**EFFECT OF FOLIAR APPLICATION OF CHEMICALS AND PLANT GROWTH REGULATOR ON GROWTH AND YIELD OF BABY CORN (*Zea mays* L.)**

**ABSTRACT**

The present investigation was conducted in the Orchard, Department of Horticulture, Faculty of Agriculture, Annamalai University, Chidambaram, Cuddalore District, Tamil Nadu to find out the “Effect of foliar application of chemicals and plant growth regulator on growth and yield of Baby corn (*Zea mays* L*.*)”. The experiment was conducted in a Randomized Block Design with ten treatments in three replications. The foliar applications of chemicals and plant growth regulators *viz*., Naphthalene Acetic Acid (NAA) at 10, 20 and 30 ppm was applied @ 25 and 35 DAS, Nano urea at 1, 2 and 3 ml were applied first at 25 DAS and second at 20 days after the first spray, Potassium nitrate (KNO3) @ 1 per cent was applied at 1 week before silking. Among the various treatment combination, the application of 100% RDF + 30 ppm NAA + 3 ml Nano urea + 1% KNO3 was found to have the percentage increase in the growth and yield of Baby corn and could be used commercially, for large scale production.

**Keywords:** Baby corn, foliar spray, Naphthalene Acetic Acid, Nano urea, Potassium nitrate.

**INTRODUCTION**

Baby corn (*Zea mays* L.) is a dehusked ear of maize, harvested at young especially when the silk is just emerged or not emerged and no fertilization has taken place.
Baby corn, a member of the grass family (Poaceae), originated in East Asia, specifically Thailand and China. The sweet succulent Baby corn is a delicious and nutritious vegetable without cholesterol. Baby corn is rich in fiber content with low caloric value. Single Baby corn can be compared with an egg in terms of mineral content (Rani *et al*., 2017). Baby corn is popular among consumers because of its high nutritional value *i.e*., Energy 27 kcal, Protein 1.54 g, Carbohydrate 4.62 g, Total dietary fiber 2.3 g, Total sugar 1.54 g, Iron 0.28 mg, Sodium 169 mg (USDA, 2019). It is also a healthy vegetable with potent antioxidant properties (Swapna *et al.,* 2024) and it is the richest source of vitamins A, B, E and vitamin B6 for maintaining overall well-being (Kaur *et al*., 2022). The entire miniature ear of Baby corn is edible, both raw and cooked. It is used as a vegetable in salad, soup, pickles, pakodas, vegetable biryani, candy and other dishes (Asaduzzaman *et al*., 2014). Due to its high succulence, palatability and digestability it can also be used as cattle feed. Whereas Baby corn stover, dry leaves and cob covering can be used as good fuel (Singh *et al*., 2006). The major producer of Baby corn are Thailand, Taiwan, South Africa, Japan, Nepal, Zimbabwe, China, Sri Lanka, Guatemala, Zambia and India. In India, it is mainly grown in Western Uttar Pradesh, Meghalaya, Haryana, Karnataka Andhra Pradesh and Maharashtra. The major exporter of Baby corn is Thailand with more than 80% of total world exports of the Baby corn product. Other exporter countries of Baby corn are China, Kenya, Zimbabwe, and Zambia. Globally, Asia has the highest consumption of its products. Cultivation of Baby corn can lead to the great benefits to the farmers as it harvests processing and export potential (Kaur *et al.,* 2022). Baby corn offers a high return on investment for farmers, with a short growing period of 45-60 days. This makes it an attractive option for crop diversification and can also benefit food processing industries. (Swapna *et al*., 2024).

