

TITLE

“Effect of organic manures and bio-fertilizers on growth and yield of baby corn”

Article type: Original Research Article

ABSTRACT

A field experiment was conducted during *zaid* 2023 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P) on the topic “Effect of Organic manures and Bio-fertilizers on growth and yield of baby corn”, to study the response of Farm Yard Manure (FYM)- 20t/ha, Poultry Manure- 4t/ha, Vermicompost- 4t/ha along with the combination of biofertilizers such as, *Azotobacter* (20g) and *Azospirillum* (20g). The results revealed that Based on the objective under taken, significant and higher plant height (138.7 cm), higher plant dry weight (55.49 g), maximum number of cobs/plant (1.93), higher cob length (19.1 cm), higher cob weight (52.54 g), higher cob yield with husk (9.07 t/ha), higher cob yield with-out husk (3.90 t/ha), higher stover yield (22.05 t/ha), Harvest index (29.15 %), maximum Gross returns (1,34,773.33 INR/ha), Net returns (87,106.33 INR/ha) and Benefit cost ratio (1.83) was also recorded in treatment 6 [poultry manure (4t/ha) + Azotobacter (20g) + Azospirillum (20g)].

Keywords: Bio-fertilizers, Organic manures, Growth, Yield.

INTRODUCTION

Baby corn is a vegetable picked from regular maize or sweet corn plants when the ears are still premature and immediately after the emergence of white silk (2–3 cm) length. It is very young cob with undeveloped seeds, obtained from a corn plant at about 45-60 days after sowing or 2-3 days after silking. One hundred grams of baby corn are found to be rich in 89.1% Moisture, 1.9 g Protein, 0.2 g Fat, 0.06 g Ash, 8.2 mg Carbohydrate, 28 mg Calcium, 86 mg Phosphorus and 11 mg Ascorbic Acid. (Thavaprakash *et al.* 2005). It is a warm weather crop and grows from sea level 3000m altitude and optimum temperature for better growth is 28-32°C. It grows well in areas with annual rainfall 250-400 cm. It can be grown successfully in soils with pH ranging from 6.5-7.5. The alluvial soils of Uttar Pradesh are well suitable for raising baby corn. The soils with sandy loam to silty loam texture are best for the crop (Tomar *et al.* 2011)

Globally maize grown in America, Asia and Africa. It is cultivated globally over an area of about 169.81 million hectares with a production of 835.32 million tonnes with the productivity of 49.2 q/ha (USDA, 2023). In India, which is the fifth-largest producer in the world and accounts for 3% of worldwide production, maize is grown over an area of roughly 9.18 million hectares, with a yield of 27.23 million tonnes and an average productivity of 2965 kg/ha. With a contribution of 14.87% (1.37 million tonnes) of the total Indian maize produced area, while Uttar Pradesh gives an area of approximately 0.73 million hectares with a 7.98% to the entire country of India, which has a production of approximately 1.53 million (GOI, 2021).

Application of inorganic fertilizers helps in obtaining maximum production of baby corn but, it increases the cost of production along with its hazardous effects on environmental health. Synthetic fertilizers have become the primary nutrient sources for agriculture over the last 50 years because of certain advantages behind their use. But their extravagant use has created several environmental problems like soil acidity and nutrient imbalance, which may result in reduction of crop yield. So, judicious uses of nutrients from different source of organic as well as bio-fertilizers will maintain the environmental sustainability.

Organic fertilizers including Farm yard manure, Poultry manure, Vermicompost may be used for crop production as substitutes or supplements of the chemical fertilizers. FYM occupies an important position among the organic manures. The FYM seems to act directly by increasing crop yield by acceleration of respiratory process or by cell permeability or by hormonal growth action. Soil physical qualities can also be enhanced with the use of FYM. Soil organic carbon, nitrogen, phosphorus, and potassium levels all improve as a result of this, as do the soil's chemical characteristics. It supplies N, P and K in available form to the plant through biological decomposition. It has an efficiency to improve N fertilizer in the presence of FYM application. Substitution of 50 percent mineral fertilizer-N by FYM in different agro-eco regions has been found to sustain the productivity in a longterm experiments involving various food, fodder crop sequences and inorganic and inorganic sources of nitrogen. Poultry manure is a valuable fertilizer and can serve as a suitable alternate to chemical fertilizers. Poultry manures provide organic matter to soil and nutrients to crops. Poultry manure is a good source of major and minor mineral elements that are capable of enhancing soil fertility on application. Recently vermicompost as source of organic manure in crop production is gaining popularity due to its higher nutrient content, faster mineralization and acceptability. Vermicompost has been reported to give very high crop productivity along with maintaining higher nutritional quality and improving the physical, chemical and biological properties of soil. Vermicompost is highly nutritive and a powerful plant growth promoter and protector and has scientifically proven to be a miracle plant growth promoter. It also increases the efficiency of added fertilizers in the soil.

