Original Research Article

Response of zinc and panchagavya on growth and yield of sweet corn

ABSTRACT

A field experiment was conducted during *Zaid* summer season of 2023 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj. The experiment was laid out in Randomized Block Design (RBD) with 10 treatment and replicated thrice. The results showed significantly increase in growth parameter with application of zinc (25kg/ha) and Panchagavya (3 sprays of 3%) recorded the highest plant height (166.55cm), dry weight (69.59g/plant) at 80 DAS. Whereas number of cobs per plant (2.00 g), number of rows per cobs (15.50 g), number of grains per cobs (28.93g), cob yield (5.24 t/ha) were recorded at harvest. Treatment combination with zinc 25kg/ha and Panchagavya 3 sprays of 3% produced highest gross returns (Rs 2,19,560/ha), net return (Rs 1,61,952.45/ha), and benefit cost ratio (2.81) which was significantly superior to other treatments.

Keywords:*Growth, panchagavya, sweet corn, yield and zinc.*

INTRODUCTION

Maize belongs to a family poaceae is an important cereals food grain crop of the also known as the “Queen of cereals” is the third most important cereals crop in India. About two-third of the total production of maize is used for livestock feed or for commercial starch and oil production. Apart maize is an important industrial raw material and provide large opportunity for value addition. Maize is cultivated in all season’s *viz.*, Kharif, rabi and summer. In India, maize 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 average productivity of 2965 kg/ha. While Uttar Pradesh gives an area of approximately 0.73 million hectares with a 7.98% to the entire country of India, which has production of approximately 1.53 million (Agricultural statistics 2019-2020).

Sweet corn is a type of speciality corn also a hybridized variety of maize used as fresh or canned vegetable which produce kernels consisting mostly. The Kernel of sweet corn is much

sweeter than normal In recent years, sugar has gained more value than starch. corn, especially at 25-30%. The kernel contain a high amount of carbohydrates, protein, vitamin and minerals. Sweet corn contain 5-6% sugar, 10-11% starch, 3% water soluble polysaccharides and 70% water. The higher content of water soluble polysaccharide in the kernel adds texture and quality in addition to sweetness Ventakesh *etal.* (2003). Because of its high level of glucose and low starch content sweet corn has become more common in both rural and urban areas. Being a potential crop in India sweet corn occupies important place as food, animal feed, poultry feed, industrial products mainly starch and each in brewery and seed Das *et al.* (2008). The crop has become increasingly important in India due to its high nutritional value and versatility in cooking.

Among the micronutrients, zinc is one of the micronutrients recognised as an essential for the plants. Zinc plays an important role in photosynthesis, nitrogen metabolism and regulates aux in concentration in the plant. Zinc increases dry matter by increasing leaf chlorophyll content and increase in N and P efficiencies Amanullah *et al.* (2016). Zinc is crucial in taking part in plant development due to its catalytic action in metabolism for all crops especially maize. About 50% Indian soils are deficient in zinc causing low level of zinc and yield in fodder crops and affecting the health of the livestock. Usage of the liquid manures got a lot of attention among scientists and farmer in recent years as they proved effective in increasing the absorption and translocation of nutrients by the crops. It helps to improve soil fertility and enhance crop productivity and quality of product and also working as a pest-repellent Swaminathan *et al*. (2007). Foliar application will be more efficient than soil applications at the late growth stage when there is preferential assimilate translocations into seeds (or) root activity for nutrient uptake is limited. Use of chemical fertilizers and pesticides in agriculture fields led to environmental degradation and hence as an alternative to chemicals. Panchagavya is also being sought to enhance crop establishment and health Shakuntala *et al*. (2012).

