Original Research Article

Effect of Nitrogen and Foliar application of NAA on growth and yield of Baby corn (*Zea ~~Mays~~ mays L.*)

ABSTRACT

The experiment entitled Effect of Nitrogen and Foliar application of NAA on growth and yield of Baby corn (*Zea ~~Mays~~ mays L.*) was conducted during *Rabi* season of 2020 at Fodder Production Farm of Livestock Research Station, Sri Venkateswara Veterinary University, Lam Farm, Guntur. A.P. The experiment was laid out in Randomized Block Design with 10 treatments and each replicated thrice. Treatments comprised ~~consisted~~ of a combination of three levels of Nitrogen (60,90,120 kg/ha) and three levels of Naphthalene Acetic Acid (20,40,60 *ppm*). It was observed that application of 120 kg Nitrogen / ha as basal along with a foliar spray of 40 *ppm* Naphthalene Acetic Acid at 25 and 35 days after sowing, was found to be the best treatment for obtaining growth and yield attributes such as plant height (177.60 cm), no. of leaves (11.33), plant dry weight (113.58g / plant), chlorophyll content (68.43), Leaf Area Index (8.65) and green fodder yield (20333 kg / ha) with net return (83,701.88 Rs / ha) and B:C ratio (1.68). On the basis of one-year experimentation, it is concluded that application of 120 kg Nitrogen /ha + 40 *ppm* Naphthalene Acetic Acid~~,~~ on baby corn was found more productive.

Key words: Baby corn, Nitrogen, NAA, Growth, Yield,

INTRODUCTION:

Maize (*Zea mays* L.) is the world's 3rd leading cereal crop following wheat and Rice, with highest production potential among the cereals. In India, maize is grown in 9.22 Million ~~hectre~~hectare area with a production and productivity of 28.72 million tonnes and 3,115 kg/ha respectively through contributing 2.53~~-~~% share over world's production (Directorate of Economics and Statistics 2018, FAO Statistics 2020).

Baby corn is a de-husked maize ear, harvested young especially when the silk has either not emerged or just emerged and no fertilization has taken place or we can say the shank with un-pollinated silk which grown as a vegetable crop and have potentially to improve the economic status of farmer (Das *et al*.,2009).

Baby corn grab the attention of consumers worldwide with its high nutritional value *i.e*., 86-89-% Moisture, 8.2 g Carbohydrate, 2 g Protein, 0.2 g Fat, 0.28 mg Iron, 0.05 mg Thiamine, 0.08 mg Riboflavin, 11 mg Ascorbic acid per 10 gm of fresh baby corn (Das *et al*., 2009) and its taste & easiness in consumption by its tenderness and sweetness. Further it may be may be used as raw as ingredient in various preparations viz. chop- suey (Chinese dish), pickles, corn pakoras, etc. fresh baby corn ears are used as decorative and crispy vegetable and salad. Baby corn's by-products, such as tassels, young husk silk and green stalk provide good cattle food. Recently, baby corn has gained popularity as valuable vegetable in Delhi, Uttar Pradesh, Haryana, Maharashtra, Karnataka, Andhra Pradesh, Rajasthan and Meghalaya States in India, and is grown on 8.5m ha area with the production and productivity of 21.3 Mt. and 2507 kg / ha, respectively. It is a profitable crop that allows a diversification of production, aggregation of value, and increased income (Pandey *et al*., 2002).

It is highly remunerative and farmers can get a high return in a short period of 45-60 days. As baby corn provides more income within a short period, it becomes a demand by crop and farmers are cultivating those on a large scale.

Plant growth regulators known as bio-stimulants or bio inhibitors modify physiological process in plant but the sites of action and production are different. Plant growth regulators improve the effective partitioning and translocation of accumulates from source to sink in the field crops. Naphthalene Acetic Acid (NAA), being an auxin, promotes vegetative growth by active cell division, cell enlargement and cell elongation and thus, helped in improving growth characteristics and in stimulating reproductive growth. Growth regulators spray had a positive influence on green cob yield of baby corn (Muthu Kumar *et al*., 2005).