Farmers cultivating Baby corn often encounter challenges such as poor root growth, yellowing of leaves (chlorosis), stunted root development, weak stems, smaller cobs and reduced yield. While plant growth regulators and chemicals have been suggested as potential solutions, it’s important to consider more sustainable and eco-friendly alternatives. The foliar application of plant growth regulator Naphthalene Acetic Acid (NAA) being a synthetic auxin, promotes vegetative growth of the plant (Rao *et al.,* 2021) and it has a positive influence on green cob yield and also increase the fodder yield of Baby corn (Muthukumar *et al.,* 2005). Similarly, Nano urea is a liquid nutrient which supplies nitrogen to plants as an alternative to conventional urea. Compared to conventional urea, which has a nitrogen utilization rate of 30-40%, nano urea liquid can deliver nitrogen to plants with over 80% efficiency. (Kantwa and Yadav, 2022). One of the main advantages of Nano urea is its increased nutrient use efficiency. Because Nano urea is more soluble and reactive than conventional urea, it can be absorbed more quickly by plant roots, resulting in higher crop yields with less fertilizer. Potassium (K) plays an major role in plant growth and development and key role in photosynthesis, enzyme activity, ion balance, nutrient transport, water regulation, and cell turgor (Wang and Wu, 2017).

**MATERIALS AND METHODS**

The field investigation was conducted in the Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalai Nagar, Chidambaram, Cuddalore district of Tamil Nadu. This experiment site is graphically located at 11°24’ North latitude and 79°44’ East longitude and at an altitude of +5.79 m above mean sea level. The soil of this
experiment was sandy loam with low nitrogen, medium in phosphorous and high availability of potassium. The Baby corn hybrid G-5417 was chosen for the experiment and adopted with a spacing of 45 x 25 cm. The field experiment was conducted in Randomized Block Design (RBD) with ten treatments in three replication.

The treatment comprised of T1 - Control (100% RDF), T2 - 100% RDF + 10 ppm NAA + 1 ml Nano urea + 1% KNO3, T3 - 100% RDF + 20 ppm NAA + 1 ml Nano urea + 1% KNO3, T4 - 100% RDF + 30 ppm NAA + 1 ml Nano urea + 1% KNO3, T5 - 100% RDF + 10 ppm NAA + 2 ml Nano urea + 1% KNO3, T6 - 100% RDF + 20 ppm NAA + 2 ml Nano urea + 1% KNO3, T7 - 100% RDF + 30 ppm NAA + 2 ml Nano urea + 1% KNO3, T8 - 100% RDF + 10 ppm NAA + 3 ml Nano urea + 1% KNO3, T9 - 100% RDF + 20 ppm NAA + 3 ml Nano urea + 1% KNO3 and T10 - 100% RDF + 30 ppm NAA + 3 ml Nano urea + 1% KNO3. The chemical fertilizers NPK (150:60:40 kg ha-1) were applied as urea, single superphosphate, and muriate of potash. The dosage was calculated and applied to each plot based on the treatment. Half of the nitrogen, along with the full dose of phosphorus and potassium, was applied as basal. The remaining nitrogen was split into two equal applications: one at the knee-high stage and the other at the tasseling stage. The treatment comprised of three foliar applications of chemicals and plant growth regulators *viz*., Naphthalene Acetic Acid (NAA) at 10, 20 and 30 ppm were applied @ 25 and 35 DAS, Nano urea at 1, 2 and 3 ml were applied first at 25 DAS and second at 20 days after first spray, Potassium nitrate (KNO3) @ 1 per cent was applied at 1 week before silking. The observations were recorded on growth characters like plant height, number of leaves
plant-1, leaf area, Leaf Area Index (LAI), Chlorophyll content (SPAD value), and Dry Matter Production (DMP). The yield characters like number of cobs plant-1, cob length, cob girth, individual cob weight, cob yield and green fodder yield were recorded based on the standard procedure. These observations were statistically analyzed by the standard procedure of Panse and Sukhatme (1985).

**Result and Discussion**

**Growth characters**

Combined foliar application of NAA @ 25 and 35 DAS, Nano Urea @ 25 and 45 DAS and KNO3 at 1 week before silking, showed a considerable effect on different growth and yield of Baby corn.

