**Original Research Article**

# "Effect of boron and panchagavya on growth and yield of baby corn (*Zea mays* L.)"

## ABSTRACT

The experiment was conducted in Crop Research Farm in department of agronomy during summer season of 2022 on baby corn crop. The treatments consisted of 3 levels of boron (2kg, 3kg, 4 kg/ha) and Panchagavya (2 sprays of 2%, 3%, 4%) as a foliar spray at 15 and 30 DAS and a control. The experiment was laid out in Randomized Block Design (RBD) with 10 treatments and replicated thrice. Application of Boron (4kg/ha) and Panchagavya ( 2 sprays of 4%) produced maximum plant height (135.44 cm), plant dry weight (138.95 g), number of cobs per plant (3.06), weight of cobs with husk (44.85g), weight of cobs without cob (8.24g), cob yield with husk (7.48 t/ha), cob yield without husk (3.01 t/ha), green fodder yield (41.80 t/ha). Treatment combination with Boron 4 kg/ha and Panchagavya 2 sprays of 4% produced highest gross returns (Rs. 1,44,700/ha), net returns (Rs. 99,845/ha) and benefit cost ratio (2.23) when compared to control(RDF).


Key words: Boron, Panchagavya, Baby Corn, economic and yield.

# INTRODUCTION

Baby corn is an ear of maize (*Zea mays* L.) that has been harvested when it is still young, typically before the silks have fully emerged or have just begun. Its botanical name is *Zea mays* L. belonging to the family Gramineae, sub family Poaceae and chromosome number is 2n=20. Although baby corn can be cultivated in a variety of agro climatic settings, the plants thrive and show their greatest potential biomass at temperatures between 25 and $35^0$C. Baby corn can be produced on a range of soil types, deep, fertile, rich in organic matter but well-drained soils are the most desirable ones for the crop. In general, irrigation is not needed for kharif crops. Baby corn needs to be detasseled before it flowers. Detasseling prevents fertilisation and facilitates harvesting later, resulting in an increase in the quantity of cobs with better development.

The majority of baby corn is consumed in Asian nations. Thailand, China, and Taiwan are Asia's top producers of baby corn. Due to its high demand, promising market, chances for value addition, and high earning potential, it is attracting growers' interest in India, much like it has in other Asian nations. Crude protein, phosphorus, potassium, calcium, sugars, ascorbic acid, and crude fibre levels are all abundant in baby corn. Both fresh and processed ingestion of baby corn are options. In addition to the primary crop, it also produces a sizable amount of high-quality green fodder, which serves as a valuable by-product for cattle feed. Consequently, growing baby corn offers a chance to keep a dairy farm running.

Panchagavya, a natural, eco-friendly remedy made from cow by-products. The ingredients used to make these liquid organic solutions include cow dung, urine, milk, curd, ghee, bean flour, and jaggary. Panchagavya is an indigenous Tamil Nadu material made by organic growers that is utilised extensively for agricultural crops **(Natarajan, 2002).** A small number of farmers in the southern states of India have tried modified Panchagavya formulations, and they've found that they increase the biological effectiveness of field crops and the quality of fruits and vegetables. **(Vallimayil and Sekar, 2012).** Growth regulators including IAA, GA, and cytokinin, as well as crucial plant nutrients and advantageous microbes like lactic acid bacteria, yeast, and actinomycetes, are all included in panchagavya **(Venkatalakshmi *et al.* 2009).** Higher population of bacteria actinomycetes phosphate solubilizers fluorescent pseudomonads, nitrifiers, dehydrogenase activity and microbial biomass carbon were found in Panchagavya **(Amalrag 2013).**

Boron is an important micronutrient for healthy plant growth and development. Numerous plant processes, including sugar transport, cell wall synthesis, lignification, meristematic tissue cell division, formation of petal and leaf buds, cell wall integrity, ribose nucleic acid (RNA) metabolism, respiration, indole acetic acid (IAA) metabolism, cytokinin production and transfer, phenol metabolism, nitrogen fixation, pollen germination, pollen tube formation, and seed formation, depend on it. Cell wall strength and development, cell wall division, fruit and seed development, sugar transport, and hormone development are all related to the principal functions of boron. **Gay Lussac and Thenard, 1808** discover Boron and state that it plays an important role in plant growth and development. Boron is one of the essential nutrients for the optimum growth, development, yield, and quality of crops **(Brown *et al.* 2002)** Boron strengthened the cell wall and development, cell division, fruit and seed development and development of hormone **(Ahmad W. 2009).** A Lack of boron hinders blooming and fruiting. It also delays the processes of pollen germination and pollen tube development **(Muntean DW, 2009).** Boron deficiency inhibits root elongation through limiting cell enlargement and cell division in the growing zone of root tips **(Dell *et al.* 1997).** Plants require minimal amounts of boron, although most plants become hazardous at levels of 20 ppm or more **(Carlos B, 2000).**

## MATERIALS AND METHODS

**Field location**:

A field experiment was conducted during July-September (2022) to study the effect of boron and foliar spray of panchagavya on growth, yield and economics of Baby corn at Crop Research Farm, Department of Agronomy, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj ($25{\cdot}77^0$N, $81.50^0$E and 98 m altitude from the sea level) with variety Syngenta G-5414.

