



E-ISSN: 2278-4136  
P-ISSN: 2349-8234  
JPP 2019; SP1: 505-507

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(Special Issue- 1)  
**2<sup>nd</sup> International Conference**  
**“Food Security, Nutrition and Sustainable Agriculture -  
Emerging Technologies”**  
(February 14-16, 2019)

**Effect of *Azotobacter*, FYM (Farmyard manure) and  
PSB (Phosphorus solubilizing bacteria) on the yield and  
yield attributing characters on pearl millet (*Pennisetum  
glaucum*).**

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**Abstract**

The experiment was conducted at the farm of Mr. Radha Krishan at village Khippan wali, Teh. Fazilka, District Fazilka in Punjab state during July-October 2018. To study the Effect of *Azotobacter*, FYM (Farmyard manure) and PSB (Phosphorus solubilizing bacteria) on the yield and yield attributing characters on Pearl Millet (*Pennisetum glaucum*). *Azotobacter*, FYM (Farmyard manure) and PSB (Phosphorus solubilizing bacteria) were used for experimentation the effect of *Azotobacter*, FYM (Farmyard manure) and PSB (Phosphorus solubilizing bacteria) on Plant height (cm), Cob length (cm), Number of tillers per plant, Grain yield per plot (g) and Test weight (g) were observed. Results showed that maximum average plant height (191.2cm), average cob length(28.8cm) and yield per plot (6986.59g) was obtained in T<sub>2</sub> i.e (RDF N @ 40 kg/acre and P @ 24 kg/acre) + *Azotobacter* @ 4 kg/acre). Maximum average number of tillers (3.2) were obtained in T<sub>1</sub> (RDF (N @ 40 kg/acre and P @ 24 kg/acre) + PSB @ 4 kg/acre). Test weight (11g) remained maximum in T<sub>3</sub> (PSB @ 4 kg/acre + FYM @ 4tonnes/acre) as compared to T<sub>5</sub> control.

**Keywords:** Bajra/Pearl millet (*Pennisetum glaucum*), *Azotobacter*, FYM (Farmyard manure) and PSB Phosphorus solubilizing bacteria

**Introduction**

Pearl millet (*Pennisetum glaucum*) is the most widely grown type of millet. It has been grown in Africa and the South Asia since prehistoric times. India is the largest producer of pearl millet both in terms of area (7.1 million ha) and production (8.06 million t) (www.aicpmip.res.in) [1]. Bajra is rich in essential compounds like protein, fibre, phosphorous, magnesium and iron. 100 grams of bajra has the following nutritional values: energy 360 calories, moisture 12g, protein 12g, fat 5g, mineral 2g, fiber 1 g, carbohydrate 67g, Calcium 42mg, phosphorus 242mg, and iron 8mg (www.nutrchoice4u.com) [2]. *Azotobacter* is a free-living nitrogen-fixing bacterium, which is used as a bio-fertilizer in the cultivation of most crops. *Azotobacter* is usually motile, oval, or spherical bacteria, form thick-walled cysts, and may produce large quantities of capsular slime. Plant needs nitrogen for its growth and *Azotobacter* fixes atmospheric nitrogen non-symbiotically (www.primaryinfo.com) [3]. Phosphate solubilizing bacteria (PSB) are an aggregation of helpful microscopic organisms capable of hydrolysing natural and inorganic phosphorus from insoluble compounds. P-solubilization capacity of the microorganisms is recognized to be a standout amongst the most important traits associated with plant phosphate nourishment. PSB produce phosphatase like phytase that hydrolyse organic forms of phosphate compounds productively. The utilization of PSB as inoculants increases the P uptake by plants. Simple inoculation of seeds with PSB gives crop yield reactions equal to 30 kg P<sub>2</sub>O<sub>5</sub>/ha or 50 percent of the need for phosphatic fertilizers (www.omicsonline.org) [4]. Farmyard manure refers to the decomposed mixture of dung and urine of farm animals along with litter and left over material from roughages or fodder fed to cattle. On an average well decomposed farmyard manure contains 0.5% N, 0.2%

On an average well decomposed farmyard manure contains 0.5% N, 0.2% P<sub>2</sub>O<sub>5</sub> and 0.5% K<sub>2</sub>O (www.wikipedia.org) [5].

