

Effect of phosphate solubilizing bacteria, farmyard manure, and phosphorus on growth and yield of lentil (*Lens culinaris* Medik.).

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Abstract

A field experiment was conducted during winter seasons of 2004-05 and 2005-06 at Crop Research Centre, G.B. Pant University of Agriculture and Technology, Pantnagar to study the effect of FYM, phosphorus and PSB on growth, yield and quality of lentil (*lens culinaris* Medik.). Treatments comprised of different levels of FYM (0 t and 5 t/ha), phosphorus (0, 20 and 40 kg P₂O₅ ha⁻¹) and inoculation (no inoculation and PSB inoculation). Twelve treatment combinations were replicated four times in a randomized block design.

Most of the growth parameters and yield attributes could not be influenced significantly due to the application of FYM, phosphorus and PSB though there was increasing trend with the use of treatments. The grain yield was affected significantly due to levels of FYM and phosphorus, but PSB inoculation did not bring significant difference in grain yield per hectare. Application of FYM (5 t/ha) produced significantly higher yield than control during both the years. It was 6.3% and 26.9% higher in 2004-05 and 2005-06, respectively. Grain yield increased significantly with increase in phosphorus level from 0 to 20 and 20 to 40 kg P₂O₅/ha. Increase in grain yield by 20 kg P₂O₅ over control was 5.83% and 13.3% during 2004-05 and 2005-06, respectively. Phosphorus @ 40 kg P₂O₅/ha recorded increase in grain yield over control by 14.3% and 26.2% during 2004-05 and 2005-06, respectively. The grain yield did not increase significantly due to PSB-inoculation over uninoculated plots during both the years. However, PSB inoculation increased the yield by 3.97% and 7.07% during 2004-05 and 2005-06, respectively. All the treatments improved protein yield.

Introduction

- In pulses, India contributing 25 per cent to the global production (Ali and Kumar, 2005). In spite of being largest producer in the world, India has to import pulses to the tune of 25 million tones every year to meet its domestic requirements.
- In India lentil occupies an area of 1.40 m ha and produced 1.03 m tones of grains with an average productivity of 741 kg/hectare (Anonymous, 2005).
- Well-nodulated lentil crops seldom respond to application of organic and inorganic nitrogen fertilizer.
- Phosphorus is applied to ensure good symbiotic performance and overall plant growth.
- Enhancing phosphorus availability to crop through phosphate solubilizing bacteria (PSB) holds a great promise in enhancing growth and yield of lentil.
- Application of FYM not only provides nutrition to crop on decomposition but also increases the nutrient and water holding capacity of soil.

Objective

- Since quite inadequate information is available on the response of the lentils to PSB, with or without application of phosphorus and FYM. With these considerations the present experimental study is planned with following objectives:
- To study the growth and development behavior of lentil under different levels of FYM, phosphorus and PSB.
- To find out the effect of different levels of FYM, phosphorus and PSB on yield and yield attributes.
- To find out the optimum dose of phosphorus under varying levels of PSB and FYM for maximum production of lentil.

Figure 1. Uprouted lentil plants at 65 days and; roots images at 12 and 7 days .



Table 1. Different growth and yield parameters of lentil as influenced by levels of FYM, P₂O₅ and PSB.

Treatments	Mortality (%)		Plant height (cm)		Branches per plant		Dry matter (g/m ²)		Grain yield (kg/ha)	
	2004-05	2005-06	2004-05	2005-06	2004-05	2005-06	2004-05	2005-06	2004-05	2005-06
FYM (t/ha)										
0	20.4	19.2	26.7	19.9	8.6	9.6	330.2	206.2	1534.9	989.7
5	17.3	18.5	26.8	20.5	8.9	10.4	348.7	231.9	1631.6	1256.6
CD (p=0.05)	NS	NS	NS	NS	NS	NS	NS	23.7	68.0	100.1
P₂O₅ level (kg/ha)										
0	19.8	20.5	25.7	19.8	8.4	9.6	327.1	208.3	1483.7	992.2
20	18.1	18.2	27.0	20.1	8.8	10.0	328.7	217.5	1570.2	1124.2
40	18.6	17.9	27.5	20.8	8.9	10.4	362.6	231.4	1695.9	1253.0
CD (p=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	83.3	122.6
PSB										
Uninoculated	22.5	19.9	26.0	19.7	8.3	9.9	349.2	237.6	1552.4	1084.8
Inoculated	15.2	17.8	27.4	20.8	9.1	10.1	329.7	200.6	1614.1	1161.5
CD (p=0.05)	4.9	NS	1.36	NS	0.8	NS	NS	23.7	NS	NS