**Treatment details:**

The experiment was laid out in a Randomized Block Design with ten treatments and three replications. The treatments included in the study were $T_1$- Boron (2 kg/ha) + Panchagavya (2 sprays of 2%), $T_2$- Boron (2 kg/ha) + Panchagavya (2 sprays of 3%) $T_3$- Boron (2 kg/ha) + Panchagavya (2 sprays of 4%) $T_4$- Boron (3 kg/ha) + Panchagavya (2 sprays of 2%) $T_5$- Boron (3 kg/ha) + Panchagavya (2 sprays of 3%) $T_6$- Boron (3 kg/ha + Panchagavya (2 sprays of 4%), $T_7$- Boron (4 kg/ha) + Panchagavya (2 sprays of 2%) $T_8$- Boron (4 kg/ha) +

Panchagavya (2 sprays of 3%) $T_9$- Boron (4 kg/ha) + Panchagavya (2 sprays of 4%) and $T_{10}$- Control (120: 60:40 NPK kg/ha).

## RESULTS AND DISCUSSION

**Growth parameters:**

**Plant height (cm):**

Maximum plant height of Baby corn at harvesting stage was recorded (135.44 cm) with the application of $T_9$- Boron (4 kg/ha) + Panchagavya (4% of 2 sprays) (Table 1). Panchgavya boost the creation of new cells, increase plant vigour, and speed up the development of leaves, all of which aid in capturing more solar energy and better utilization of nitrogen for higher growth qualities. Similar results also found by **Kumar *et al.* (2018)** and **Vimalendran *et al.* (2014).** The significant effect of panchagavya was mainly attributed to its nutrient content, higher biological activity and presence of plant growth promoting substances where apical meristem's activity has a major role in determining the growth and development of the plant's above-ground components and elongates the stem, which was confirmed by **Hazarika *et al.* (2006).**

**Dry weight (g/plant)**:

Maximum dry weight of baby corn at harvest was recorded at (69.80 g) with the application of $T_9$- Boron (4 kg/ha) + Panchagavya (4% of 2 sprays) (Table 1). In panchagavya, hormonal substance particularly cytokinin plays an important role in nutrient partitioning in vegetative plant parts. Panchagavya promote the synthesis of chemicals IAA and GA3 which might have stimulated the production of growth regulators in cell system, which led to an increase in growth. Improved nutrition may enable greater leaf area production that results in greater interception of light thereby increasing dry matter production **De Britto and Girija, (2006).**

**Crop Growth Rate (g/m$^2$/day):**

The crop growth rate (CGR) (g/m$^2$/day) of Baby corn between 15-30 DAS, 30-45 DAS and 45-60 DAS was recorded non-significantly maximum (13.34, 24.76 and 14.96 g/m2/day) with the application of $T_9$- Boron (4 kg/ha) + Panchagavya (4% of 2 sprays) (Table 1).

**Relative Growth Rate (g/g/day):**

The relative growth rate (RGR) (g/g/day) of Baby corn between 15-30 DAS, 30-45 DAS and 45-60 DAS was recorded non-significantly maximum (0.034, 0.024 and 0.016 g/g/day) with the application of $T_9$- Boron (4 kg/ha) + Panchagavya (4% of 2 sprays) (Table 1).

## YIELD AND YIELD ATTRIBUTES

**No. of cobs per plant:**

Number of cobs per plant failed to touch the level of significance from various treatments (Table 2). Similar findings were found in **Khan *et al.* (2008).**

**Cob weight with husk (g):**

Maximum cob weight with husk was recorded significant at (44.85 g) with the application of $T_9$ - Boron (4 kg/ha) + Panchagavya (4% of 2 sprays) (Table 2). The microorganisms present in panchagavya established in the soil improved the sustainability of agriculture, and the rhizosphere environment around the roots enhanced the plant growth, enhanced flowering, increased fruit and crop yield **Beaulah (2001)** and **Yadhav and Christophe (2006).**

**Cob weight without husk (g):**

Maximum cob weight without husk was found significant at (8.24 g) with the application of $T_9$ - Boron (4 kg/ha) + Panchagavya (4% of 2 sprays) (Table 2). Application of boron activates the enzyme, membrane integrity, chlorophyll formation, stomatal balance and starch utilization at early stages enhances grain filling **(Asif 2013).** Boron enhances grain yield and reduce partly grain-free ear in corn **Ziaeyan *et al.* (2009).**

