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The Morphological Responses of Sweet Corn (*Zea* Mays *Saccharata*) to Foliar Application of Amino acids Bio-stimulants sprayed at Two Growth stages

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ABSTRACT

The present investigation aims to study the effect of amino acid treatment on sweat corn plant to study of morphological response. To determine optimum foliar concentration of amino acids bio stimulants at appropriate growth stages, the ultimate influence on yield and also effect of two different stages components growth characters about plant height at plants treated with 3ml/l at 7th leaf stage (81.00 cm) 2 ml/l at tasseling stage (86.67cm) as compared control (76.67 cm) Leaf length 3 ml/l at 7th leaf stage (81.33 cm) 2 ml/l at tasseling stage (87.67cm) compare to control (76.0 cm) plant Breadth 3 ml/l at 7th leaf stage (5.70 cm) at 2ml/l tasseling stage (6.07cm) as compared to control (5.03 cm) in the pot culture.

Key words: *Amino acids, Morphological response, Sweet Corn, Bio-stimulants sprayed*

Introduction

Sweet corn (*Zea mays saccharata)* is arising as one of the important crops establishing diversified and value added uses of maize. Diversification and value addition of sweet corn are estimated to swift growth in the food processing industry. Sustained market demand for fresh sweet corn cobs has resulted in cultivation of sweet corn round the year with varied soil conditions, agro climatic modifications and management practices. There was a small share of the sweet corn production costs with the application of bio stimulants and a significant increase in the monetary return (Jesus *et al*., 2016). Thus, Sweet corn has potential to increase farmer's income.

Bio stimulants are mixtures of one or more growth regulators with other compounds of different chemical nature, (Castro and Pereira, 2008), which promote hormonal balance and stimulate root growth (Silva *et al*., 2008). It may contribute to increase productivity of sweet corn, and used in various crops to. The low concentrations of plant regulators necessary to experience changes in the plant physiology (Taiz *et al*., 2017). Bio stimulant action can induce vegetative and reproductive conduct when it is applied in the initial crop growth stages (Cunha *et al*., 2016) and accelerating cell division and extension rates at optimum doses of bio stimulants (Taiz *et al*., 2017).

Corn growth and development is greatly correlated with the availability of different nutrients. Therefore, applying plants with amino acids and nutrients plays very key roles in the plant's required processes (Ibrahim *et al*., 2010; Zlatev and Lidon, 2012). Amino acids are organic nitrogenous compounds involved in the synthesis of other organic compounds studied an principal component for plant growth and development (Ibrahim *et al.*, 2010).

Therefore, the present investigation was conducted to study the effect of foliar applications of amino acids bio stimulants on morphological characteristics of sweet corn.

To determine optimum foliar concentration of amino acids bio stimulants at appropriate growth stages, the ultimate influence of on yield and yield components.

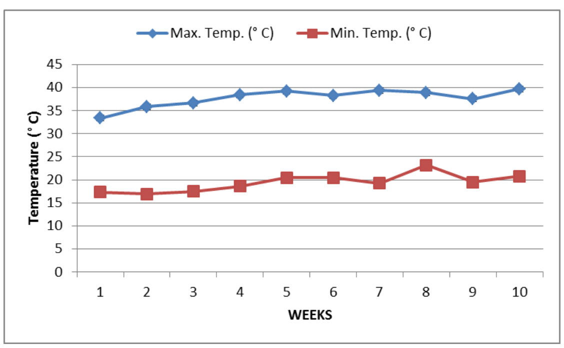
Materials and Methods

Plant material: Hybrid sweet corn (*Zea* mays *saccharata*).

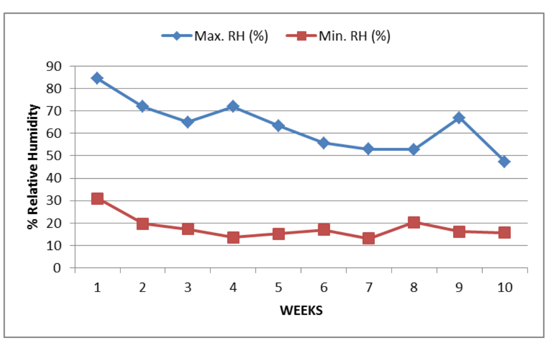
Methodology

Uniform size seeds of sweet corn were sown in February 2021 at a rate of four seeds per 10 liter pot containing a mixture of soil: vermicompost in a volume ratio of 2:1 following Randomized complete block design with 3 replicates under shade net (50 shade %) at Kavivarya Moropant Botanical garden, TC College, Baramati, India.