MATERIALS AND METHODS

The experiment was conducted during the *Zaid* season 2023, at the Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Prayagraj (U.P). This experimental field is located approximately 7 kilometers from Prayagraj city, near the Yamuna River, on the left

side of the Prayagraj-Rewa Road. Prayagraj is located in the subtropical zone of Uttar Pradesh, with hot summers and pleasant winters. The area's average temperature is 22˚C to 39˚C. In this location, the total rainfall received during crop growing season of 2023 was 6.11 mm. The soil chemistry analysis revealed a sandy loam texture with a neutral pH of 7.4, low level of organic carbon (0.336 percent), medium level of available potassium (217.8 kg), high level of available phosphorus (28.7 kg). The soil was electrically conductive and had a conductivity of 0.618 Ds/m.

The experiment was laid out in Randomized Block Design with 10 treatments that were replicated three times *viz.*, T_1 :120 kg N + 60 kg P + 60 kg K (control), T_2 :15 kg zn + 3 sprays of 1% Panchagavya, T_3 :25 kg zn + 3 sprays of 2% Panchagavya, T_4 :15 kg zn + 3 sprays of 3%, T_5 :20 kg zn + 3 sprays of 1% Panchagavya, T_6 :20 kg zn + 3 sprays of 2% 4anchagavya,

T_7 :20 kg zn + 3 sprays of 3% Panchagavya, T_8 :25 kg zn + 3 sprays of 1% Panchagavya, T_9 :25 kg zn + 3 sprays of 2% Panchagavya, T_{10} :25 kg zn + 3 sprays of 3% Panchagavya. Sweety is the variety of sweet corn which was sown at 25 kg/ha with the spacing of 60 × 20 cm in net plot area of 3 × 3m. The field trial was ploughed, harrowed and levelled. Nitrogen was applied as per treatments and full dose of P and K. Nitrogen was applied through urea, phosphorus and applied through Di-ammonium phosphate and potassium in the form of murate of potash. Zinc was applied as basal at the time of sowing whereas the liquid foliar sprays at different time intervals as 15, 30 and 45 days after sowing (DAS). The growth parameters such as plant height (cm), dry weight per plant (g), crop growth rate and relative growth rate of data were collected from five randomly. The number of cobs/plant, row/cob and grain/rows were collected separately from five tagged plant and green cob yield were recorded at the time of harvest from net plot area. The raw data was subjected to appropriate statistical analysis (ANOVA) as describe by Gomez and Gomez (1984). The data from the experiments were analyzed satistically, wherever treatment differences were found significant, the critical differences value were calculated at 5% level of probability (P = 0.05).

RESULTS AND DISCUSSION

Plant height (cm)

Maximum plant height was observed with the application of 25 kg zinc + 3 sprays of Panchagavya 3% (166.55cm) (Table 1). Zinc is an activator of plant nutrients and plays an important role in growth and metabolism of microorganism Monu *et al.* (2019). Increase in plant height with zinc might be due cell and internodal elongation, plant metabolism, there by promoting vegetative growth which is positively correlated to the productive potentiality of plant which corroborates. Also improvement in metalloenzyme system regulatory function and growth promoting auxin production, The result was reported by Kumar and Salakinkop (2018). The application of nutrients through foliar spraying Panchagavya may have contributed to the increase in plant height because it contains a favourable combination of macro and micronutrients, growth hormones, and biofertilizers in a liquid formulation. The result was reported by Mushar *et al*. (2023).

Dry weight (g)

Maximum dry weight was observed with the application of 25 kg Zinc + 3 sprays of Panchagavya 3% (65.59 g/plant) (Table). Increase in dry weight which is attributed to photosynthesis being enhanced in the presence of zinc. This indicates that the micronutrients help in activating the production of tryptophan and precursor IAA, which is responsible for promoting plant growth and biomass accumulation. This result was reported by singh *et al.*(2007). Panchagavya make easily available of nutrients to crop without any looses (leaching, runoff), nutrient uptake will increase ultimately dry matter accumulation significantly increases was reported by Gurwinder Singh *et al*.(2018). The essential nutrients that organic manure provides are crucial in the plant system growth and physiological function Kumar *et al.* (2018).