Biofertilizers are microbial inoculants of selective microorganisms like bacteria, algae, fungi, already existing in nature. They increase the biological fixation of atmospheric nitrogen and enhance phosphorous availability to baby corn crop. Therefore, introduction of efficient strain of azospirillum in the soil which is poor in nitrogen may be helpful in boosting up production and consequently more nitrogen fixation. Among several bio agents, azospirillum and azotobacter is known to fix atmospheric nitrogen and increased about 10-15 per cent grain yield in baby corn. On an average 20 and 22 kg of nitrogen/ha can be saved by inoculation of baby corn seed before sowing with azotobacter or azospirillum, respectively. Many researchers optimistically predicted that microorganisms azotobacter and azospirillum associations could be lucratively managed to reduce dependence on chemical fertilizers, but promises concerning the applied value of azotobacter in agriculture have been more rhetorical than deliverable (Dawson *et al.* 2017). With this in mind, the experiment was carried out to determine the **“Effect of Organic manures and Bio-fertilizers on growth and yield of baby corn”**

Material and Methods

A field experiment was conducted during *zaid* 2023 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P) on the topic “Effect of Organic manures and Bio-fertilizers on growth and yield of baby corn”, to study the response of Farm Yard Manure (FYM)- 20t/ha, poultry Manure- 4t/ha, Vermicompost- 4t/ha along with the combination of biofertilizers such as, *Azotobacter* (20g) and *Azospirillum* (20g). The soil of experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 8.0), low in organic carbon (0.62 %), available N (225 kg/ha), available P (38.2 kg/ha) and available K (240.7 kg/ha). There were 9 treatments, each being replicated thrice and laid out in Randomized Block Design. The treatment combinations are FYM 20t/ha + *Azotobacter* (20g), FYM 20t/ha + *Azospirillum* (20g), FYM 20t/ha + *Azotobacter* (20g) + *Azospirillum* (20g), poultry Manure 4t/ha + *Azotobacter* (20g), Poultry Manure 4t/ha + *Azospirillum* (20g), poultry Manure 4t/ha + *Azotobacter* (20g) + *Azospirillum* (20g), Vermicompost 4t/ha + *Azotobacter* (20g), Vermicompost 4t/ha + *Azospirillum* (20g) and Vermicompost 4t/ha + *Azotobacter* (20g) + *Azospirillum* (20g). Growth parameters, yield attributes and economics was recorded. The Data recorded on different aspects of crop, such as, growth parameters, yield attributes were subjected to statistically analysis by analysis of variance method (**Gomez and Gomez, 1976**).

RESULT AND DISCUSSION

Growth Parameters of Babycorn

Plant height (cm)

The data revealed that, significantly higher plant height (138.7 cm) was recorded in treatment 6 [poultry Manure (4t/ha) + *Azotobacter* (10g) + *Azospirillum* (10g)] as compared to rest of the treatments. However, the treatment 5 [poultry Manure (4t/ha) + *Azospirillum* (20g)] was found to be statistically at par with treatment 6 [poultry Manure (4t/ha) + *Azotobacter* (10g) + *Azospirillum* (10g)]. Significant and higher plant height was recorded with poultry manure (4t/ha) might be due to poultry manure improves soil fertility by adding essential nutrients and soil organic matter in the soil, which improves soil moisture and nutrient retention, results in better growth and development of the crop. Similar result was also reported by **Hossain et al. (2012)**. Significant and higher plant height was recorded with *Azotobacter* might be due to seed treatment with bio-fertilizers increases nitrogen availability by fixing appreciable amount of molecular nitrogen and makes available for plant growth and enhance plant in synthesis of growth promoting enzyme like indole acetic acid (IAA), gibberellins, vitamins, which