Minimum and maximum temperatures during period of experiment are presented in Fig. 1a & 1b.



(a)



(b)

Fig. 1(a). Weekly maximum and minimum Temperatures (°C) **(b).** Weekly maximum and minimum Relative Humidity (%) during experiment.

Homogenized soil samples were analyzed for soil physical and chemical properties (Table 1) in the KVK Baramati Soil testing Laboratory.

Two weeks after planting, the seedlings were thinned to two seedlings per pot.

Foliar application treatments

The source of amino acids bio-stimulants used in this study was a commercial product (Fantac plus liquid). The Fantac Plus is a well-known product which is commonly used on different crops in India. The spraying of the foliar application was carried out at the early morning by using a hand sprayer in order to increase the sensitivity of the spraying.

This experiment includes seven treatments in addition to control plants. Each foliar concentration was applied with three concentrations at two plant stages.

In Treatment 7 plants were sprayed with distilled water only (control).

Treatments 1, 3 and 5: plants were sprayed at 7th leaf stage with 2, 3 and 4 ml/l respectively.

Treatments 2, 4 and 6: plants were sprayed at tasseling stage with 2, 3 and 4 ml/l respectively.

Treatment applied at 7th leaf

Crop at Tasseling

Measurements and Data Recorded

The morphological measurement of corn plants height, leaf length and length breath was performed using a measuring tape (±0.1mm), while, the number of leaves was counted manually.

Plant height

It was taken from the base of the plant to tip of the newly opened leaf. The mean plant height was worked out and expressed in centimeter.

Leaf Length

It was taken from the base of the leaf to tip. The mean plant height was worked out and expressed in centimeter.

Leaf Breadth

It was taken from the base of the leaf to tip. The mean plant height was worked out and expressed in centimeter.

Number of leaves

Total number of fully opened green leaves of five plants was counted and their average was taken as the number of leaves plant-1

Statistical analysis and interpretation of data

The experimental data collected on growth, yield and quality components of plant were subjected to Fisher's method of "Analysis of Variance" (ANOVA) as outlined by Panse and Sukhatme (1967). Wherever, F- test was significant, for comparison among the treatment means, an appropriate value of critical difference (C.D.) was worked out. If F-test found non-significant, against C.D. values NS (Non-Significant) was indicated. All the data were analyzed and the results were presented and discussed at a probability level of five per cent.

Experimental design and statistical analysis

The differences among the means of different treatments were tested using the Least Significant Differences (LSD) at probability 5% ($P \leq 0.05$).

Results and Discussion

Growth characteristics

Plant height: The different foliar application concentrations sprayed at different growth stages affecting corn plant height (Table 2a). Differences between mean values of 7 treatments for Plant height is highly significant (Table 3a). All over the treatments, the results were significantly noticed by plants treated with 3 ml/l at 7th leaf stage (81.00 cm) followed by 2 ml/l at the same stage (78.33 cm) and 2ml/l at tasseling stage (86.67 cm) compared to the

Table 1a. Result of Soil analysis

pH	Electrical conductivity	Organic carbon%	Available N kg/ha	P kg/ha	K kg/ha	Fe ppm	Zn ppm	S ppm	Bo ppm
8.89	0.38	0.6	144	6.3	430	0.38	0.04	11.83	0.07

Table 1b. Result of water analysis

pH	Electrical conductivity	Ca^{++}	Mg^{++}	Na^{++}	HCO_3	Cl^-
12	2	2	2	6.2	1.3	3.6

Table 2a. Treatment Effect on plant height (cm) values.

Treat.	Rep.1	Rep.2	Rep.3	Total Treat.	Treat. mean
1 (control)	74	80	76	230	76.67
2	90	86	84	260	86.67
3	81	78	76	235	78.33
4	76	79	78	233	77.67
5	84	78	81	243	81.00
6	82	80	78	240	80.00
7	80	79	77	236	78.67
Total Rep	567	560	550	1677	559.00
Rep. Mean	81	80	78.57	239.57	79.86

control (76.67cm) were plants treated with 4 ml/L at 7th leaf stage (78.00 cm) that scored the lowest plant height. While, leaves number were not significantly different between treatments.

In this matter, El-Ghareib *et al*. (2014) reported that foliar amino acids treatments increased corn plants height compared to the control. Similarly Hammad and Ali (2014) demonstrated that majority of wheat plants treated (*Triticum aestivum* L.) with foliar application of amino acids under irrigation and drought conditions had higher plant height comparing to the control in both seasons.

Table 2b. Treatment Effect on Leaf length (cm) values.

