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Effect of Bio-fertilizer and Gibberellic Acid on Growth and Yield of Baby Corn (*Zea mays*, Poaceae)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The field experiment was conducted during *Zaid* season 2021-22 at Crop Research Farm, Department of Agronomy, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P). The soil of the experiment plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.2), low in organic carbon (0.48%), available N (171.48 kg/ha), available P (13.6 kg/ha) and available K (215.4 kg/ha). The treatments consisted of three levels of Gibberellic acid 50, 100 and 150 ppm of foliar application and (20 g and 10g per kg litre of water) and two levels of Bio fertilizer {Azospirillum seed inoculation (10 and 20 g/kg of seed) and Azotobacter seed inoculation (10 and 20 g/kg of seed)} respectively and Azospirillum + Azotobacter 10 g/kg each gibberellic acid 150 ppm treatment combined. The experiment was laid out in randomized block design with nine treatments and were replicated thrice. Results defined those maximum values of plant height (185.29 cm), dry weight (90.42 g/plant), number of cobs per plant (2.64), cob length

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(19.76 cm), cob weight with husk (48.54 g/cob) and cob weight without husk (12.51 g/cob) cob yield with husk (11.04 t/ ha), cob yield without husk (4.15 t/ha) were recorded with application of Azotobacter 10g/kg + Azospirillum 10g/kg + Gibberellic acid 150 ppm (T9) treatment combination.

Keywords: Baby corn; biofertilizer; economics; gibberellic acid; yield.

1. INTRODUCTION

"Maize (*Zea mays* L.) is the third most important cereal crop in India after wheat and rice. It is grown all over the world under a wide range of climate. Currently it is cultivated in an area of 9.2 m ha with a production of 27.8 m t and productivity of 2965 kg/ha in India" (IIMR 2022). It is popularly known as "miracle crop" and "Queen of Cereals." Maize is recognized as the "golden food" because of its higher potentiality of grain yield and higher nutritional value. Baby corn is an extremely easy crop to produce, and for a corn growing nation, it is surprising that baby corn is an imported crop. The reason behind locally non-production of baby corn is manual labour required for detasseling, harvesting and processing, which economically prevents large-scale production. However, locally produced fresh baby corn can have an advantage over imported baby corn.

"Locally grown fresh and organic baby corn may now have a place in the small farm. Baby corn cultivation promises to have an important role in the future of crop production due to its fresh and safe product" [1]. "Bio-fertilizers play an important role in the increasing availability of nitrogen and phosphorus. Among several bio agent Azospirillum is known to fix atmospheric nitrogen and increased about 10-15 % grain yield in maize" [2]. "Azotobacter was the first and is the most common bio- fertilizer for some plants such as maize, wheat, sorghum and rice which produces some plant growth promoting metabolites, enzymes and hormones (auxin, cytokinin and gibberellin) in addition to fixing air nitrogen" [3].

"A numerous microorganism have been used for preparation of biofertilizers such as azotobacter, azolla, rhizobium, blue green algae, Azospirillum etc. 10-15% of yield is increased with the addition of azotobacter. Azospirillum facilitates the vegetative growth in maize" [4].

"The main environmental factors that negatively affect plant growth and yield are salinity, extremes of temperature, drought and nutrient imbalances" [5]. "The application of plant growth regulators is one of the most important factors in improving the growth, yield and flower quality. Plant growth regulators are found as two types; bio inhibitors and promoters like gibberellins, auxins and cytokinin's. As an organic compound, a plant growth promoter can control biochemical and physiological processes in the plants such as controlling the chemical composition of crops, dormancy, amount of mineral uptake from the soil, organ size, flowering, fruit set and crop development. Hence, growth regulators substances are applied to balance internal hormones and to inhibit or stimulate flowering depending on the concentration and application time" [6]. "Contain gibberellic acid, which incited elongation of plant cells and configure the fruit without seed, which overcomes the genetic dwarf leg, and increases the production of side branches, especially floral which increases the number of flowers and fruits of production rise, and can be sprayed gibberellic acid equipped on specific types of plants to increase their growth. When gibberellic acid sprayed on the plant, has physiological effects on plant growth and its role in the process of photosynthesis, and activate other vital activities that done in parts of the plant cell in division of cells and increase, Elongation and increasing plant height and size of the leaves, root and all of these effects are increased Productivity" [7].

