



## Germination, Survival and Growth rate (Shoot length, root length and dry weight) of *Lens culinaris* Medik. the masoor, induced by biofertilizers treatment

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**ABSTRACT :** An experiment was conducted during 2007 and 2008 winter seasons at Botany department of Saifia science college Bhopal. To study the effect of two biofertilizers Azotobacter, PSB (Phosphate solubilizing bacteria) and their combination with different doses on growth rate, germination and survival percentage of *Lens culinaris*. Inoculation of both biofertilizers alone and in combination shows considerable improvement in the growth rate, germination and survival percentage as compared to control. Experiment prove that the application of biofertilizers perform significant improvement in growth rate, germination and survival percentage. This experiment shows that with increase in concentration of biofertilizer, growth rate, germination and survival percentage of *Lens culinaris* increased. Maximum increase in the growth parameter was with combined treatment of Azotobacter + PSB inoculated crop and then the crop treated with Azotobacter showed somewhat less growth parameters and the least growth parameters in these three inoculations with PSB treatment.

**Keywords :** Azotobacter, PSB, Germination, Survival, Shoot length, root length and dry weight

### INTRODUCTION

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/ha. (Deol *et al.*, 2005) cultivated lentil belong to two broad group the small seeded and large seeded. The large seeded varieties of lentil are comparatively found to be more mutable than the small seeded varieties (Solanki and Sharma, 2002). Lentil belongs to the family fabaceae. Lentil is an important pulse crop of Indian subcontinent. The diploid chromosome number is  $2n = 2x = 14$  Lentil (*Lens culinaris* Medik.) contains 28.6% proteins, 3.1% ash, 4.6% crude fibres, 44.3% starch, 36.1% amylase, 63.1% total carbohydrates and 420 cal. 100/gm gross energy. Cooking quality generally depends on the varieties fertility status of the soil and seed maturity of the crop seed (Shah *et al.*, 2000). This crop is valued as a high protein source residues are used for animal feedings (Mishra *et al.*, 2001).

Soil microorganisms are involved in a range of processes that effects phosphate transformation and thus influence the subsequent availability of phosphate to plant roots (Richardson, 2001). Phosphorous is abundant in soil in both organic and inorganic forms it is frequently major or a prime limiting factor for plant growth (Khan *et al.*, 2007). Biofertilizers are gaining importance as they are ecofriendly, non-hazardous and non-toxic (Sharma *et al.*, 2007). Biofertilizers are useful to reduce the pollution rate of soil and water (El-Assiouty and Abo-Sedera, 2005). Bacteria that aggressively colonizes in plant roots is plant growth promoting Rhizobacteria (PGPR) (Antoun, 2003; Antoun and Kloepper, 2001). To overcome the adverse effects of chemical fertilizers the best available option lies in the complimentary use of biofertilizers as a mean of increasing yield by biological nitrogen fixation and other microbial activities (Mubassara *et al.*, 2008). Nowadays multistrain biofertilizers

*i.e.* gathered groups of soil microorganisms, having a definite beneficial well role in supporting plant growth in developing sustainable soil fertility and in bio-controlling soil born diseases (Mekki and Ahmad, 2005). Biofertilizers include mainly the nitrogen fixing, phosphate solubilizing and plant growth promoting microorganisms (Geol *et al.*, 1999; Shehata and El-Khawass, 2003). Microbiological fertilizers are an important part of environment friendly sustainable agricultural practices (Ramazan *et al.*, 1999).

### MATERIAL AND METHODS

This work was conducted in Saifia science college, Bhopal during two successive winter seasons (2007-08 and 2008-09). In these studies the effect of biofertilizers, Azotobacter, Phosphate solubilizing bacteria (PSB) and their combination was observed on the germination percentage, survival percentage and growth rate (shoot length, root length and dry weight) of *Lens culinaris* variety JL-3.

*Lens culinaris* seeds of known varieties JL-3 of central India procured from Seed Corporation of India, New Market Bhopal. Five hundred dry healthy seeds with average moisture content of each variety selected from macrosperma Lentil.