Nitrogen is considered as one of the most important plant nutrients for growth and development of crop plant due to its key role in synthesis of chlorophyll and amino acids which contribute to the building unit of protein and thus, growth of plants. Nitrogen is most deficient primary nutrient in Indian soil and varies from state-to-state. Chouhan *et al*., 2016 revealed that Nitrogen promotes leaf and stem growth rapidly which consequently increase the yield and its quality.

Baby corn is considered as a high nutrient demanding crop which requires balanced application of nutrients either from Nitrogen or Naphthalene acetic acid as both of these are integrated components that are associated with proper growth, development and high productivity of baby corn when applied under appropriate dosage. With this backdrop the present experiment was conducted to find out the effect of Nitrogen and NAA on growth and yield of Baby corn (*Zea mays*.L).

MATERIALS AND METHODS:

The field experiment was conducted during *rabi* season of 2020-21 at Fodder Production Farm of Livestock Research Station, Sri Venkateswara Veterinary University, Lam Farm, Guntur Andhra Pradesh, India, which is having tropical climate with maximum and minimum temperatures of 31.37 and 15.82 °C, respectively. The soil of experimental field was black clay in nature with pH 8.5 and EC 0.45 dms^{-1} low in Organic carbon (0.42 %) medium in available N (288 kg/ ha^{1}), high in both available P_2O_5 (174 kg / ha^{1}) and K_2O (418 kg / ha).

A combination of ten treatments were replicated thrice and laid out in a randomized block design. The treatments were: T_1-60 kg Nitrogen/ha + 20 *ppm* Naphthalene Acetic Acid, T_2-90 kg Nitrogen/ha + 20 *ppm* Naphthalene Acetic Acid, T_3-120 kg Nitrogen/ha + 20 *ppm* Naphthalene Acetic Acid, T_4-60 kg Nitrogen/ha + 40 *ppm* Naphthalene Acetic Acid, T_5-90 kg Nitrogen/ha + 40 *ppm* Naphthalene Acetic Acid, T6-120 kg Nitrogen/ha + 40 *ppm* Naphthalene Acetic Acid, T_7-60 kg Nitrogen/ha + 60 *ppm* Naphthalene Acetic Acid, T_8-90 kg Nitrogen/ha + 60 *ppm* Naphthalene Acetic Acid, T_9-120 kg Nitrogen/ha + 60 *ppm*

Naphthalene Acetic Acid, T_{10}- N:P: K 60:60:60. All treatments were commonly received 20 kg P_2O_5, 40 kg K_2O/ha and Nitrogen as per the treatment description as basal dose.
The ridges and furrows were opened at 45 cm distance. Healthy Seeds of Baby corn variety G-5414 of Syngenta Pvt. Ltd., were sown on 23rd November 2020 by dibbling two seeds manually per hill on one side of ridge by keeping 15 cm intra row spacing at a depth of 3-4 cm. Foliar application of NAA was given (500 l / ha) at 25 and 35 days after sowing with hand sprayer during morning hours between 07-10 IST as per the treatment. Relative Chlorophyll content was determined (4th or 5th leaves from apex) using a Portable dual-wave length Chlorophyll meter (Minolta SPAD-502) at 30 & 60 DAS. To calculate the Leaf Area Index (L.A.I.), five leaves were selected at random from the sample plants. The leaf area of these sample leaves was measured with the help of Leaf Area Meter (LI- COR-3100C). The area covered by the leaf was worked out and the total surface area of leaves per plant was calculated by counting the leaves per plant & multiplying it by average leaf area. Then the leaf area index (LAI) was calculated by following formula LAI (Leaf Area Index) = Leaf area/Ground area.
The first harvesting of baby cobs ~~were~~ was carried out 58 days after sowing (20.01.2021) and subsequently green cobs harvested in 2 pickings. The cobs were harvested from an area of one meter square, treatment wise and weighed with and without husk, then the obtained values were converted to per hectare and recorded as kg/ha.

