Ann. Pl. Soil Res 14(1):39-41 (2012)

EFFECT OF COBALT APPLICATION ON GROWTH, YIELD ATTRIBUTES AND YIELD OF LENTIL CULTIVARS

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Received: September, 2011

ABSTRACT

Three lentil genotypes were grown with five levels of cobalt (0, 2, 4, 6 and 8 kg Co ha^{-1}) during rabi season of 2008-10 at Bichpuri (Agra). The results revealed that the cultivars did not differ among themselves for growth characters and yield attributes. However, based on grain and straw yield, DPL-15 (17.26 and 29.19 q ha^{-1}) was found significantly superior to PL-4(15.88 and 26.81 q ha-^{1}) and JL-3(17.26 and 24.19 q ha-^{1}). Application of cobalt up to 4 kg ha^{-1} improved significantly growth characters, i.e. height of plant, branches/plant, and dry matter accumulation over control. Lentil variety DPL 15 responded up to 6 kg Co ha^{-1} while PL-4 and JL-3, though least producer responded up to 4 kg Co ha^{-1}.
Keywords: Cobalt, yield, lentil, cultivars

INTRODUCTION

Lentil (*Lens culinaris* Medik) is an important grain pulse crop in India and occupies a prominent position on account of its manifold uses in daily life. The production and productivity of lentil are poor, which can be improved through micro-nutrient fertilization. Cobalt is one of the essential micronutrient and its deficiency causes chlorosis, a well known micronutrient disorder. While most of the soils contain sufficient amount of total cobalt, its availability to plants is often limited by factors like high pH and high $CaCO_3$. Genotypic differences exist in sensitivity to cobalt deficiency. The information on the responses of lentil genotypes to cobalt application is meager in alluvial soils of Agra region, Uttar Pradesh. This report describes the response of lentil genotypes to cobalt application in alluvial soil.

MATERIALS AND METHODS

The experiment was conducted under field condition during Rabi season in 2008-09 and 2009-10 at the research farm, R.B.S. College, Bichpuri, Agra. There were 15 treatment combinations having three lentil varieties (PL-4, JL-3, DPL-15) and five levels of cobalt (0, 2, 4, 6 and 8 kg Co ha^{-1}) in randomized block design with three replications. The soil of the experimental plot was sandy loam in texture with pH 7.8, organic carbon 4.8 g kg^{-1}, available N 170 kg ha^{-1}, P 8.0 kg-^{1}, K 160 kg ha^{-1}, S 8.5 mg kg^{-1} and cobalt 0.2 mg kg^{-1}. Cobalt was applied as cobalt sulphate at the time of sowing. Recommended dose of NPK (20, 60, 60 kg ha^{-1}) were applied through diammonium phosphate and muriate of potash, respectively. The growth observations and yield attributes were recorded at maturity. The cultivars were harvested and yield was recorded.

RESULTS AND DISCUSSION

Lentil variety DPL-15 attained the maximum plant height followed by PL-4 whereas minimum in JL-3 in both the years. The varieties did not show-any variation for number of branches at harvest. However, the maximum and minimum numbers of branches were recorded in DPL-15 and JL-3, respectively. The varieties also showed differences in dry matter accumulation. The variety DPL-15 enabled more dry matter accumulation than PL-4 and JL -3, which may be due to its more relative growth rate. Height of plant increased significantly with increasing levels of cobalt up to 6 kg ha^{-1} and decreased at 8 kg Co ha^{-1} during both years. The application of 6 kg Co ha^{-1} recorded higher values for number of branches/plant and dry matter/plant as compared to its zero level (control) in both seasons (Table 1).Cobalt being a component of vitamin B_{12} plays an important role in cell synthesis which might have contributed to plant

height. Higher level of cobalt had slightly deleterious effect on these characters. The beneficial effect of cobalt application on these growth characters was reported by Randhawa et al. (1982) Jana et al. (1994).

Table 1: Effect of cobalt levels on growth characters of lentil cultivars

Treatment	Plant height (cm)		Branches/Plant		Dry matter accumulation (g)	
	2008-09	2009-10	2008-09	2009-10	2008-09	2009-10
Genotypes						
PL-4	37.73	36.60	6.49	6.15	9.37	9.09
JL-3	37.33	34.57	6.46	6.16	9.31	9.01
DPL-15	38.22	37.09	6.52	6.22	9.56	9.21
CD (P=0.05)	NS	NS	NS	NS	NS	NS
Cobalt (kg ha^{-1})						
0	33.00	31.49	5.17	4.85	8.21	7.89
2	37.63	36.63	6.95	6.79	9.50	9.40
4	40.03	38.95	7.58	7.21	10.17	9.89
6	41.53	39.06	6.85	6.52	10.11	9.85
8	36.59	37.65	5.89	5.53	9.08	8.49
CD (P=0.05)	1.57	1.94	0.12	0.17	0.46	0.41

Lentil genotypes did not differ significantly in their yield contributing characters. Variety DPL-15 had highest pod/plant, and grain/plant closely followed by PL-4, whereas JL-3 occupied lowest position. The 1000 grains weight in DPL-15 was maximum followed by PL-4 and lowest in JL-3. The lowest 1000 grains weight in JL-3 may be due to better partitioning which helped in the improvement of all other yield attributes. Application of cobalt (6 kg Co ha^{-1}) significantly increased the pods/plant, seeds/plant, test weight over no cobalt. Higher level (8 kg Co ha^{-1}) of cobalt did not increase these characters over its lower level, although 4 and 6 kg of cobalt application were at par during both seasons (Table 2). The improvement in yield contributing characters in lentil genotypes due to cobalt application was the resultant of improved growth characters. The increase in yield components of lentil genotypes with the application of cobalt is similar to those obtained by Jana et al. (1994).