Treat.	Rep.1	Rep.2	Rep.3	Total Treat.	Treat. mean
1 (control)	74	78	76	228	76.00
2	90	86	87	263	87.67
3	81	78	77	236	78.67
4	80	79	77	236	78.67
5	84	79	81	244	81.33
6	82	80	78	240	80.00
7	76	79	77	232	77.33
Total Rep	567	559	553	1679	559.67
Rep. Mean	81	79.86	79.00	239.86	79.95

Table 2c. Treatment Effect on Leaf breadth (cm) values.

Treat.	Rep.1	Rep.2	Rep.3	Total Treat.	Treat. mean
1 (control)	4.70	5.4	5	15.1	5.03
2	5.80	6.4	6	18.2	6.07
3	5.00	5.5	5	15.1	5.03
4	5.60	6	5.8	17.4	5.80
5	6.00	5.4	5.7	17.1	5.70
6	5.80	5.5	5.2	16.5	5.50
7	5.8	5.55	5.7	17.05	5.68
Total Rep	38.7	39.75	38.4	116.85	38.82
Rep. Mean	5.53	5.68	5.49	16.69	5.56

Table 3a. Analysis of Variances for Plant Height (cm)

Source	DF	Sum of squares	Mean Squares	Calculated F	Table value of F at 6 and error DF at 0.01 P
Replication	2	20.86	10.43		
Treatment	6	199.24	33.21	6.18**	4.82
Error	12	64.48	5.37		
Total	20	284.57			

** Significant at P< 0.01.
% Coefficient of Variation = 25.93; Std. Error = 1.89; Least significant Difference = 4.12cm.

Table 3b. Analysis of Variances for Leaf length (cm)

Source	DF	Sum of squares	Mean Squares	Calculated F	Table value of F at 6 and error DF at 0.01 P
Replication	2	14.10	7.05		
Treatment	6	261.62	43.60	12.69**	4.82
Error	12	41.24	3.44		
Total	20	284.57			

** Significant at P< 0.01
% Coefficient of Variation = 20.73; Std. Error = 1.51; Least significant Difference = 3.29cm.

Table 3c. Analysis of Variances Leaf breadth (cm)

Source	DF	Sum of squares	Mean	Calculated F Squares	Table value of F at 6 and error DF at0.01 P
Replication	2	0.14	0.07		
Treatment	6	2.35	0.39	5.07**	4.82
Error	12	0.93	0.08		
Total	20	284.57			

** Significant at P< 0.01
%Coefficient of Variation = 11.78; Std. Error = 0.22; Least significant Difference = 0.49cm.

Leaf length: The different foliar application concentrations sprayed at different growth stages affecting leaf length (Table 2b). Differences between mean values of 7 treatments for Leaf Length is highly significant (Table 3b). The results were significantly noticed by plants treated with 3 ml/l at 7th leaf stage (81.33 cm) followed by 2 ml/l at the same stage (78.67cm) and 2 ml/l at tasseling stage (87.67cm) compared to the control (76.ocm) were plants treated with 4ml/l at 7th leaf stage (77.33 cm) that scored the lowest Leaf Length. Vendruscolo *et al*. (2016) conducted seed treatment with bio stimulants and observed increases in the plant height, leaf size in the seedlings.

Leaf Breadth: The different foliar application concentrations sprayed at different growth stages affecting corn Leaf breadth (Table 2c). Differences between mean values of 7 treatments for plant breadth is highly significant (Table 3c). The results were significantly noticed by plants treated with 3ml/l at 7th leaf stage (5.70cm) and 2ml/l at tasseling stage (6.07cm) compared to the control (5.03cm) were plants treated with 2ml/l at 7th leaf stage (5.03cm) that scored the lowest leaf breadth. Cunha *et al*. (2016) in Seed treatment experiment for sweet corn observed increases in height, and leaf area.

Conclusion and Recommendation

This study was conducted to investigate the effect of the foliar application of amino acids bio-stimulants on the morphological characteristics of corn plants (*Zea mays saccharata*) variety Sweet 16. From the results, we conclude that corn plants sprayed with the foliar application of amino acids bio stimulants with 2ml/l at tasseling followed by 3ml/l at 7th leaf stage granted the best results for the majority of corn parameters studied in this research. We believe that providing plants with amino acids bio stimulants through leaves enhances corn plants characteristics and consequently their growth and development. Further studies are needed to evaluate the foliar application of amino acids bio stimulants in the cellular level for fully understanding its effects and mode of action. As well as, by focusing on the effect of foliar application on corn under other environmental conditions such as heat stress and salinity to explore the effectiveness of the foliar application under these conditions.

Conflict of Interest: None

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