2. MATERIALS AND METHODS

This aim of this experiment was to investigate the effect of bio-fertilizer and gibberellic acid on growth and yield of baby corn (*Zea mays* L.) was laid out during Zaid season of 2022 at Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.). The crop research farm is situated at 25.570 N latitude, 87.190 E longitude and at an altitude of 98 m a.s.l. above mean sea level. The experiment was laid out in randomized block design comprised of levels of Biofertilizers and Gibberellic acid with nine treatments and each were replicated thrice viz. (T1) (Azotobacter 20g/kg + Gibberellic acid 50 ppm), (T2) (Azotobacter 20g/kg + Gibberellic acid 100 ppm), (T3) (Azotobacter 20g/kg + Gibberellic acid 150 ppm), (T4) (Azospirillum 20g/kg +

Table 1. Effect of bio-fertilizers and Gibberellic Acid on plant growth attributes of baby corn (*Zea mays*)

S. No.	Treatments	Plant height(cm)	Plant Dryweight (g)
T1.	Azotobacter 20g/kg + Gibberellic acid 50 ppm	156.49	79.49
T2.	Azotobacter 20g/kg + Gibberellic acid 100 ppm	164.28	81.42
T3.	Azotobacter 20g/kg + Gibberellic acid 150 ppm	175.12	86.79
T4.	Azospirillum 20g/kg + Gibberellic acid 50 ppm	152.25	72.76
T5.	Azospirillum 20g/kg + Gibberellic acid 100 ppm	160.24	80.59
T6.	Azospirillum 20g/kg + Gibberellic acid 150 ppm	168.28	82.28
T7.	Azotobacter 10g/kg + Azospirillum 10g/kg + Gibberellic acid 50 ppm	173.65	83.56
T8.	Azotobacter 10g/kg + Azospirillum 10g/kg + Gibberellic acid 100 ppm	183.33	88.26
T9.	Azotobacter 10g/kg + Azospirillum 10g/kg + Gibberellic acid 150 ppm	185.29	90.42
	F-test	S	S
	SEm(±)	0.68	0.77
	CD (p=0.05)	2.05	2.31

Table 2. Effect of Gibberellic Acid and bio-fertilizers on yield attributes and yield of baby corn (*Zea mays*)

S. No.	Treatments	No. ofcobs plant	Length ofthe cob (cm)	Cob Weight withhusk (g)	Cob weight without husk (g)	Cobyield with husk (t/ha)	Cob yield without husk (t/ha)
T1.	Azotobacter 20g/kg + Gibberellic acid 50 ppm	1.95	15.98	42.42	10.31	7.50	3.64
T2.	Azotobacter 20g/kg + Gibberellic acid 100 ppm	2.25	16.64	45.24	11.26	8.59	3.56
T3.	Azotobacter 20g/kg + Gibberellic acid 150 ppm	2.60	18.43	45.61	12.34	10.10	3.83
T4.	Azospirillum 20g/kg + Gibberellic acid 50 ppm	1.81	14.61	38.81	9.86	7.18	3.54
T5.	Azospirillum 20g/kg + Gibberellic acid 100 ppm	2.30	15.84	40.83	10.99	7.97	3.62
T6.	Azospirillum 20g/kg + Gibberellic acid 150 ppm	2.48	16.88	44.03	11.51	8.73	3.70
T7.	Azotobacter 10g/kg + Azospirillum 10g/kg + Gibberellic acid 50 ppm	2.35	17.45	44.15	11.75	9.44	3.83
T8.	Azotobacter 10g/kg + Azospirillum 10g/kg + Gibberellic acid 100 ppm	2.43	18.65	46.69	12.27	10.56	4.03
T9.	Azotobacter 10g/kg + Azospirillum 10g/kg + Gibberellic acid 150 ppm	2.64	19.76	48.54	12.51	11.04	4.15
	F-test	S	S	S	S	S	S
	SEm(±)	0.20	0.48	0.67	0.11	0.17	0.11
	CD (p=0.05)	0.07	1.47	2.01	0.32	0.51	0.34

Table 3. Economics of baby corn (*Zea mays*) as influenced by bio fertilizers and gibberellic acid