**Cob yield with husk (t/ha):**

Maximum cob yield with husk was found significant at (7.48 t/ha) with the application of $T_9$ - Boron (4 kg/ha) + Panchagavya (4% of 2 sprays) (Table 2). Boron is important for metabolism of carbohydrate and translocation and also plays a vital role in materialization of cell in plants, pollen tube growth, integrity of plasma membranes, and encouragement fertilization for seed development **Ceyhan (2008).**

**Cob yield without husk (t/ha):**

Maximum cob yield without husk was found significant at (3.01 t/ha) with the application of $T_9$ - Boron (4 kg/ha) + Panchagavya (4% of 2 sprays) (Table 2). The application of panchagavya result in higher fruit yield due to the enhancement of nutrient availability

uptake by the plants and fruit yield is closely related to the physiological attributes like leaf area, chlorophyll content and dry matter production **Sanjutha (2008).**

**Green fodder yield (t/ha):**

Maximum green fodder yield was found significant at (41.80 t/ha) with the application of $T_9$ - Boron (4 kg/ha) + Panchagavya (4% of 2 sprays) (Table 2). The above result might be attributed due to the fact that the presence of Boron increase photosynthesis, which is indicative of how the micronutrients help to activate the synthesis of tryptophan and the precursor to IAA and is responsible for stimulating plant growth and biomass accumulation, the maximum plant height and greater number of leaves were observed in this treatment. Similar results were also reported by **Satybhan *et al.* (2019).**

## ECONOMICS

**Cost of cultivation:**

The maximum cost of cultivation (Rs 44,855/ha) was recorded with the application of treatment $T_9$ - Boron (4 kg/ha) + Panchagavya (2 sprays OF 4%) (Table 3). It may be attributed due to the increasing prices of Boron, Panchagavya and labour cost.

**Gross return:**

The maximum gross return (Rs 1,44,700/ha) was found with the application of treatment $T_9$ - Boron (4 kg/ha) + Panchagavya (2 sprays OF 4%) (Table 3). It may be attributed due to maximum cob yield and green fodder yield was found over the other treatments.

**Net return:**

The maximum net return (Rs 99,845/ha) was recorded with the application of treatment $T_9$ - Boron (4 kg/ha) + Panchagavya (2 sprays OF 4%) (Table 3). It is attributed due to the highest gross return was found in the mentioned treatment.

**Benefit cost ratio:**

Maximum benefit cost ratio (B:C) (2.23) was recorded with the application of $T_9$ - Boron (4 kg/ha) + Panchagavya (2 sprays OF 4%) (Table 3). It is attributed due to maximum output and low input. Similar results were reported by **Somasundaram 2003** in maize.

**Table 1 Growth attributes of Baby corn as influenced by Boron and panchagavya**

| Treatments | Growth attributes | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Plant height (cm) | Dry weight (g/plant) | CGR(g/m$^2$/day) | | | RGR(g/g/day) | | |
| | | | 15-30 DAS | 30-45 DAS | 45-60 DAS | 15-30 DAS | 30-45 DAS | 45-60 DAS |
| Boron (2 kg/ha) + Panchagavya (2 sprays of 2%) | 105.18 | 60.83 | 7.29 | 9.75 | 12.75 | 0.030 | 0.018 | 0.014 |
| Boron (2 kg/ha) + Panchagavya (2 sprays of 3%) | 106.07 | 75.20 | 8.75 | 13.61 | 15.36 | 0.033 | 0.021 | 0.013 |
| Boron (2 kg/ha) + Panchagavya (2 sprays of 4%) | 125.14 | 97.91 | 10.04 | 16.73 | 22.26 | 0.031 | 0.021 | 0.015 |
| Boron (3 kg/ha) + Panchagavya (2 sprays of 2%) | 123.06 | 102.87 | 12.79 | 18.59 | 20.11 | 0.034 | 0.020 | 0.013 |
| Boron (3 kg/ha) + Panchagavya (2 sprays of 3%) | 117.43 | 93.49 | 8.54 | 17.70 | 21.07 | 0.030 | 0.021 | 0.015 |
| Boron (3 kg/ha) + Panchagavya (2 sprays of 4%) | 134.07 | 115.84 | 12.53 | 21.86 | 24.32 | 0.034 | 0.023 | 0.014 |
| Boron (4 kg/ha) + Panchagavya (2 sprays of 2%) | 124.84 | 113.19 | 12.24 | 21.93 | 23.08 | 0.034 | 0.023 | 0.013 |
| Boron (4 kg/ha) + Panchagavya (2 sprays of 3%) | 125.61 | 117.49 | 13.10 | 21.08 | 25.34 | 0.035 | 0.022 | 0.014 |
| Boron (4 kg/ha) + Panchagavya (2 sprays of 4%) | 135.44 | 138.95 | 13.34 | 24.76 | 33.33 | 0.035 | 0.024 | 0.016 |
| Control (120: 60:40 NPK kg/ha) | 119.28 | 69.80 | 7.65 | 11.49 | 14.96 | 0.029 | 0.019 | 0.014 |
| SEm(±) | 2.53 | 1.20 | 0.29 | 0.57 | 0.92 | 0.0009 | 0.00067 | 0.00063 |
| CD(p=0.05) | 5.33 | 3.57 | 0.86 | 1.72 | NS | 0.0028 | 0.00201 | NS |