The plant which received 100% RDF along with 30ppm NAA, 3ml Nano urea and 1% KNO3 (T10) recorded maximum plant height (52.67 and 191.78 cm) at 30 and 60 DAS, number of leaves plant-1 (6.95 and 14.67) at 30 and 60 DAS,leaf area (121.05 and 506.72 cm2) at 30 and 60 DAS, Leaf Area Index (0.75 and 6.61) at 30 and 60 DAS, Chlorophyll content (52.47), Dry Matter Production (4293 and 8441 kg.ha-1) whereas minimum plant height (38.07 and 160.08 cm) at 30 and 60 DAS, number of leaves plant-1 (4.75 and 10.11) at 30 and 60 DAS,leaf area (86.65 and 361.96 cm2) at 30 and 60 DAS, Leaf Area Index (0.37 and 3.25) at 30 and 60 DAS, Chlorophyll content (37.60), Dry Matter Production (3123 and 6068 kg ha-1) at 30 and 60 DAS were observed in control (T1). These results were represented in Table 1.

Increased growth attributes of Baby corn is due to combined foliar application of chemicals and Plant Growth Regulators. NAA (Growth Regulator), being an auxin promotes the vegetative growth of Baby corn by promoting cell division, enlargement, and elongation, leading to improved plant development. A similar finding was reported by (Muthukumar *et al*., 2005). Comparably Nano urea application which caused an increase in cell growth as influenced by nitrogen availability and Nano urea has been proposed to various physiological process in plants such as photosynthesis, nutrient uptake, enzymatic activities. These advancements contribute to better growth and development, potentially leading to increased plant height and number of leaves. These results were similar with the findings of ()Samui *et al*., 2022) and Srivastava and Singh (2023). Application of NAA, increasing photosynthetic activities, efficient translocation and utilization of photosynthates could be causing increasing chlorophyll content and Dry Matter Production. The result of this experiment is in agreement with the results of (Krishna *et al*., 2023) and (Muthukumar *et al*., 2005). Whereas, Nano urea application 3 ml increased chlorophyll content and Dry Matter Production could be attributed to the enhanced absorption and utilization of nutrients like nitrogen facilitated by nano-sized particle, which possess a massive surface area and smart delivery system, thereby boosting the photosynthetic capacity, increasing nutrient use efficiency resulting in high DMP. The findings in the present study was similar with (Qureshi *et al*., 2018), (Muthukumar *et al*., 2005) and (Kumar *et al*., 2017). Increase of photosynthetic surface that stimulates leaf area. The application of NAA at 30 ppm likely increased leaf area index due to significant leaf expansion, accelerated cell division and enlargement, and subsequent improvements in vegetative growth. The similar findings were in accordance with the result of Rao *et al*. (2020).

**Yield characters**

The data regarding yield and yield attributes of Baby corn was analyzed in Table 2. The maximum cob length (22.62 cm), cob girth (8.62 cm), individual cob weight (46.03 g), cob yield (99.71 g plant-1, 2.49 kg plot-1 and 8.86 t ha-1), green fodder yield (336.84 g
plant-1, 8.42 kg plot-1 and 29.94 t ha-1) was observed in T10 - 100% RDF + 30 ppm NAA + 3 ml Nano urea + 1% KNO3 whereas, minimum cob length (15.22 cm), cob girth (5.77 cm), individual cob weight (35.63 g), cob yield (72.50 g plant-1, 1.81 kg plot-1 and 6.44 t ha-1), green fodder yield (272.95 g plant-1, 6.82 kg plot-1 and 24.26 t ha-1) were observed in control (T1).