Crop growth rate (g/m^2/day)

In the present study CGR was significantly higher for 25 kg zinc + 3 sprays of panchagavya 1% (10.19 g/g/day) (Table1) might be due to the involvement of zinc in auxin metabolism which ultimately led to hormonal activity and growth of the plant. Kumar and Bohra (2014). Application of panchagavya improved the metabolic and photosynthetic activity for enhancing biological efficiency of plant which helps the roots to spread into deeper layer of soil so that it can uptake more nutrients from soil cause there by accumulation of more

carbohydrates and higher dry matter. Similar results were reported by Katyal *et al*. (2003). The amount of all micro and macronutrients, growth enzyme present in panchagavya, ammonium, and multiplication might be the cause of the maximum dry matter Sreethu and Shikha (2020). Panchagavya improved synthesis of chemical substance which promote growth. Similar findings was recorded by Swaminathan *et al*. (2007)

Yield parameters

No. of cobs per plant

Maximum cobs per plant was observed with the application of 25 kg zinc + 3 sprays of Panchagavya 3% (2.00) (Table 2) it is due to higher quantities of chlorophyll contents and synthesis of metabolites, oxidation and increase in activity in metabolism. Similar results were also reported by Das *et al.* (2020). Also it enhance the number of leaves, which increase the rate of photosynthetic and increase the quantity of assimilates enhancing the sink size. was reported by Uwah (2014).

No. of rows per cobs

Maximum rows per cobs was observed with the application of 25 kg zinc + 3 sprays of Panchagavya 3% (15.5) (Table 2) the above result is due to the role of zinc photosynthesis, assimilation, and translocation of photosynthates from sources to sink in similar results was also reported by Innocent *et al.* (2018). Zinc has a beneficial effect on growth and physiological process resulting in higher no. of rows per cob. Soil application of zinc results in the improvement of nutrients use efficiency which leads to better cob size. Similar result were reported by Ravi *et al.* (*2012*)

No. of grains per row

Maximum grain per rows was observed with the application of 25 kg zinc + 3 sprays of Panchagavya 3% (28.93) (Table 2). Zinc application give significant highest no. of grains per row because it activates several plant enzymes that are involved in carbohydrate metabolism, protein synthesis and pollen formation as reported by Ehsanullah *et al*. (2015) Nikhil and Salakinkop (2018). The quantities of panchagavya when applied as foliar spray could have stimuli in the plant system and increased the production of growth regulator in cell system

and the action of growth regulators in plant system stimulated the necessary growth and development as reported by Yadav and Loudraj (2007).

Cob yield (t/ha)

Maximum cob yield was observed with the application of 25 kg zinc + 3 sprays of Panchagavya 3% (5.24) (Table 2). The increase in yield might be enhanced micronutrients availability. The positive effect of applied zinc on the physiological and metabolic function of the plants, might have helped to the increase in cob production process. Similar results were also reported by Ghodpage *et al*. (2008). The easy transfer of nutrients through foliar spray of Panchagavya might be the reason for enhancement of yield attributes, and then increased yield ultimately Yadav and Loudraj (2006). Foliar application of Panchagavya at different growth stages as a growth regulator result in higher cob yield Sridhar *et al*. (2001).

Economics

The maximum cost of cultivation (Rs 57,607.55/ha), gross return (Rs 2,19,560/ha), net return (Rs 1,61,952.45/ha) and benefit cost ratio (B:C) (2.81) was observed with the application of 25 kg zinc + 3 sprays of Panchagavya 3% (Table 3). The application of zinc nutrients result in increased growth and yield attributes of crop which ultimately increase the productivity of crop. Similar result were recorded by Swati *et al*. 2014 and Jagdeep *et al*. (2021). Foliar application of panchagavya physically supplied nutrients and growth hormone, particularly IAA and GA3, which are found in the plant and may have stimulated the synthesis of growth regulators throughout the cell system. Similar finding was recorded by Yadav and Lourduraj (2006).

Conclusion

The study showed that different treatment effects on almost of the growth and yield parameters. In the present investigation it was concluded that application of zinc 25 kg/ha + 3 sprays of Panchagavya 3% was found to profound on growth and yield attributes in sweet corn.

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Table 1: Response of zinc and Panchagavya on growth attributes of sweet corn.