**Bio-fertilizers :** In this study Biofertilizers Azotobacter, PSB were took from Agro Industries in Inderpuri, Bhopal (M.P.) about 10 gm, 20 gm and 30 gm of Azotobacter mixed with 2 kg soil were used in these three treatment, 10 gm, 20 gm and 30 gm of PSB mixed with 2 kg soil were used in next three treatments and then 10 gm + 10 gm, 20 gm + 20 gm, 30 gm + 30 gm of Azotobacter + PSB mixed with 2 kg soil were used in the next three treatment. One control will be grown to seen the germination percentage, survival percentage and growth rate (shoot length, root length and dry weight) of *Lens culinaris* variety JL-3.

Treatment of soil with Biofertilizers Azotobacter, PSB and their combination. Soil is treated with Biofertilizers Azotobacter, PSB and their combination in two years 100 seeds are sown in the treated soil with 10, 20 and 30gm. Azotobacter and PSB 100 seeds are also sown in the treated soil with 10 gm + 10 gm 20 gm + 20 gm, 30 gm + 30 gm of Azotobacter + PSB.

Seeds will be sown in the field with treated soil to study the germination percentage, survival percentage and growth rate (shoot length, root length and dry weight) of *Lens culinaris* variety JL-3 in October 2007 and seed obtain from treated generation to next year in October 2008 and then observed the germination percentage, survival percentage and growth rate of these plants.

## RESULTS AND DISCUSSION

Results in the Table-1 showed that the germination percentage of *Lens culinaris* variety JL-3 with the inoculation of the combination of the two biofertilizers was more than the Azotobacter and PSB inoculation separately. With the inoculation of 10 gm Azotobacter germination percentage was observed 88 percent, inoculation with 20 gm Azotobacter germination percentage was observed 92 percent with inoculation of 30 gm Azotobacter germination percentage was observed 97 percent.

Inoculation with PSB showed germination less than Azotobacter with the inoculation of 10gm. PSB germination percentage was 86 percent. Inoculation of 20 gm. PSB germination percentage was 89 percent .With the inoculation of 30 gm. PSB germination percentage was 94 percent.

Inoculation with the combination of the two biofertilizers Azotobacter + PSB 10 gm + 10 gm. Germination percentage was observed 90 percent. Inoculation with 20 gm + 20 gm Azotobacter + PSB Germination percentage was observed 92 percent. With the inoculation of 30 gm + 30 gm Azotobacter + PSB Germination percentage was observed 100 percent. Control of *Lens culinaris* variety JL-3 showed 80 percent germination percentage.

Survival percentage with the inoculation of 10 gm Azotobacter was 86 percent. With the inoculation of 20 gm

Azotobacter it was 92 percent, with the inoculation of 30 gm. Azotobacter survival percentage was 95 percent. With the inoculation of PSB 10 gm survival percentage was 85 percent. With the inoculation of PSB 20 gm survival percentage was 87 percent. Inoculation with 30 gm PSB survival percentage was 92 percent. With the inoculation of two biofertilizers in combination of Azotobacter + PSB maximum survival was observed as compared to the separate doses of biofertilizers Azotobacter and PSB. With inoculation of 10 gm + 10 gm Azotobacter + PSB it was 88%.With 20 gm + 20 gm inoculation it was 91% and with the inoculation of 30 gm + 30 gm biofertilizes it was 99 percent. In control *Lens culinaris* variety JL-3 the survival percentage was observed 78 percent.

**Table 1 : Germination percentage and survival Percentage of *Lens culinaris* Medik., in variety JL - 3 under the treatment of biofertilizers Azotobacter, PSB and their combination.**

S.No.	Treatment	Concentration	Germination %	Survival %
1.	Azotobacter	10 gm	88%	86%
2.	Azotobacter	20 gm	92%	92%
3.	Azotobacter	30 gm	97%	95%
4.	PSB	10 gm	86%	85%
5.	PSB	20 gm	89%	87%
6.	PSB	30 gm	94%	92%
7.	Azotobacter	10 gm + 10 gm	90%	88%
8.	Azotobacter + PSB	20 gm + 20 gm	92%	91%
9.	Azotobacter + PSB	30 gm + 30gm	100%	99%
10.	Control		80%	78%

Results in the Table 2 showed that the growth rate was maximum in case of the inoculation with the combination of the two biofertilizers Azotobacter + PSB, less in case of Azotobacter inoculation and minimum with the inoculation of PSB. In control it least growth rate was observed.

