in the diets of a vast majority of Indian population. Pulses are relatively more important in Indian as their contribution in nutrition supply is more than that in Asia and World. Being Leguminous crops, pulses have the ability to fix atmospheric nitrogen in symbiotic relationship with rhizobium bacteria, which enables them to meet their own nitrogen requirement as well as to meet the nitrogen requirement. Lentil (*Lens culinaris.* M) is predominantly cultivated in Asia which accounts for 80% of global area and 75% of world production. In India it is the second most important grain legumes of *rabi* season ranking next to chickpea, with an area of 1.59 million ha, production of 0.94 million tonnes and productivity of the 591 kg ha^{-1} (Anonomous, 2012). The major lentil producing states are U.P., M.P., Bihar, West Bengal, Rajasthan and Assam. In U. P. it is mainly cultivated under marginal and submarginal lands, Diara lands, after harvest of Paddy in input starved situations. The average productivity of lentil is low as compared to its experimental yield of 30 q/ha^{-1}. The various cultivation practices adopted for increasing lentil production are the simple and cheap. Most of the crop lentil growing soils are deficient of P & N status. Use of recommended N & P is essential for growth and productivity and crop resistance to diseases. Feeding plants through soil of these two nutrients is uneconomical, slow and complicated. Under rice fallow situations, there is no possibility of basal application of fertilizer for lentil since under *utera* condition it is grown prior to harvest of rice crop and fertilizer incorporation become impossible. Under these circumstances foliar application would be more appropriate efficient and economical than the soil application (Rajesh and Paulpandi, 2013). Foliar application of fertilizer assumes greater importance also as the nutrient remains throughout in immediate vicinity of the metabolizing area viz, foliage (De and Chatterjee, 1976; Mala and Selvam, 1998). Moreover, applications of fertilizer through soil improve the fertility and FOE is also low. It also pollutes the ground water. Keeping the above points in view the foliar spraying of urea and DAP was tested for their effect on lentil production.

Materials and Methods

A fields experiment was conducted during *rabi*, season of 2006-07 at Agronomy Research Farm of N.D. University Agriculture & Technology Kumarganj Faizabad. The experimental field was well leveled and free from weeds and stubbles of previous crop and having good irrigation and drainage facility. The soil was sandy loam in texture, neutral in reaction. The experiment was laid out in randomized block design with 10 treatments; control (R D F though basal) T_1; one spray 2% urea at branching, T_2; one spray 2% urea at flower initiation, T_3; one spray 2% urea at pod initiation, T_4; two spray 2% urea each at branching and pod initiation, T_5; one spray 3% DAP at branching, T_6; one spray 3% DAP of flowering initiation, T_7; one spray 3% DAP at pod initiation, T_8; two spray 3% DAP each at branching and pod initiation, T_9;

one spray 2% urea and 3% DAP at pod initiation, T_{10}; with foliar application. The plot size was 5 X 2.9 meter. The recommended dose N P K and Sulphur that is @ 20, 40, 20:20 kg/ha^{-1} respectively was applied through DAP, MOP and element sulphur. All the fertilizers were applied before sowing plough sole placement. The lentil verity Narendra Masoor-1 was used in the experiment and sowing was done in furrow, spaced 30 cm apart. Normal cultural practices were adopted to raise a good crop. The observation on five plant sample were taken on randomly selected plants for the seven character viz. number of branch plant^{-1}, number of pods plant^{-1}, number of grain pod^{-1}, test weight, grain yield (kg plant^{-1}), grain yield (q ha^{-1}) and straw yield (kg ha^{-1}). The data obtained in respect of various observations were statistically analyzed by Cochran and Cox, (1963). The significance of "F"and 'T' was tested at 5% and 1% level of significance. The critical difference was determined where 'F' test was significant.

Results and Discussion

Analyses of variance for the all seven characters are given in table-1. Effect of foliar application of nutrients on various yield and yield attributing characters have been discussed character vise as under:

Yield: The grain yield kg plot^{-1} and q ha^{-1} was maximum with treatment T_5 (Two spray of 2% urea each at branching and pod initiation stage) followed by T_2 and T_4 treatments except T_6, T_7, T_8. This result shows the maximum response of urea when it was applied once at branching and other at pod initiation stage. This fertilizer has also responded significantly better even when it was applied either at branching or pod initiation stage. But the DAP did not enhance grain yield. This might be due to diversion of phosphorus towards plant growth but due to good interaction and compability of DAP and urea for better utilization and intake of Nitrogen and Phosphorus to the crop plant, which ultimately resulted in bit-higher grain yield. Pareek and Chandra (2007) in lentil, Kumaran and Subramanian (2001 a & b) in black gram, and Rajesh and Paulpandi (2013) in chickpea have also observed good response of foliar application of urea and DAP+urea for enhancing grain yield in pulse crops. The straw yield (q ha^{-1}) was recorded maximum with treatment T_8 (one spray of 3% DAP at pod initiation stage) and minimum with T10 (one spray 2% urea and 3% DAP at pod initiation stage). Hussain *et. al.* (1996) have also reported higher straw yield through foliar application of phosphorus on *Lavandula officinalis*. The treatment T_5 (two spray 2% urea each at branching and pod initiation) have also found to be increased straw yield in lentil. Yadava and Gupta (2007) have also observed increased straw yield with the foliar application of urea in chickpea which confirm our finding in lentil.

Yield attributes: Number of branches plant^{-1}, number of pods plant^{-1}, number of seeds pod^{-1}, and test weight are important yield contributing characters. The maximum number of branches plant^{-1} at different crop stages (30, 60 and 90 days after sowing) was observed with the treatment T_5. However all treatments except T_8 were significantly superior over the control. It indicated the good response of Nitrogen alone as well as in combination to Phosphorus for more number of branches plant^{-1}. Ram and Punia (2007) have also recorded higher number of branches plant^{-1} with foliar application of urea in lentil. All the treatment significantly increased number of pods plant^{-1} over the control (one spray of 3%, DAP at pod initiation). This may be due to poor response of DAP spray for pod development. The maximum number of pods plant^{-1} was observed with the treatment T_5, where two sprays of urea was done. A number of authors have found impact of foliar application of urea on the pod development in various pulse crops. Nandan *et. al.* (1998), Yadava and Gupta (2002), Venkatesh *et. al.* (2007) in chickpea, Ram and Punia (2007) in lentil. The maximum number of grains pod^{-1} were recorded with treatment T_5 followed by T_4, which were significantly higher over the control. Rest of the treatments did not show significant effect on number of grains pod^{-1} as compare to the control (T_1). It advocated the foliar application of urea only exerted the more number of grains pod^{-1}. This might be due to quick and more availability of nitrogen to the leaves for maximum photosynthates. Foliar application of DAP did not enhanced number of grains pod^{-1}. Contrary to this statement Raman (2006); Nigmananda and Elamathi (2007) observed more number of grains pod^{-1} due to foliar application of DAP in green gram. These result may be due to different response of DAP in different pulse crops. However, Venkatesh *et. al.* (2007); Yadava and Gupta (2007) in chickpea; Ram and Punia (2007) in lentil have found similar

Table-1: Analysis of variance for various traits in lentil

Source of variation	d.F	Mean sum of squares								
		Number of branches plant^{-1}			Number of pod plant^{-1}	Number of grain pod^{-1}	Test weight (g)	Grain yield (kg plant^{-1})	Grain yield (q ha^{-1})	Straw yield (q ha^{-1})
		30DAS	60DAS	90DAS						
Replication	3	0.116	0.307	0.139	9.400	0.008	0.006	0.002	0.034	0.337
Treatment	9	2.652**	8.656**	33.060**	431.51**	0.322**	0.757**	0.167**	14.343**	3.524*
Error	27	0.159	0.470	0.269	20.733	0.052	0.008	0.009	0.796	1.310

* Significant at 5% probability level; ** Significant at 1% probability level

results of foliar application of urea for increasing the number of grains pod^{-1}.

For test weight, all the treatment resulted higher test weight over the control except T_8. Where only DAP was used as foliar application for nutrition. The maximum test weight was recorded with treatment T_5. This may due to increase seed size of lentil through foliar application of urea alone as well as in combination with DAP in T_{10}. The response of foliar application of DAP was better at early crop stages, which further reduced when this fertilizer was applied in pod initiation stage. It may be due to less absorption of DAP to the plant system and also less metabolic activities for immediate utilization of seed growth in pod. Raman (2006); Nigmanand and Elamathi (2007) have reported good response of DAP to this character in green gram, when it was applied as foliar application at early stage of the crop growth (35 DAS). A number of reports are available suggesting impact of foliar application of urea for enhancing the test weight in pulse which confirm our findings; Ram and Punia (2007) in lentil; Nandan *et. al.* (1998); Verma and Yadav (2007); Venkatesh *et. al.* (2007); Yadava and Gupta (2007) in chickpea.

Thus on the basis of results it is concluded that all the treatments except T_6, T_7 and T_8 accounted increased grain yield over the control (T_1). However two sprays of 2% urea at branching and pod initiation stage has manifested maximum seed yield (21.06 q ha^{-1}) in lentil.

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