On perusal of the statistically analysed data, it was observed that the number of cobs plant-1 is non-significant, however, it exhibited minor numerical value by foliar application of chemicals and Plant growth regulator on growth and yield of Baby corn. Enhancing photosynthetic efficiency in plants can lead to increased carbohydrate production, which is necessary for reproductive development and the formation of cobs. Increased cob length may be attributed to the enhanced availability of photosynthetic products and nutrients, which support the development of reproductive structures and subsequently increased the cob yield of Baby corn with these nutrient management treatments. Nano urea has the potential to improve nutrient availability and uptake in plants. It improves nutrient use efficiency, which can contribute to better crop growth and development, including the formation of more cobs per plant which leads to increased cob yield. The results of this experiment were similar with the findings of Aher and Umesha (2023), Srivastava and Singh (2023), Jaswinder *et al*. (2019) and Raliya *et al*. (2017). Similarly, the plant sprayed with KNO3 @ 1% at tassel initiation stage produced thicker cob and increased cob girth and cob length due to the potassium and nitrogen's ability to stimulate growth, photosynthesis, and the efficient movement of photosynthetic products. These findings were following the results of (Singh *et al*., 2017).

Nano-urea’s potential to enhance cob yield can be attributed to several factors. Its smaller particle size improves nitrogen solubility and uptake, stimulating plant growth and development. Consequently, increased photosynthesis and nutrient mobilization contribute to higher biomass accumulation and cob formation. Foliar application at critical growth stages further optimizes nutrient delivery, maximizing cob yield through enhanced photosynthetic efficiency and nutrient allocation to the cob.  These findings were conform with the results of Enigi *et al*. (2022), Ajirloo *et al*. (2015), Ninama *et al*. (2023) and Srivastava and Singh (2023). Similarly, As an auxin (NAA) promotes both vegetative and reproductive growth by stimulating cell division, enlargement, and elongation, leading to improved overall plant development. Similar findings with Muthukumar *et al*. (2005). Singh *et al*. (2017) reported that plant sprayed with KNO3 at 1% at tassel initiation stage resulted in higher yield attributes and yield.

The increased fodder yield resulting from foliar NAA application may be due to increased plant height, a larger leaf area index and total biomass. These factors could be attributed to increased cell division, enlargement, and elongation. The present findings agreed with Galoda *et al*. (2018) and Muthukumar *et al*. (2005).

**Conclusion**

 Based on the present investigation, it could be concluded that the foliar application of 100% RDF + NAA @ 30 ppm + Nano urea @ 3 ml + KNO3 @ 1% was found to be the best treatment for enhancing the growth and yield of Baby corn.

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| --- | --- | --- | --- | --- | --- | --- |
| **Treatment** | **Plant height (cm)** | **Number of leaves** | **Leaf area (cm2)** | **Leaf Area Index** | **Dry Matter Production kg ha-1** | **Chlorophyll content** |
| **30 DAS**  | **60 DAS**  | **30 DAS** | **60 DAS** | **30 DAS**  | **60 DAS**  | **30 DAS** | **60 DAS** | **30 DAS** | **60 DAS** |
| T1 | 38.07 | 160.08 | 4.75 | 10.11 | 86.65 | 361.96 | 0.37 | 3.25 | 3123 | 6068 | 37.60 |
| T2 | 40.08 | 163.97 | 5.08 | 10.75 | 91.09 | 380.48 | 0.41 | 3.64 | 3277 | 6369 | 39.55 |
| T3 | 45.02 | 173.91 | 5.79 | 12.19 | 101.82 | 425.17 | 0.52 | 4.61 | 3630 | 7109 | 44.16 |
| T4 | 48.84 | 183.47 | 6.42 | 13.52 | 112.3 | 469.81 | 0.64 | 5.65 | 3985 | 7840 | 48.68 |
| T5 | 40.58 | 165.52 | 5.18 | 10.96 | 92.99 | 388.18 | 0.43 | 3.78 | 3322 | 6509 | 40.30 |
| T6 | 45.02 | 175.12 | 5.87 | 12.34 | 97.41 | 432.87 | 0.51 | 4.75 | 3677 | 7239 | 44.86 |
| T7 | 50.75 | 187.63 | 6.69 | 14.10 | 116.68 | 488.27 | 0.69 | 6.12 | 4139 | 8140 | 50.58 |
| T8 | 42.94 | 169.72 | 5.49 | 11.58 | 97.41 | 406.68 | 0.48 | 4.19 | 3476 | 6809 | 42.23 |
| T9 | 46.92 | 179.30 | 6.15 | 12.93 | 107.91 | 451.34 | 0.59 | 5.19 | 3831 | 7539 | 46.77 |
| T10 | 52.67 | 191.78 | 6.95 | 14.67 | 121.05 | 506.72 | 0.75 | 6.61 | 4293 | 8441 | 52.47 |
| **SE(d)** | **0.89** | **1.94** | **0.11** | **0.24** | **2.04** | **8.55** | **0.01** | **0.12** | **75.89** | **149.16** | **0.93** |
| **C.D. (p=0.05)** | **1.87** | **4.07** | **0.24** | **0.51** | **4.29** | **17.96** | **0.03** | **0.22** | **152.54** | **299.81** | **1.86** |