FYM- Farmyard manure; PSB- phosphate solubilizing bacteria

Material and Methods

• A field experiment was conducted in C2 Block of Crop Research Centre, G.B. Pant University of Agriculture and Technology, Pantnagar (Uttaranchal), during winter season, 2004-05 and 2005-06, respectively.

• Maximum temperature during the crop season of 2004-05 and 2005-06 ranged between 16.9°C-33.9°C and 19°C-35.1°C, respectively. Minimum temperature during the crop season of 2004-05 and 2005-06 ranged between 3.9°C-16.9°C and 3.7°C-14.6°C, respectively.

• The well distributed total rainfall (120.4 mm) was received during crop season of 2004-05, which was much higher (85.8%) than the rainfall (17 mm) received during 2005-06. In 2004-05 the maximum amount of rainfall (47.6 mm) received in the month of January, however during 2005-06, maximum amount of rainfall (9.2 mm) received in the month of December.

SOIL CHARACTERS:

• Soil is classified as mollisol (Deshpande *et al.*, 1971).

• A composite soil sample of experimental plot was taken from the depth of 0-15 cm before sowing and analyzed for different constitute

• Organic Carbon (0.79 %) Walkley and Black method (Black, 1965)

• Available nitrogen (202.6 kg ha⁻¹) Alkaline potassium permanganate(KMnO₄) method (Subbaiah and Asija, 1956)

• Available phosphorus (39.1 kg P ha⁻¹) Olsen's method (Olsen *et al.*, 1954)

• Available potassium (212.8 kg K ha⁻¹) Neutral normal NH₄OAc method (Jackson 1973)

• pH of soil 7.1 [1 :2.5 soil water suspension] Blackman glass electrode pH meter (Jackson, 1973)

• The experimental was laid out in randomized block design (3 factor RBD) with four replications. The details of treatments are given below :-

• FYM levels (0 & 5 t/ha)

• Phosphorus levels (0, 20 & 40 kg P₂O₅ /ha)

• PSB (20 g/kg seed) / 500 g/ha) and No inoculation

• Sowing was done at 3-4 cm depth in furrows opened at 22.5 cm apart. Seeds of lentil (cv. Pant Lentil-5) were treated with a mixture of thiram + bavistin (2:1) at the rate of 3 g/kg of seed before sowing.

Results

• Survival rate of lentil plant was recorded higher with PSB inoculation. Mortality percentage was highly reduced in the year of higher and well distributed rainfall.

• Dry matter accumulation was reduced when PSB was applied but it was observed that the reduction was more in the year of less rainfall

• FYM improved the dry matter accumulation but this increase was significantly higher over control in the year of less rain fall

• PSB increased the number of branches and plant height but increase was significant in the year of higher rainfall

• FYM and phosphorus recorded significant improvement in grain yield increase in grain yield due to PSB inoculation was non-significant

References

- Gautam, P. 2002. Phosphate solubilizing efficiency of *Pseudomonas* sp. in combination with FYM at different rates of phosphorus in soybean (*Glycine max* L.) Ph.D. Thesis submitted to G.B. Pant University of Agriculture and Technology, Pantnagar, India.
- Sahu, J.P.; Singh, N.P.; Kaushik, M.K.; Sharma, B.B. and Singh, V.K. 2002. Effect of *Rhizobium*, phosphorus and potash application on the productivity of lentil. *Indian Journal of Pulse Research*. 15 (1): 39-42.
- K. K. Singh, Ch. Srinivasarao, Masood Ali 2005. Root Growth, Nodulation, Grain Yield, and Phosphorus Use Efficiency of Lentil as Influenced by Phosphorus, Irrigation, and Inoculation. *Communications in Soil Science and Plant Analysis*. 36, (13-14): 1919-1929.