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Effect of Boron on Growth and Yield of Lentil in Alluvial Soil

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ABSTRACT

A filed experiment was conducted during rabi season of 2015- 16 and 2016-17 at Krishi Vigyan Kendra (KVK) Farm, Ashokenagar (North 24 Pargana), West Bengal on a sandy loam soil to assess the effect of foliar applications of Boron on growth, yield attributing characters and yield of lentil, ***cv.*** *Moitree, (WBL-77). The experiment was carried out in a randomized block design with four treatments and five replications. Results revealed that grain yield increased significantly with foliar application of Boron in to 3 splits (at 15, 40 DAS and at flower initiation stage), along with soil application of NPK over control. Application of boron recorded 26.98% higher seed yield than soil application of sole NPK fertilizers. The maximum plant height (38.86 cm), pod per plant (45.40), seed yield (11.34 q/ha) and BC ratio (2.06) were recorded in soil application of NPK along with 0.5% foliar application of Boron in to 3 splits i.e. at 15, 40 DAS and at flower initiation stage.*

Key words: *Lentil, Boron, Growth parameters, Yield*

INTRODUCTION

Lentil (*Lens culinaris* Medic) is an important grain legume in Asia. It occupies an important position in this region. In India it is cultivated in area of 1.47 million ha with the production of 0.9 million tones and productivity of 675 kg/ha[12]. It is an important source of protein and several essential micronutrients. It synthesizes N in symbiosis with rhizobia and enriches the soil. It improves the fertility status of soil through atmospheric N fixation[11]. Pulse crops are generally grown in marginal and poorly fertile soils, almost exclusively under rain-fed condition without proper management practices. Among the major constraints affecting the production of pulses, lack of proper management practices[4] assumes importance on account of continuous depletion of micronutrients due to over mining by way of intensive cropping and continuous application of major nutrients (NPK) only[6]. Reproductive growth of lentil, especially flowering, fruit and seed set is more sensitive to B deficiency than vegetative growth[10]. Boron is very important in cell division and in pod and seed formation. Boron influence the absorption of N, P, K and its deficiency changed the equilibrium of optimum of those three macronutrients.

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The N and B concentrations of grain for lentil were markedly influenced by B treatment indicating that the B had a positive role on protein synthesis. Several studies reported that the deficiency of micro nutrients in alluvial soil of Indo-gangetic plains is severe and thereby response to added micronutrients such as boron in lentil is beneficial[12]. Increases in seed yield of pulses from application of micronutrients are reported but the lentil crop has so far received scanty attention. In view of the limited information, this experiment was designed to evaluate the response of Boron on the yield and yield contributing characters of lentil; and to find out a suitable time of application for the maximization of lentil yield under alluvial soil of North 24 Parganas District.

MATERIAL AND METHODS

Field experiment was carried out at the Instructional Farm, Krishi Vigyan Kendra, Ashokenagar, North 24 Parganas, West Bengal during two successive rabi seasons of 2015- 16 and 2016-17 to study the effect of foliar applications of Boron on growth, yield attributing characters and yield of lentil, **cv.** Moitree, (WBL-77). The experiment consisted of four treatments *i.e* T1: T1: control (no input), T2: 20:40:20 kg/ha NPK and no use of micro nutrient; T3: T2 + Foliar spray as 0.5 % solution of borax at 15, 40 DAS, T4: T2 + Foliar spray as 0.5 % solution of borax at15, 40 DAS and at flower initiation stage. The sources of N, P, K and B were urea, single superphosphate, muriatic of potash and borax. The experiment was laid out in a randomized block design with five replications. Crop management practices were done as per schedule and necessity. The data were subjected to statistical analysis by analysis of variance method. The correlation studies were made to reveal the association among the variables in the investigation[7]. As the error mean squares of the individual experiments were homogenous, combined analysis over the years were done through unweighted analysis. Here, the interaction between years and treatments were not significant.

RESULTS AND DISCUSSION

The plant height of lentil was significantly influenced with NPK fertilizers plus foliar application of boron (Table 1). The highest plant height of 38.86 cm was recorded for the treatment of foliar spray as 0.5 % solution of borax at15, 40 DAS and at flower initiation stage. All the foliar spray of boron at different interval along with soil application of NPK fertilizer gave higher plant height than the control (31.08 cm). The plots treated with foliar application of boron in 3 splits i.e. at 15, 40 DAS and at flower initiation stage showed higher LAI (5.38) at 90 DAS, although statistically different from the other treatments, except the control treatment (2.84) which registered the significantly lowest LAI (Table 1). The influence of different interval of boron application on total number of nodules per plant and nodule dry weight differed significantly (Table 1). Application of boron enhanced the production of nodules than the exclusive NPK fertilizer treatment (T2) but the increases were marginal. Total number of nodules varied from 10.80 observed in control plots to 23.80 in soil application of NPK along with foliar spray as 0.5 % solution of borax at 15, 40 DAS and at flower initiation stage. Tripathy *et al.*[15] also conclusively suggested that application of boron increased pods per plant in groundnut. Havlin[8] reported that flowering and fruit development were restricted by a shortage of boron. The highest dry weight of nodule (215.03 mg plant^{-1}) was found for the treatment of T4 and the lowest (120.41 mg plant^{-1}) was in control plots.