Treatments	Plant height (cm) 80 DAS	Plant dry weight (g/plant) 80 DAS	Crop growth rate (g/m^2/day) 40-60 DAS
1 Control 120-60-60 kg NPK/ha	157.06	50.54	9.15
2 15 kg Zn + 3 sprays of 1% panchagavya	157.58	53.93	9.72
3 15 kg Zn + 3 sprays of 2% panchagavya	156.16	56.96	9.74
4 15 kg Zn + 3 sprays of 3% panchagavya	157.49	54.74	9.28
5 20 kg Zn + 3 sprays of 1% panchagavya	160.69	58.48	8.74
6 20 kg Zn + 3 sprays of 2% panchagavya	160.56	57.75	9.49
7 20 kg Zn + 3 sprays of 3% panchagavya	158.98	58.54	9.55
8 25 kg Zn + 3 sprays of 1% panchagavya	164.72	56.48	10.19
9 25 kg Zn + 3 sprays of 2% panchagavya	165.19	59.04	9.78
10 25 kg Zn + 3 sprays of 3% panchagavya	166.55	65.59	9.99
SEm(±)	2.26	2.02	0.25

CD (p=0.05)		6.72	5.99	0.74

Table 2: Response of zinc and Panchagavya on yield attributes of sweet corn.

Treatment	No. of cobs Per plant	No. of rows per cob	No. of grains per rows	Cob yield (t/ha)
1 Control 120-60-60 kg NPK/ha	1.80	13.26	26.60	4.44
2 15 kg Zn + 3 sprays of 1% panchagavya	1.93	14.26	27.53	4.28
3 15 kg Zn + 3 sprays of 2% panchagavya	1.93	14.40	26.86	4.41
4 15 kg Zn + 3 sprays of 3% panchagavya	1.86	14.86	26.86	4.93
5 20 kg Zn + 3 sprays of 1% panchagavya	1.86	14.00	27.26	4.73
6 20 kg Zn + 3 sprays of 2% panchagavya	1.80	14.53	27.33	4.54
7 20 kg Zn + 3 sprays of 3% panchagavya	1.73	14.26	26.93	4.67
8 25 kg Zn + 3 sprays of 1% panchagavya	1.93	14.40	27.73	4.52
9 25 kg Zn + 3 sprays of 2% panchagavya	2.00	14.73	28.00	4.92
10 25 kg Zn + 3 sprays of 3% panchagavya	2.00	15.50	28.93	5.24
SEm(+)	0.06	0.33	0.43	0.02

CD (p=0.05)	0.16	0.98	1.28	0.06

Table 3: Response of zinc and Panchagavya on economic of sweet corn.

Treatments	Cost of cultivation (INR/ha	Gross return (INR/ha)	Net return (INR/ha)	B:C ratio
1 Control 120-60-60 kg NPK/ha	55,163.80	1,84,824	1,29,660.20	2.35
2 15 kg Zn + 3 sprays of 1% panchagavya	56,445.05	1,82,912	1,26,235.70	2.23
3 15 kg Zn + 3 sprays of 2% panchagavya	56,676.80	1,88,394	1,31,715.70	2.32
4 15 kg Zn + 3 sprays of 3% panchagavya	56,907.55	2,03,314	1,46,406.45	2.57
5 20 kg Zn + 3 sprays of 1% panchagavya	56,795.05	2,02,250	1,45,454.95	2.56
6 20 kg Zn + 3 sprays of 2% panchagavya	57,026.30	1,90,372	1,33,345.70	2.33
7 20 kg Zn + 3 sprays of 3% panchagavya	57,257.55	2,00,342	1,43,084.45	2.49
8 25 kg Zn + 3 sprays of 1% panchagavya	57,145.05	1,88,744	1,31,598.95	2.30
9 25 kg Zn + 3 sprays of 2% panchagavya	57,376.30	2,04,984	1,47,607.70	2.57
10 25 kg Zn + 3 sprays of 3%panchagavya	57,607.55	2,19,560	1,61,952.45	2.81