RESULTS AND DISCUSSION:

Basal application of Nitrogen in the combination of Naphthalene Acetic Acid (NAA) at 25 and 35 days after sowing showed a considerable effect on different growth and yield attributes of baby corn. The results presented in Table1 showed that the plants received 120 kg Nitrogen /ha as basal along with 40 *ppm* Naphthalene Acetic Acid at 25 and 35 days after sowing recorded highest plant height, 17.60% higher plant height *i.e.* 177.60 cm over the plants received recommended dose of fertilizer, where as recorded plant height is 151.02 cm. Enhanced plant height with NAA application may be due to cell wall extensibility and cell wall loosening and increased cell division and elongation in the presence of endogenous GA (Lakshmamma, P *et.al.*, 1996) and synergetic effect of enhanced Nitrogen availability which is required for vegetative growth throughout the crop period (Muthu Kumar B.V *et al.*, 2005). These results were in conformity with (Muthu kumar et al., 2005).

Comment [SHA1]: Too old

The highest number of leaves (11.33) , Chlorophyll content (68.43) , Leaf Area Index(8.65) was also recorded with the same treatment *i.e.* 120 kg Nitrogen /ha as basal along with 40 *ppm* Naphthalene Acetic Acid at 25 and 35 days after sowing. And it is observed that there was no significant difference among treatments regarding~~in regard to~~ no of leaves. Significant response in leaf area index and chlorophyll content might be due to the combined effect of Nitrogen and NAA which might be promoted promoting rapid vegetative growth and giving the plant a healthy green colour (Singh *et al.*, 2019) and NAA, being an auxin, promoted vegetative growth. In fact, increase in leaf area index with nitrogen fertilization could be attributed to a more fact that more protein synthesis at higher nitrogen rates induced vegetative growth which resulted in increase of photosynthetic surface that stimulated more leaf length, width and leaf blade size. Earlier Thakur *et al.*, (1997), Bhindhani *et al.*, (2007), Jeet *et al.*, (2012) also reported similar findings. The increase in LAI might be due to a significant increase in leaf expansion, higher rate of cell division and cell enlargement and there by improved quality of vegetative growth with application of NAA. These results are ~~Comparable~~ comparable with results reported by (Muthu Kumar *et al.*,2005).
The highest Plant Dry weight (113.83g), Crop Growth Rate (3.33 g/m^2/day), Relative Growth Rate (0.0168 g/g /day) was observed with the application of 120 kg Nitrogen /ha as basal along with 40 *ppm* Naphthalene Acetic Acid at 25 and 35 days after sowing which was significantly higher than rest of the treatments. Dry matter production related to productivity contributes to an important factor in the source-sink relationship. Total dry matter production

is related with plant height and leaf area Growth Regulator application had an influence on leaf area index (LAI) which had an indirect effect on and dry matter production (DMP). Similar findings were reported by (Muthukumar *et al.*, 2005).

The analyzed data (Table.2) regarding reproductive parameters shown that yield and yield attributes of baby corn was significantly affected by the combination of basal application of 120 kg/ha with foliar application of 40 *ppm* Naphthalene Acetic Acid at 25 and 35 days after sowing which is significantly superior over rest of the treatments.

A faster growth under influence of higher level of nitrogen fertilization might have played a significant role in reducing competition for photosynthates and nutrients with other plants resulting in healthy plants. The increased availability of photosynthates might have enhanced the number of flowers and their fertilization, resulting in a higher number of yield attributes. Further, in most of cereals, greater assimilating surface at reproductive developments results in better green cob formation because of adequate production of metabolites and their translocation towards cob (Golada Shankar Lal *et al.*,2013). The findings of the present investigation are in line with several researchers (Bindhani *et al.*, 2007.)

Cob yield increased due to increased mobilization of reserve food materials to developing sinks through increase in hydrolyzing and oxidizing enzyme activities. NAA, being an auxin, promoted vegetative growth by cell division, cell enlargement and cell elongation and thus helped improving growth characteristics and also in stimulating reproductive growth (Muthukumar *et al.*, 2005). The results of the present study indicating a positive response of baby corn to plant growth regulators also corroborate the findings of several research workers.