A highly significant effect of boron fertilized treatment was observed on the number of pods per plant, compared to control. Number of pods per plant ranged from 29.60 in control plots to 45.40 in treatment with foliar spray as 0.5 % solution of borax at 15, 40 DAS and at flower initiation stage. While the numbers of pods (42.80 per plant) produced by the treatment of (T3) 0.5 % solution of borax at 15 and 40 DAS was statistically at par with the foliar spray of 0.5 % solution of borax in to three splits i.e. T4 . Test weight of the seed in any crop is one of

the prime factors that contribute and decide the yield of a particular crop. Application of 0.5 % solution of borax did not significantly influence the 1000 – seed weight of lentil. However spraying of boron at different intervals considerably increased the test weight. 1000 – Seed weight ranged from 20.79 to 22.96 g. These might be due to enhance the photosynthesis process and translocation of photosynthetic products to the seeds as a result of increased enzymatic and other biological activities, as also indicated by Zeidan *et al*.[16].

Application of boron produced significantly higher grain in comparison to control plots. The application of NPK fertilizers (T2) increased the lentil seed yield by 92 % over the control treatment. The higher grain (11.34 q/ha) was recorded with foliar spray of borax in to 3 splits, which was 144% higher than control and 26.98% higher than soil application of sole NPK fertilizers (T2) where no use of micro nutrient occurred. The lowest in control plot might be due to boron deficiency as it has been reported to help in seed formation[3]. Results are in accordance with that of Singh *et al*.[13], who documented that crop yields, in general, have been promoted by regular application of boron. Chowdhury *et al*.[5] also reported that seed yield of cowpea increased significantly with the increase in boron application. Anonymous[1] reported that balanced application of N, P, K, S, Zn and B significantly increased the yield of lentil over control. The results obtained in this experiment is in agreement with the findings of Mondal *et al.*[9]; Bhuiyan *et al.*[2]; Singh *et al.*[14]. Data in Table 2 showed that spraying of boron at different intervals significantly enhances the net returns and B: C ratio. The higher B:C ratio (2.06) with the application of borax in to three splits i.e. T4 might be due to higher net returns obtained by the treatment.

The correlation coefficients among the different characters were worked out (Table 3) and in general, the correlation coefficients were higher in magnitude. The correlation coefficients among seven characters showed that yield per ha had positive and significant association with number of LAI (0.973), number of nodule per plant (0.945), pod per plant (0.955) and test weight (0.838). Similarly number of pods per plant was significantly and positively correlated with plant height (0.978) and LAI (0.998). Number of nodule per plant was significantly correlated with LAI (0.955).

The results of the present experiments suggested that micronutrient application along with macro nutrients could prove advantageous in increasing the seed yield of lentil in the resource poor soils of the alluvial tracts.

Table1: Efficacy of Foliar Application of Boron on Lentil (Pooled over two seasons)

Treatments	Plant height (cm)	LAI	No. of nodule/ plant	Nodule dry weight (mg)	Pod/ plant	1000 seed weight (g)	Yield (q/ha)
T1: Control	31.08	2.84	10.80	120.41	29.60	20.79	4.64
T2: 20:40:20 kg/ha NPK	33.03	3.93	16.40	172.08	35.40	21.15	8.93
T3: T2 + Foliar spray as 0.5 % solution of borax at 15, 40 DAS	36.08	4.96	18.20	201.14	42.80	21.80	10.32
T4: T2 + Foliar spray as 0.5 % solution of borax at15, 40 DAS and at flower initiation stage.	38.86	5.38	23.80	215.03	45.40	22.96	11.34
CD at 5%	4.82	0.264	3.79	6.08	3.002	NS	0.796

Table2: Efficacy of foliar application of Boron on economics of Lentil (Pooled over two seasons)

Treatments	Cost of cultivation (Rs/ha)	Gross return (Rs/ha)	Net Return (Rs / ha)	B:C Ratio
T1: Control	17000.00	18560.00	1560.00	1.09
T2: 20:40:20 kg/ha NPK	19500.00	35720.00	16220.00	1.83
T3: T2 + Foliar spray as 0.5 % solution of borax at 15, 40 DAS	21250.00	41280.00	20030.00	1.94
T4: T2 + Foliar spray as 0.5 % solution of borax at15, 40 DAS and at flower initiation stage.	22000.00	45360.00	23360.00	2.06
CD at 5%	-	-	-	-

Table 3: Correlation Matrix among the Yield of Lentil, Plant height (cm), LAI, No. of nodule/ plant, Nodule dry weight (mg), Pod/ plant, 1000 seed weight (g)

Parameters	Plant height (cm)	LAI	No. of nodule /plant-1	Nodule dry weight (mg)	Pod/ plant	1000 seed weight (g)	Yield (q/ha)
Plant height (cm)	1.00	0.971*	0.970*	0.942	0.978*	0.981*	0.909
LAI		1.00	0.955*	0.992**	0.998**	0.911	0.973*
No. of nodule /plant			1.00	0.953*	0.947	0.959*	0.945
Nodule dry weight (mg)				1.00	0.982*	0.874	0.994**
Pod /plant					1.00	0.921	0.955*
1000 seed weight (g)						1.00	0.838
Yield (q/ha)							1.00
*. Correlation is significant at the 0.05 level (2-tailed).							
**. Correlation is significant at the 0.01 level (2-tailed).							

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