S. No.	Treatments	Total cost ofcultivation (INR/ha)	Gross return(INR/ha)	Net return (INR/ha)	B:C ratio
T1.	Azotobacter 20g/kg + Gibberellic acid 50 ppm	37,165.00	86,363.00	49,198.00	1.32
T2.	Azotobacter 20g/kg + Gibberellic acid 100 ppm	37,265.00	95,279.00	58,014.00	1.56
T3.	Azotobacter 20g/kg + Gibberellic acid 150 ppm	37,315.00	1,02,508.00	65,193.00	1.75
T4.	Azospirillum 20g/kg + Gibberellic acid 50 ppm	37,215.00	84,603.00	47,388.00	1.27
T5.	Azospirillum 20g/kg + Gibberellic acid 100 ppm	37,315.00	90,053.00	52,738.00	1.41
T6.	Azospirillum 20g/kg + Gibberellic acid 150 ppm	37,365.00	98,379.00	61,014.00	1.63
T7.	Azotobacter 10g/kg + Azospirillum 10g/kg + Gibberellic acid 50 ppm	37,315.00	1,00,025.00	62,710.00	1.68
T8.	Azotobacter 10g/kg + Azospirillum 10g/kg + Gibberellic acid 100 ppm	37,415.00	1,05,173.00	67,758.00	1.81
T9.	Azotobacter 10g/kg + Azospirillum 10g/kg + Gibberellic acid 150 ppm	37,465.00	1,08,252	70,787.00	1.89

Gibberellic acid 50 ppm), (T5) (Azospirillum 20g/kg + Gibberellic acid 100 ppm), (T6) (Azospirillum 20g/kg + Gibberellic acid 150 ppm), (T7) (Azotobacter 10g/kg + Azospirillum 10g/kg + Gibberellic acid 50 ppm), (T8) (Azotobacter 10g/kg + Azospirillum 10g/kg + Gibberellic acid 100 ppm), (T9) (Azotobacter 10g/kg + Azospirillum 10g/kg + Gibberellic acid 150 ppm).

3. RESULTS AND DISCUSSION

3.1 Growth Attributes

Effect of Bio-fertilizer and Gibberellic Acid on growth and yield of baby corn (*Zea mays*) presented in below Table 1.

Plant height- Plant height increased significantly due to the application of biofertilizers and gibberellic acid. Application of Azotobacter 10g/kg + Azospirillum 10g/kg + Gibberellic acid 150 ppm gives highest plant height (185.29 cm). Meena et al. [8] revealed that bio-fertilizer (Azotobacter) recorded higher plants height.

Plant dry weight- The maximum dry weight (90.42 g) was recorded with application of Azotobacter 10 g/kg + Azospirillum 10g/kg + Gibberellic acid 150 ppm. Phyto hormones which stimulate the formation of lateral roots and absorbent root hairs, which eventually helped in uptake of higher nutrients and minerals by plants and leads to increase in higher biomass accumulation and higher plant dry weight. Xiaoyun et al. [9] also reported “a significant increase in shoot dry weight by Fe application under both aerobic and flooded plots”.

Yield attributes and Yield- (Table 2). In T9, maximum number of cobs per plant (2.64), cob length (19.76 cm), cob weight with husk (48.54 g/cob) and cob weight without husk (12.51 g/cob), cob yield with husk (11.04 t/ ha), Cob yield without husk (4.15 t/ha) were recorded maximum with application of Azotobacter 10g/kg + Azospirillum 10g/kg + Gibberellic acid 150 ppm treatment combination, respectively. Ram and Mir [10] indicated that “the application of Azotobacter significantly increased grains per spike, test weight, grain yield and straw yield over the control. Found that the application of Azotobacter significantly increased net returns and benefit cost (B: C) ratio in wheat crop over the control”.

Economics- (Table 3). In (T9) maximum gross return (Rs. 108,252/ha), net return (Rs. 70,787 /ha) and B: C ratio (1.89) was recorded in treatment T9 Azotobacter 10g/kg + Azospirillum 10g/kg + Gibberellic acid 150 ppm (Table 3).

4. CONCLUSION

Application of Azotobacter 10g/kg + Azospirillum 10g/kg + Gibberellic acid 150 ppm is a fitting practice for augmenting higher babycorn yields for farmer. This is the application with the maximum Net returns and benefit- cost (B:C) ratio were recorded with the application of Azotobacter 10g/kg + Azospirillum 10g/kg + Gibberellic acid 150 ppm.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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