altered the microbial balance in the rhizosphere and producing metabolites results in growth and development of Plant. Similar result was also reported by **Patel *et al.* (2014)** in pearl millet. Further, significant and higher plant height was recorded with *Azospirillum* might be due to increasing nutrients up taking by plant and improving soil properties such as organic content, which enhance plant growth through increasing availability nitrogen. Similar result was also reported by **Hoshang *et al.* (2011)** in maize.

Plant Dry Weight (g)

The data revealed that, significantly higher plant dry weight (55.49 g) was recorded in treatment 6 [Poultry Manure (4t/ha) + *Azotobacter* (10g) + *Azospirillum* (10g)] as compared to rest of the treatments. However, the treatment 5 [Poultry Manure (4t/ha) + *Azospirillum* (20g)] was found to be statistically at par with treatment 6 [Poultry Manure (4t/ha) + *Azotobacter* (10g) + *Azospirillum* (10g)]. Significant and higher plant dry weight was recorded with Poultry manure (4t/ha) might be due to optimum availability of essential nutrients through poultry manure leads to increase in leaf area enhance the photosynthesis rate and plant biomass, which may have attributed to achieve higher dry matter accumulation. Similar result was also reported by **Kharche *et al.* (2020)**. Significant and higher plant dry weight was recorded with *Azotobacter* might be due to *azotobacter* fixes atmospheric nitrogen and enhance plant growth promoters, which increase in plant growth and increases ability to uptake more water and nutrients results in production of more biomass. Similar result was also reported by **Marngar and Dawson, (2017)** in maize. Further, significant and higher plant dry matter was recorded with *Azospirillum* might be due to seed treatment with *azospirillum* fixes air nitrogen which promotes plant growth, increases root hairs, uptake of water and nutrients results in accumulation of more dry matter. Similar result was also reported by **Marngar and Dawson, (2017)** in maize.

Yield and Yield Attributes

Number of Cobs/plant

The data revealed that, significant and maximum number of cobs/plant (1.93) was recorded in treatment 6 [poultry Manure (4t/ha) + *Azotobacter* (20g) + *Azospirillum* (20g)] as compared to rest of the

treatments. However, the treatment 5 [poultry Manure (4t/ha) + Azospirillum (20g)] and treatment 9 [Vermicompost (4t/ha) + Azotobacter (20g) + Azospirillum (20g)] was found to be statistically at par with treatment 6 [poultry Manure (4t/ha) + Azotobacter (20g) + Azospirillum (20g)]. Significant and maximum number of cob/plant was recorded with Poultry manure (4tn/ha) might be due to greater availability of photosynthates, metabolites and nutrients results in develop of reproductive parts and increased number of cobs/ plant. Similar result was also reported by **Addepalli and Debbarma, (2022)** in maize.

Length of Cob (cm)

The data revealed that, significant and maximum number of seeds/pod (19.1 cm) was recorded in treatment 6 [poultry Manure (4t/ha) + Azotobacter (20g) + Azospirillum (20g)] as compared to rest of the treatments. However, the treatment 5 [poultry Manure (4t/ha) + Azospirillum (20g)] was found to be statistically at par with treatment 6 [poultry Manure (4t/ha) + Azotobacter (20g) + Azospirillum (20g)]. Significant and higher length of cob was recorded with Poultry manure (4tn/ha) might be due to increasing photosynthetic rate and translocation of photosynthates towards the sink results in development of cob length. Similar result was also reported by **sawant *et al.* (2020)**. Further, significant and higher length of cob was recorded with Azotobacter might be due to adequate availability of nutrients, Photosynthates and metabolites, which help in development of reproductive parts and results in increase of cob length. Similar result was also reported by **Raj *et al.* (2016)**.