Table 2: Effect of cobalt application on yield attributed and yield of lentil cultivars

Treatments	Grain/Pod		Pod/Plant		Test weight (g)		Grain yield (q ha^{-1})		Straw yield (q ha^{-1})	
	2008-09	2009-10	2008-09	2009-10	2008-09	2009-10	2008-09	2009-10	2008-09	2009-10
Genotypes										
PL-4	2.07	2.04	110.1	106.3	24.13	24.05	16.31	15.46	27.54	26.09
JL-3	2.06	2.03	111.8	106.3	24.12	24.04	15.86	15.01	26.78	25.36
DPL-15	2.09	2.06	111.9	106.5	24.16	24.09	17.68	16.85	29.85	28.54
CD(P=0.05)	NS	NS	NS	NS	NS	NS	1.19	1.28	2.18	2.06
Cobalt (kg ha^{-1})										
0	2.03	2.02	96.0	90.3	23.51	23.35	15.20	14.37	25.53	24.23
2	2.06	2.03	115.7	111.3	24.40	24.36	16.25	15.40	27.45	26.02
4	2.11	2.06	119.0	112.1	24.52	24.47	17.83	16.99	30.31	28.88
6	2.12	2.08	120.3	114.6	24.58	24.51	17.27	16.39	29.18	27.69
8	2.05	2.02	108.0	103.6	23.69	23.62	16.55	15.72	27.81	26.45
CD(P=0.05)	0.08	0.08	2.88	2.79	0.41	0.44	1.67	1.77	3.05	3.46

DPL-15 being at par with PL-4 produced significantly more grain and straw as compared to JL-3, which may be due to more number of pods/plant. The higher grain yield of DPL-15

was attributed to its more number of branches (6.72 and 6.22), pods/plant (111.94 and 106.54) and number of grains/pod (2.09 and 2.06) as compared to other genolypes. Kumar et al. (2003) reported genotypic variation in yield in mung bean. The mean data indicated that significant increase in grain yield of lentil was observed up to 4 kg Co ha^{-1} application and further increase in dose of cobalt decreased it significantly over 4 kg Co ha^{-1}. Application of 4 kg Co ha^{-1}, on an average increased the grain yields by 17.8, 16.9 and 18.5% in PL-4, JL-3 and DPL-15, respectively. Thus, DPL-15 produced the maximum grain yield under various levels of cobalt followed by PL-4 and JL-3. These results are in conformity with the findings of Basu et.al (2006). Increase in grain yield with the increase in Co rate may be due to higher values of yield attributing characters. The maximum average straw yield was recorded under DPL-15 followed by PL-4 and JL-3. Based on straw yield due to applied cobalt, the cultivars may be arranged as DPL-15 > PL-4 > JL-3. The straw yield was also significantly higher with the application of 4 kg Co ha^{-1}. Increase in straw yield owing to application of cobalt might be attributed to increase in plant height, number of branches and dry matter accumulation (Table 2). Similar results were also reported by Jana et al. (1994).

Table 3: Interaction effect of cultivars and cobalt levels on grain and straw yield of lentil

Cobalt (kg ha^{-1})	2008-09			2009-10		
	Genotypes			Genotypes		
	PL-4	JL-3	DPL-15	PL-4	JL-3	DPL-15
Grain yield (q ha^{-1})						
0	14.99	14.71	15.90	14.07	13.95	15.10
2	15.93	15.88	16.93	15.10	14.91	16.20
4	17.70	17.18	18.62	16.75	16.35	17.88
6	16.83	16.02	18.97	16.02	15.20	17.95
8	16.14	15.53	18.00	15.36	14.65	17.15
CD (P=0.05)		1.99			2.13	
Straw yield (q ha^{-1})						
0	25.18	24.71	26.71	23.63	25.63	25.63
2	26.92	26.83	28.61	25.51	27.37	27.37
4	30.09	29.20	31.65	28.47	30.39	30.39
6	28.44	27.07	32.05	27.07	30.33	30.33
8	27.11	26.09	30.24	25.80	28.81	28.81
CD (P=0.05)		3.68			3.46	

The interaction effect between cultivars and cobalt levels (Table 3) was found significant. The levels of cobalt affected the varietal performance and yield potential expression. A significant increase in yield with cobalt levels was observed in all the cultivars. The maximum grain and straw yield were produced by DPL-15 cultivar under 6 kg Co ha^{-1} followed by DPL-15 with 4 kg Co ha^{-1}. The difference between these two treatment combination was non significant. On the other hand, lowest values of grain and straw production were noted with JL-3 under no cobalt.

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