### Material and Methods

The experiment was conducted at the farm of Mr. Radha Krishan at village Khippan wali, Teh. Fazilka, District Fazilka in Punjab state during July-October 2018. An experiment was conducted in five different plots with each plot having dimensions of 272.25 square feet or 25.29 square meters. Field was irrigated first after adding fym to field one month before sowing. Then irrigation was done before 2 days of sowing for maintaining proper moisture in soil. The field was prepared with disc harrow followed by 2 ploughing with cultivator and leveling was done with the help of planker. Sowing of seed was done at seed rate of 1.5 kg acre<sup>-1</sup> by kera pora method. The seeds were sown at row to row 50cm and plant to plant 15cm spacing. Well rotted fym was added before 30 days of sowing as per treatments @4t/acre. Full amount of Bio-fertilizers (Azotobacter and PSB 4kg/acre) as per treatments were mixed thoroughly in soil before sowing of crop. The sources of N, P, K were urea (46% N) and Di-ammonium phosphate (DAP-18% N, 46% P<sub>2</sub>O<sub>5</sub>). For 100% RDF, 40kg/acre N was applied in two splits (half as basal dose at sowing and half at 2nd irrigation) whereas, 24kg P<sub>2</sub>O<sub>5</sub> was applied as basal dose at sowing. Cultural methods were used to reduce the weed population from the standing crop. 2-3 hoeings were done at 25-30 days interval with the help of spade to remove the weeds from field. First irrigation was given at interval of 18 days and others according to the requirements. For measuring plant height, five plants were selected randomly per treatment and then height of selected plants were measured with the help of measuring tape from ground level up to the top of plant at 15 days interval. Five plants were selected randomly from each plot then with the help of measuring scale length of every cob of selected plants were measured at harvest. One plant from each plot was selected and grains from each cob of plant were threshed and weighed with the help of weighing machine. Five plants were selected randomly from each plot then number of tillers per plant were counted at interval of 15 days. All the plants from each plot were harvested and grains were threshed separately from each plot and weighed with the help of weighing machine. 1000 seeds were collected from each plot after harvesting and were weighed with the help of weighing machine.

### Treatments

- T1:** RDF (N @ 40 kg/acre and P @ 24 kg/acre) + PSB @ 4 kg/acre  
**T2:** RDF (N @ 40 kg/acre and P @ 24 kg/acre) + Azotobacter @ 4 kg/acre  
**T3:** PSB @ 4 kg/acre + FYM @ 4 tonnes/acre  
**T4:** Azotobacter @ 4 kg/acre + FYM @ 4 tonnes/acre  
**T5:** Control

### Results and Discussions

#### Average plant height

By the time crop reached its physiological maturity, maximum plant height was achieved by T<sub>2</sub> (191.2 cm) followed by T<sub>1</sub> (183.4 cm), T<sub>3</sub> (167.0 cm), T<sub>4</sub> (160.0 cm) and minimum plant height was in T<sub>5</sub> (135.8 cm). (Thumar *et al.*)

[6] carried out a field experiment and seen that among the various treatments, the application of (T<sub>9</sub>) FYM @ 2.5 t ha<sup>-1</sup> along with recommended dose of fertilizer (120 kg N + 60 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup>) and seed inoculation with *Azotobacter* and phosphorus solubilizing bacteria (PSB) is resulted higher plant height 158.47 cm.