Weight of cob (g)

Significant and higher seed index (52.54 g) was recorded in treatment 6 [poultry Manure (4t/ha) + Azotobacter (20g) + Azospirillum (20g)] as compared to rest of the treatments. However, the treatment 5 [poultry Manure (4t/ha) + Azospirillum (20g)] was found to be statistically at par with treatment 6 [poultry Manure (4t/ha) + Azotobacter (20g) + Azospirillum (20g)].

Significant and higher weight of cob was recorded with poultry manure (4t/ ha) might be due to greater availability of photosynthates, metabolites and nutrients to develop reproductive structures which, leads to increase in cob weight. Similar result was also reported by **Kumar *et al.* (2022)**. Further,

significant and higher weight of cob was recorded with *Azotobacter* and *Azospirillum* might be due to increased cob weight appears to be the result of more photosynthates, metabolites, and nutrients being available to build reproductive structures in cob weight. Similar result was also reported by **Jinjala *et al.* (2016)**.

Cob yield (t/ha)

I. With Husk (t/ha)

The data revealed that, Significant and higher seed yield (9.07 t/ha) was recorded in treatment 6 [poultry Manure (4t/ha) + *Azotobacter* (20g) + *Azospirillum* (20g)] as compared to rest of the treatments. However, the treatment 5 [poultry Manure (4t/ha) + *Azospirillum* (20g)] and treatment 9 [Vermicompost (4t/ha) + *Azotobacter* (20g) + *Azospirillum* (20g)] was found to be statistically at par with treatment 6 [poultry Manure (4t/ha) + *Azotobacter* (20g) + *Azospirillum* (20g)]. Significant and higher cob yield with husk was recorded with poultry manure (4tn/ha) might be due to higher mineralization potential of poultry manure enabling it to active and fast release of its nutrients for plant uptake. Similar result was also reported by **Kharche *et al.* (2020)**. Further, significant and higher cob yield with husk was recorded with *Azotobacter* and *Azospirillum* might be due to nitrogen fixing bacteria could be beneficial source to enhance plant growth and produce considerable amounts of biologically active substances such as, auxin, gibberellin etc. that promote growth of reproductive organs and increase plants productivity. higher mineralization potential of poultry manure enabling it to active and its nutrients uptake of plants.

II. Without Husk (t/ha)

Significant and higher seed yield (3.90 t/ha) was recorded in treatment 6 [Poultry Manure (4t/ha) + *Azotobacter* (20g) + *Azospirillum* (20g)] as compared to rest of the treatments. However, the treatment 5

[Poultry Manure (4t/ha) + Azospirillum (20g)] was found to be statistically at par with treatment 6 [Poultry Manure (4t/ha) + Azotobacter (20g) + Azospirillum (20g)].

Stover yield (t/ha)

The data revealed that, Significant and higher Stover yield (22.05 t/ha) was recorded in treatment 6 [poultry Manure (4t/ha) + Azotobacter (20g) + Azospirillum (20g)] as compared to rest of the treatments. However, the treatment 5 [poultry Manure (4t/ha) + Azospirillum (20g)] and treatment 9 [Vermicompost (4t/ha) + Azotobacter (20g) + Azospirillum (20g)] was found to be statistically at par with treatment 6 [poultry Manure (4t/ha) + Azotobacter (20g) + Azospirillum (20g)]. Significant and higher Stover yield was recorded with poultry manure (4tn/ha) might be due to incorporation of organic manures increases the availability of plant nutrients and helps in formation of organic acids through decomposition process, which develops native nutrients within the soil and increases their availability to plants for better vegetative growth and leads to increase in stover yield. Similar result was also reported by **Kharche *et al.* (2020)**.

Significant and higher stover yield was recorded with *Azotobacter* might be due to bacterization with azotobacter culture helping in fixation of atmospheric nitrogen, secretion of growth promoting substances, resulting in better seed germination and expanded root system for nutrient uptake, which results in production of more stover yield. Similar result was also reported by **Laxminarayana, (2001)** in maize. Further, significant and higher stover yield was recorded with *Azospirillum* might be due to fixation of atmospheric nitrogen, enhance production of indoleacetic acid, gibberellin and cytokinin like substances results in more nutrient uptake and crop production. Similar result was also reported by **Laxminarayana, (2001)** in maize.