**Table -1 Effect of foliar application of chemicals and plant growth regulator on growth characters of Baby corn (*Zea mays* L.)**

**Table -2 Effect of foliar application of chemicals and plant growth regulator on yield and yield attributes of Baby corn (*Zea mays* L.)**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Treatment** | **Number of cobs plant-1** | **Cob length (cm)** | **Cob girth (cm)** | **Individual cob weight (g)** | **Cob yield****(g plant-1)** | **Cob yield****(kg plot-1)** | **Estimated cob yield****(t ha-1)** | **Green fodder yield****(g plant-1)** | **Green fodder yield****(kg plot-1)** | **Estimated green fodder yield (t ha-1)** |
| T1 | 2.04 | 15.22 | 5.77 | 35.63 | 72.50 | 1.81 | 6.44 | 272.95 | 6.82 | 24.26 |
| T2 | 2.05 | 16.20 | 6.18 | 37.08 | 76.07 | 1.90 | 6.76 | 281.82 | 7.05 | 25.05 |
| T3 | 2.10 | 18.49 | 7.08 | 40.29 | 84.34 | 2.11 | 7.50 | 301.77 | 7.54 | 26.82 |
| T4 | 2.14 | 20.71 | 7.91 | 43.37 | 92.59 | 2.31 | 8.23 | 320.77 | 8.02 | 28.51 |
| T5 | 2.06 | 16.55 | 6.31 | 37.46 | 77.21 | 1.93 | 6.86 | 284.65 | 7.12 | 25.30 |
| T6 | 2.11 | 18.79 | 7.18 | 40.61 | 85.46 | 2.14 | 7.60 | 304.48 | 7.61 | 27.06 |
| T7 | 2.15 | 21.67 | 8.27 | 44.71 | 96.15 | 2.40 | 8.55 | 328.84 | 8.22 | 29.23 |
| T8 | 2.08 | 17.52 | 6.70 | 38.88 | 80.78 | 2.02 | 7.18 | 293.33 | 7.33 | 26.07 |
| T9 | 2.12 | 19.75 | 7.55 | 42.00 | 89.02 | 2.23 | 7.91 | 312.67 | 7.82 | 27.79 |
| T10 | 2.17 | 22.62 | 8.62 | 46.03 | 99.71 | 2.49 | 8.86 | 336.84 | 8.42 | 29.94 |
| **SE(d)** | 0.04 | **0.39** | **0.14** | **0.64** | **1.76** | **0.04** | **0.15** | **3.22** | **0.08** | **0.31** |
| **C.D. (p=0.05)** | NS | **0.79** | **0.30** | **1.29** | **3.54** | **0.08** | **0.31** | **6.47** | **0.17** | **0.64** |