#### Average cob length

The result showed that maximum cob length was obtained in the treatment (T<sub>2</sub>) receiving *azotobacter* and RDF in combination which is 28.8 cm followed by T<sub>1</sub>, T<sub>4</sub>, T<sub>3</sub>, i.e. 21.4cm, 18.6cm, 17.8cm and minimum cob length was obtained in treatment T<sub>5</sub> i.e. control which is 12.4 cm. (Togas *et al.*) [7] Conducted a field experiment at Agronomy farm, of S.K.N. College of Agriculture, Jobner (Rajasthan) during *kharif* 2015 on loamy sand soil and result showed maximum cob length was observed with inoculation (*azotobacter*) 30.5cm and minimum without inoculation (24.8cm).

#### Average number of tillers per plant

Maximum average number of tillers per plant were obtained in treatment T<sub>1</sub> at 75 DAS i.e. 3.2 and minimum were in T<sub>2</sub> at 75 DAS i.e. 1.6. (Kaur and Singh) [8] conducted field experiment during the *kharif* season 2015 and the results revealed that paired row system + 50% RDN to Pearl millet + *Azospirillum* + *Azotobacter* (Seed inoculation) produced significantly increased number of tillers plant<sup>-1</sup> i.e. 2.67.

#### Grain yield per plot (g)

Grain yield is the end result of many complex morphological and physiological processes occurring during the growth and development of crop. Maximum grain yield was obtained in the treatment receiving (RDF and *azotobacter*) T<sub>2</sub> i.e. 6986.59g followed by T<sub>3</sub> (6219.93g) T<sub>1</sub>(6113.33g) T<sub>4</sub> (5846.60g) T<sub>5</sub> (5453.27g). (Pareek *et al.*) [9] conducted a field experiment during the *kharif* season 2014. Maximum grain yield (3.47 t ha<sup>-1</sup>) was recorded by the treatment T<sub>5</sub> (transplanting of 21 days old seedlings on 5th August + application of nitrogen at 100 kg/ha + with *azotobacter* seed inoculation).

#### Test weight

Maximum test weight was 11.0 g in treatment T<sub>3</sub> i.e. PSB + FYM in combination followed by T<sub>4</sub> (10.7 g), T<sub>2</sub> (10.4 g), T<sub>1</sub> (10.1g) and minimum was 8.6 g in T<sub>5</sub> i.e. control. (Singh *et al.*) [10] conducted a study and indicated that addition of 100% NPK + FYM + PSB + *Azotobacter* + Zn + Fe + Mn recorded significantly higher value of growth and yield attributes in terms of 1000-grain weight (g).

#### Observations and Tables

**Table 1:** Average Plant height of pearl millet as effected by use of FYM, PSB and *Azotobacter*

Treatments	Average plant height (cm)				
	15 DAS	30 DAS	45 DAS	60 DAS	75 DAS
T <sub>1</sub>	19.6	45.6	108.2	183.0	183.4
T <sub>2</sub>	21.2	46.6	143.0	186.4	191.2
T <sub>3</sub>	20.6	46.4	118.8	159.8	167.0
T <sub>4</sub>	21.0	48.6	125.0	134.4	160.0
T <sub>5</sub>	15.6	44.6	88.2	130.8	135.8

**Table 2:** Average cob length as affected by use of farmyard manure, PSB and *Azotobacter*

Treatments	Average cob length (cm)
T <sub>1</sub>	21.4
T <sub>2</sub>	28.8
T <sub>3</sub>	17.8
T <sub>4</sub>	18.6
T <sub>5</sub>	12.4

**Table 3:** Average number of tillers affected by use of FYM, PSB and *azotobacter*.

Treatments	Average number of tillers per plant				
	15 DAS	30 DAS	45 DAS	60 DAS	75 DAS
T <sub>1</sub>	1.6	3.0	3.0	3.2	3.2
T <sub>2</sub>	1.0	1.2	1.2	1.2	1.6
T <sub>3</sub>	1.6	2.8	2.8	2.8	3.0
T <sub>4</sub>	1.6	2.4	2.4	2.8	3.0
T <sub>5</sub>	1.0	1.2	1.8	1.8	1.8