Harvest Index (%)

The data revealed that, Significant and higher harvest index (29.15 %) was recorded in treatment 6 [Poultry Manure (4t/ha) + Azotobacter (20g) + Azospirillum (20g)] as compared to rest of the treatments. However, the treatment 5 [Poultry Manure (4t/ha) + Azospirillum (20g)], treatment 7 [Vermicompost (4t/ha) + Azotobacter (20g)], treatment 8 [Vermicompost (4t/ha) + Azospirillum (20g)] and treatment 9 [Vermicompost (4t/ha) + Azotobacter (20g) + Azospirillum (20g)] was found to be statistically at par with treatment 6 [Poultry Manure (4t/ha) + Azotobacter (20g) + Azospirillum (20g)].

Significant and higher harvest index was recorded with *Azotobacter* and *Azospirillum* might be due to use of biofertilizers may lead to higher availability of nitrogen and phosphorus that promoted growth and development and ultimately resulting in higher yields. Similar result was also reported by **Rani *et al.* (2018)** in sorghum.

Table 1 Effect of Organic manures and Bio-fertilizers on Growth Parameters of baby corn

S.No.	Treatments combination	Growth Parameters	
		Plant Height 60 DAS	Plant Dry weight 60 DAS
1	FYM 20t/ha + Azotobactor (20g)	122.4	45.64
2	FYM 20t/ha + Azospirillum (20g)	125.4	46.91
3	FYM 20t/ha + Azotobactor (10g) + Azospirillum (10g)	131.9	50.27
4	Poultry Manure 4t/ha + Azotobactor (20g)	131.1	49.05
5	Poultry Manure 4t/ha + Azospirillum (20g)	137.0	54.73
6	Poultry Manure 4t/ha + Azotobactor (20g) + Azospirillum (20g)	138.7	55.49
7	Vermicompost 4t/ha + Azotobactor (20g)	128.6	48.39
8	Vermicompost 4t/ha + Azospirillum (20g)	132.7	50.70
9	Vermicompost 4t/ha + Azotobactor (20g) + Azospirillum (20g)	134.3	52.09
	F-test	S	S
	S Em (\pm)	0.6	0.27
	CD (p =0.05)	1.9	0.82

Table 2 Effect of organic manures and bio-fertilizers on yield and yield attributes of baby corn

S. No.	Treatment combinations							
		Number of Cobs/plant	Length of cob (cm)	Weight of cob (g)	Cob yield With husk (t/ha)	Cob yield With out husk (t/ha)	Stover Yield (t/ha)	Harvest Index (%)
1.	FYM 20t/ha + Azotobactor (20g)	1.27	16.3	43.79	7.81	2.11	20.41	27.65
2.	FYM 20t/ha + Azospirillum (20g)	1.47	16.8	45.84	7.94	2.29	20.53	27.89
3.	FYM 20t/ha + Azotobactor (20g) + Azospirillum (20g)	1.67	17.8	48.40	8.56	2.60	21.02	28.93
4.	Poultry Manure 4t/ha + Azotobactor (20g)	1.53	17.5	48.31	8.37	2.47	20.86	28.65
5.	Poultry Manure 4t/ha + Azospirillum (20g)	1.87	18.6	51.42	8.84	3.68	21.64	29.00
6.	Poultry Manure 4t/ha + Azotobactor (20g) + Azospirillum(20g)	1.93	19.1	52.54	9.07	3.90	22.05	29.15
7.	Vermicompost 4t/ha + Azotobactor (20g)	1.47	17.1	46.70	8.02	2.36	20.61	28.01
8.	Vermicompost 4t/ha + Azospirillum (20g)	1.73	18.0	48.61	8.63	2.84	21.17	28.97
9.	Vermicompost 4t/ha + Azotobactor (20g) + Azospirillum (20g)	1.80	18.2	49.52	8.71	3.15	21.30	29.01
F-test		S	S	S	S	S	S	S
S Em (\pm)		0.06	0.25	0.37	0.13	0.10	0.26	0.40
CD (p =0.05)		0.19	0.74	1.13	0.39	0.31	0.78	1.22

CONCLUSION

Based on the above findings it can be concluded that, application of Poultry manure along with azotobacter and Azospirillum (treatment 6) was observed highest yield of baby corn and benefit cost ratio.

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