**Table 2 : Growth rate (Shoot length, root length and dry weight) *Lens culinaris*, in variety JL-3 under the treatment of biofertilizers Azotobacter, PSB and their combination.**

S.No.	Treatment	Concentration	Shoot length	Root length	Dry weight
1.	Azotobacter	10 gm	10.2 cm	9.6 cm	0.55 gm
2.	Azotobacter	20 gm	10.5 cm	9.9 cm	0.61 gm
3.	Azotobacter	30 gm	10.9 cm	10.2 cm	0.69 gm
4.	PSB	10 gm	9.6 cm	8.9 cm	0.51gm
5.	PSB	20 gm	9.9 cm	9.2 cm	0.59 gm
6.	PSB	30 gm	10.3 cm	9.8 cm	0.65 gm
7.	Azotobacter + PSB	10 gm + 10 gm	10.8 cm	9.9 cm	0.62 gm
8.	Azotobacter + PSB	20 gm + 20 gm	11.2 cm	10.2 cm	0.68 gm
9.	Azotobacter + PSB	30 gm + 30 gm	11.9 cm	10.9 cm	0.76 gm
10.	Control		9.4 cm	8.5 cm	0.47 gm

With the inoculation of 10 gm Azotobacter growth rate (shoot length, root length and dry weight) was observed 10.2 cm; 9.6 cm and 0.55 gm respectively 20 gm Azotobacter inoculation showed growth rate, 10.5 cm ; 9.9 cm and 0.61 gm respectively. With 30 gm Azotobacter inoculation growth rate was observed 10.9 cm ; 10.2 cm and 0.69 gm respectively. 10 gm PSB inoculation showed growth rate (shoot length, root length and dry weight) 9.6 cm; 8.9 cm and 0.51 gm respectively 20 gm PSB inoculation showed growth rate 9.9 cm ; 9.2 and 0.59 gm respectively. With 30 gm PSB inoculation it was observed 10.3 cm ; 9.8 cm and 0.65 gm. respectively. With the inoculation of two biofertilizers Azotobacter + PSB 10 gm +10 gm growth rate (shoot length, root length and dry weight) was observed 10.8 cm; 9.9 cm and 0.62 gm respectively. With 20 gm + 20 gm inoculation it was observed 11.2 cm ; 10.2 cm and 0.68 gm, with 30 gm + 30 gm inoculation of biofertilizers it was observed 11.9 cm; 10.9 cm and 0.76 gm respectively. In control of *Lens culinaris* variety JL-3 growth rate (shoot length, root length and dry weight) was observed 9.4 cm, 8.5 cm and 0.47 gm respectively.

These table showed that the germination percentage, survival percentantage and growth rate was increased with the increase in the quantity of biofertilizers.

Table 1 and Table 2, showed the germination percentage, survival percentantage and growth rate (shoot length, root length and dry weight) *Lens culinaris* with the inoculation of the combination of Azotobacter + PSB biofertilizers the germination percentage, survival percentantage and growth rate increases with the increase in the dose and it was observed maximum in case of the highest doses of biofertilizer and it was observed least in case of control. With the inoculation of Azotobacter biofertilizer the germination percentage, survival percentantage and growth rate was observed more than PSB and less than the combination of the two biofertilizers. It was also increased with the increase in the quantity of the biofertilizers PSB. Least germination percentage, survival percentantage and growth rate was observed in control. With the inoculation of the PSB biofertilizer the germination percentage, survival percentantage and growth rate was observed less than Azotobacter and the combination of the two biofertilizers but it was more than the control. It was observed that in this case also the germination percentage, survival percentantage and growth rate increased with the increase in quantity of biofertilizer.

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