**Table 4:** Grain yield affected by use of farm yard manure, PSB and *Azotobacter*.

Treatments	Grain yield per plot (g)
T <sub>1</sub>	6113.33
T <sub>2</sub>	6986.59
T <sub>3</sub>	6219.93
T <sub>4</sub>	5846.60
T <sub>5</sub>	5453.27

**Table 5:** Test weight as affected by use of farm yard manure, PSB and *Azotobacter*.

Treatments	Test weight (g)
T <sub>1</sub>	10.1
T <sub>2</sub>	10.4
T <sub>3</sub>	11.0
T <sub>4</sub>	10.7
T <sub>5</sub>	8.6

## Conclusion

On the basis of experiment it was concluded that *Azotobacter*, FYM (Farmyard manure) and PSB (Phosphorus solubilizing bacteria) influenced plant performance i.e. maximum average plant height (191.2cm), average cob length(28.8cm), average cob girth (11.4cm), weight of grains per cob (20.96g), grain yield per plot (6986.59g) was obtained in T<sub>2</sub> (RDF (N @ 40 kg/acre and P @ 24 kg/acre) + *Azotobacter* @ 4 kg/acre) and maximum average number of tillers (3.2) and average number of leaves/plant (27) were obtained in T<sub>1</sub> (RDF (N @ 40 kg/acre and P @ 24 kg/acre) + PSB @ 4 kg/acre). Test weight (11g) remained maximum in T<sub>3</sub> (PSB @ 4 kg/acre + FYM @ 4tonnes/acre) as compared to T<sub>5</sub> control.

## References

1. [www.aicpmip.res.in/pmnews.html](http://www.aicpmip.res.in/pmnews.html)
2. [www.nutrchoice4u.com/health-benefits-of-bajra-pearl-millet](http://www.nutrchoice4u.com/health-benefits-of-bajra-pearl-millet)
3. [www.primaryinfo.com/azotobacter.htm](http://www.primaryinfo.com/azotobacter.htm)
4. [www.omicsonline.org/phosphate-solubilizing-bacteria-peer-reviewed-open-access-journals.php](http://www.omicsonline.org/phosphate-solubilizing-bacteria-peer-reviewed-open-access-journals.php)
5. [www.wikipedia.org/wiki/farmyard\\_manure](http://www.wikipedia.org/wiki/farmyard_manure)
6. Thumar CM, Dudhat MS, Chaudhari NN, Hadiya NJ, Ahir NB. Growth, Yield Attributes, Yield and Economics of Summer Pearl Millet (*Pennisetum glaucum* L.) as Influenced by Integrated Nutrient Management. Inter J Agri Sci. 2016; 8(59):3344-46.

7. Togas R, Yadav LR, Choudhary SL, Shisuvinahalli GV. Effect of *Azotobacter* on growth, yield and quality of pearl millet. J Pharmacognosy and Phytochem. 2017; 6(4):889-91.
8. Kaur V, Singh R. Effect of Different Planting Pattern and Nitrogen Management in Pearl millet (*Pennisetum glaucum* L.) + Green gram (*Vigna radiata* L.) Intercropping System. Inter J Curr. Microbiol App Sci. 2017; 6(6):1946-51.
9. Pareek B, Singh R, Sherawat A, Singh KK. Effect of establishment methods, nitrogen levels and *azotobacter* seed inoculation on growth and yield of pearl millet (*Pennisetum glaucum* L.). Res Environ Life Sci. 2016; 9(6):768-70.
10. Singh V, Rana NS, Dhyani BP, Kumar R, Vivek RK, Naresh *et al.* Influences of organic and inorganic fertilizers on productivity and soil fertility of wheat (*Triticum aestivum* L.) in Typic Ustochrept soil of Uttar Pradesh. J Pharmacognosy and Phytochem. 2018; 7(1):9260-65.