CONCLUSION:

The results of the present experiment entitled "Effect Of Nitrogen Fertilization and NAA (Naphthalene Acetic Acid) on Growth And Yield of Baby Corn (*Zea ~~Mays~~ mays L.*)" indicated that basal application of 120 kg/ha Nitrogen along with 40 *ppm* of Naphthalene Acetic Acid at 25and 35 Days after sowing as foliar spray will be beneficial to obtain higher yield of baby corn.

Table 1: Effect of Nitrogen levels and NAA on growth attributes of Baby corn

Tr. No.	Treatments	Plant Height (Cm)	Number of Leaves (No.)	Chlorophyll content	Leaf Area Index	Plant Dry weight (g)	Crop Growth Rate g/m^2/day)	Relative Growth Rate (g/g/day)
T_1	60 kg Nitrogen /ha + 20*ppm* Naphthalene Acetic Acid	115.67	10.13	51.30	5.33	76.95	1.75	0.0121
T_2	90 kg Nitrogen /ha + 20*ppm* Naphthalene Acetic Acid	165.20	10.20	57.66	6.77	80.21	1.68	0.0109
T_3	120 kg Nitrogen /ha + 20*ppm* Naphthalene Acetic Acid	173.45	11.00	68.22	8.50	113.58	2.78	0.0146
T_4	60 kg Nitrogen /ha + 40 *ppm* Naphthalene Acetic Acid	161.54	10.20	56.35	6.39	78.01	1.59	0.0106
T_5	90 kg Nitrogen /ha + 40 *ppm* Naphthalene Acetic Acid	169.81	10.33	60.50	6.86	82.81	1.78	0.0113
T_6	120 kg Nitrogen /ha + 40 *ppm* Naphthalene Acetic Acid	177.60	11.33	68.43	8.65	113.83	3.33	0.0168
T_7	60 kg Nitrogen /ha + 60 *ppm* Naphthalene Acetic Acid	155.00	10.07	52.73	5.08	73.56	1.64	0.0118
T_8	90 kg Nitrogen /ha + 60 *ppm* Naphthalene Acetic Acid	162.54	10.27	55.33	6.51	78.07	1.53	0.0101
T_9	120 kg Nitrogen /ha + 60 *ppm* Naphthalene Acetic Acid	170.68	10.47	66.80	7.90	92.42	2.01	0.0114
T_{10}	N:P: K 60:60:60	151.02	10.00	49.27	5.04	68.65	1.60	0.0125
	F test	S	NS	S	S	S	S	S
	S. Em (±)	1.43	0.28	0.16	0.20	0.16	0.08	0.0005
	CD (P=0.05)	4.25	-	0.49	0.58	0.47	0.24	0.0015

Table 2: Effect of Nitrogen levels and NAA on yield and yield attributes of Baby corn

Tr. No	Treatments	No. of cob/ Plant (No.)	Length of cob (cm)	Length of corn (cm)	Girth of Cob (cm)	Girth of Corn (cm)	Cob weight (g)	Corn weight (g)	Cob Yield (kg/ha)	Corn Yield (kg/ha)
T_1	60 kg Nitrogen /ha + 20*ppm* Naphthalene Acetic Acid	4.00	19.78	8.57	6.01	3.42	44.49	10.76	13840.74	2309.63
T_2	90 kg Nitrogen /ha + 20*ppm* Naphthalene Acetic Acid	3.87	20.06	8.27	10.42	3.58	50.29	13.47	14670.37	2396.11
T_3	120 kg Nitrogen /ha + 20*ppm* Naphthalene Acetic Acid	4.00	22.64	10.51	11.06	3.56	54.24	16.67	15773.13	2681.83
T_4	60 kg Nitrogen /ha + 40 *ppm* Naphthalene Acetic Acid	4.00	19.88	8.36	6.38	3.40	47.20	12.00	14000.00	2290.67
T_5	90 kg Nitrogen /ha + 40 *ppm* Naphthalene Acetic Acid	4.07	20.95	8.82	10.51	3.46	51.24	14.53	14685.19	2474.07
T_6	120 kg Nitrogen /ha + 40 *ppm* Naphthalene Acetic Acid	4.00	22.71	10.57	11.11	3.57	57.87	16.73	16144.44	2712.59
T_7	60 kg Nitrogen /ha + 60 *ppm* Naphthalene Acetic Acid	3.93	19.77	8.43	6.59	3.38	43.51	9.60	14685.19	2273.26
T_8	90 kg Nitrogen /ha + 60 *ppm* Naphthalene Acetic Acid	3.67	20.03	8.92	10.42	3.43	49.09	13.07	1390.00	2367.19
T_9	120 kg Nitrogen /ha + 60 *ppm* Naphthalene Acetic Acid	4.00	22.03	8.94	11.28	3.57	52.36	15.87	14814.81	2570.37
T_{10}	N:P: K 60:60:60	3.80	19.67	8.04	6.59	3.28	39.73	8.80	12881.48	2242.74
	F test	NS	S	S	S	NS	S	S	S	S
	S. Em (±)	0.09	0.04	0.06	0.07	0.07	0.46	0.12	163.23	22.61
	CD (P=0.05)	-	0.13	0.17	0.20	-	1.37	0.35	484.98	67.19

COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

REFERENCS:

1. Bindhani, A., Barik, K.C., Garnayak, L.M. and Mahapatra, P.L.2007. Productivity and nitrogen use efficiency of baby corn (Zea Mays L.) at different level and time of nitrogen application under rainfed condition. *Indian Journal of Agriculture sciences*. **78**: 629-631.
2. Chouhan, M., Gudadhe, N. N., Kumar, D., Kumawat, A. K. and Kumar, R. 2016. Transplanting dates and Nitrogen Levels Influences on Growth, Yield Attributes, And Yield of Summer Pearl Millet. The Bioscan. 10(3): 1295-1298.
3. Das, B., Ranjan, J.K., Ahmed, N., Ranjan,P. and Mishra, B.K. 2009. Green technology for production of baby corn (*Zea mays L.*) under north west Himalayan conditions. *International Journal of chemical Technology and Research.* **5**(2): 880-885.
4. Directorate of Economics and Statistics. 2018. Department of Agriculture and cooperation, Ministry of Agriculture, Government of India.
5. FAO Statistics. 2020. Statistics division, "Food and agricultural organization."
6. Golada, S.L., Sharma, G.L. and Jain., H.K. 2013. Performance of baby corn as influenced by spacing, nitrogen fertilization and plant growth regulators on yield and economics of baby corn. *African Journal of Agricultural Research*. **8**(12):1100-1107.
7. Jeet, S., Singh, J.P and Kumar, R. 2012. Effect of nitrogen and sulphur levels on yield, economic and quality of QPM hybrid under dryland condition of Eastern Uttar Pradesh. *Indian Journal Agriculture Science*. **4**:31-38.
8. Lakshmamma, P. and I.V.S. Rao, 1996. Response of Blackgram (Vigna mungo L.) to shade and Napthalene acetic acid. Indian Journal Physiology, 1: 63-64
9. Muthu Kumar, V.B., Velayudham, K. and Thava Prakash. 2005. Effect of different plant growth regulators and split application of Nitrogen on the productivity of baby corn. *Research Journal of Agricultural and Biological Sciences.* **1**(4): 303- 307.
10. Pandey, A.K., Mani, V.P., Ved Prakash, Singh, R.D. and Gupta, H.S. 2002. Effect of varieties and plant densities on yield, yield attributes and economics of baby corn (Zea mays). Indian J. Agronomy. 47(2): 221-226.
11. Singh, S.P., Neupane, M.P., Sai Sravan, U., Sandeep Kumar, Tikendra Yadav and Choudhary, S.K.2019. Nitrogen management in baby corn. *Current Journal of Applied Science and Technology*.**34**(5):1-11.
12. Thakur, D.R., Om, P., Kharwara, P.C., and Bhalla, S.K. 1997. Effect of nitrogen and plant spacing on growth, development and yield of baby corn. *Indian Journal of Agronomy*. **42**:479-483.

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