**Table 2 Yield and yield attributes of Baby corn as influenced by Boron and panchagavya**

| Treatments | Yield and yield attributes | | | | | |
|---|---|---|---|---|---|---|
| | No. of Cobs per plant | Cob weight with husk (g) | Cob weight without husk (g) | Cob yield with husk(t/ha) | Cob yield without husk(t/ha) | Green fodder yield (t/ha) |
| Boron (2 kg/ha) + Panchagavya (2 sprays of 2%) | 1.73 | 31.65 | 4.44 | 4.32 | 1.47 | 18.40 |
| Boron (2 kg/ha) + Panchagavya (2 sprays of 3%) | 1.8 | 31.89 | 5.58 | 4.86 | 1.63 | 24 |
| Boron (2 kg/ha) + Panchagavya (2 sprays of 4%) | 1.86 | 31.02 | 5.71 | 5.54 | 1.98 | 32.30 |
| Boron (3 kg/ha) + Panchagavya (2 sprays of 2%) | 1.93 | 35.57 | 5.16 | 5.01 | 1.54 | 23.90 |
| Boron (3 kg/ha) + Panchagavya (2 spraysof 3%) | 2 | 35.61 | 5.59 | 5.24 | 1.67 | 26.70 |
| Boron (3 kg/ha) + Panchagavya (2 sprays of 4%) | 2.20 | 42.29 | 6.89 | 6.98 | 2.91 | 40.70 |
| Boron (4 kg/ha) + Panchagavya (2 sprays of 2%) | 2.13 | 44.34 | 7.59 | 6.13 | 2.65 | 33.40 |
| Boron (4 kg/ha) + Panchagavya (2 sprays of 3%) | 2.06 | 39.21 | 6.31 | 6.31 | 2.78 | 38.30 |
| Boron (4 kg/ha) + Panchagavya (2 sprays of 4%) | 3.06 | 44.85 | 8.24 | 7.48 | 3.01 | 41.80 |
| Control (120: 60:40 NPK kg/ha) | 1.6 | 32.91 | 5.27 | 5.34 | 1.95 | 31.40 |
| SEm(±) | 0.18 | 2.09 | 0.27 | 0.57 | 0.17 | 2.95 |
| CD(p=0.05) | NS | 6.23 | 0.79 | 1.69 | 0.51 | 8.77 |

**Table 3 Economics of baby corn cultivation as influenced by boron and panchagavya**

| Treatments | Economics | | | |
|---|---|---|---|---|
| | **Cost of cultivation (INR/ha)** | **Gross return (INR/ha)** | **Net return (INR/ha)** | **B:C ratio** |
| Boron (2 kg/ha) + Panchagavya (2 sprays of 2%) | 42,919 | 89,200 | 46,281 | 1.08 |
| Boron (2 kg/ha) + Panchagavya (2 sprays of 3%) | 43,167 | 93,800 | 50,633 | 1.17 |
| Boron (2 kg/ha) + Panchagavya (2 sprays of 4%) | 43,415 | 1,15,800 | 72,385 | 1.67 |
| Boron (3 kg/ha) + Panchagavya (2 sprays of 2%) | 43,639 | 99,400 | 55,761 | 1.28 |
| Boron (3 kg/ha) + Panchagavya (2 sprays of 3%) | 43,887 | 1,02,200 | 58,313 | 1.33 |
| Boron (3 kg/ha) + Panchagavya (2 sprays of 4%) | 44,135 | 1,40,100 | 95,965 | 2.17 |
| Boron (4 kg/ha) + Panchagavya (2 sprays of 2%) | 44,359 | 1,16,700 | 72,341 | 1.63 |
| Boron (4 kg/ha) + Panchagavya (2 sprays of 3%) | 44,608 | 1,30,200 | 85,592 | 1.92 |
| Boron (4 kg/ha) + Panchagavya (2 sprays of 4%) | 44,855 | 1,44,700 | 99,845 | 2.23 |
| Control (120: 60:40 NPK kg/ha) | 40,983 | 1,01,100 | 60,0117 | 1.47 |

## CONCLUSION

The results of this study, indicated that application of Boron 4kg/ha with two sprays of four percent panchagavya at 15 and 30 days after sowing recorded maximum yield attributes, yield and economics of baby corn.

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