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EFFECT OF APPLICATION FREQUENCY OF NAPHTHALENE ACETIC ACID ON PHYSIO-MORPHOLOGICAL CHARACTERS AND YIELD OF BRINJAL

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ABSTRACT

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A field experiment on brinjal (*Solanum melongena* cv of brinjal) was conducted at the research field of Regional Horticulture Research Station, Shibpur, Narsingdi during the rabi season of 2016-2017 to find out the suitable application frequency of Naphthalene acetic acid (NAA) for higher and profitable yield of brinjal. Naphthalene acetic acid (NAA) 40 ppm were sprayed at the different days interval after transplanting (DAT) and flowering initial stage (FIS) of brinjal. Distilled water spray (control) (T₀) and five treatments of NAA applications were spraying at 15 DAT (T₁), spraying at 15 DAT and at 1st FIS (T₂), spraying at 15 DAT then thrice spray at 15 days interval starting from 1st FIS (T₃), one spray before 7 days of first flower initiation and thrice spray at 7 days interval starting from 1st flower initiation stage (T₄) and one spray before 15 days of first flower initiation and thrice spray at 15 days interval starting from 1st flower initiation stage (T₅). The NAA application frequencies had no significant effect on plant height, number of leaves/plant, leaf area/plant and specific leaf weight. The T₂ and T₄ treatments showed identical performances in respect of all parameters and T₂ treatment gave maximum total dry matter/plant, long and medium styled flower percent, fruit set percent, number of fruits/plan and fruit yield per hectare.

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INTRODUCTION

Brinjal (*Solanum melongena* L.) is one of the most common tropical vegetable grown throughout the country. Among the vegetables, brinjal or eggplant has commercial importance across the world both for fresh fruit market and for processed food industries. In addition to being a host of vitamins and minerals, eggplant also contains important phytonutrients with antioxidant activities. Phytonutrient contained in eggplant include phenolic compounds. Research on eggplant has focused on an anthocyanin phytonutrient found in eggplant skin called nasunin. Nasunin is a potent antioxidant and free radical scavenger that has been shown to protect cell membranes from damage. It contains good amount of many essential B-complex group of vitamins such as pantothenic acid (vitamin B5), pyridoxine (vitamin B6), thiamine (vitamin B1) and niacin (B3). Role of plant growth regulators in altering plant physiological processes is well known. Poor fruit set and low yield are the major problems of brinjal production. Plant growth regulators have been reported to improve growth, fruit set, fresh vegetable yield and yield quality (Bisaria and Bhatnagar 1978; Saimbhi, 1993). Sharma (2006) reported higher yield with NAA foliar spray @ 40 ppm. Glaps and Gorecki (1989) reported that spray of NAA at 0.15% resulted in increased plant growth and total yield while Reddy and Joshi (1990) observed that monoerotophos (0.04%) and endosulfan (0.07%), alone and in combination with NAA 100 ppm resulted significant reduction in infestation by the pyralid and all combined treatments increased plant growth and yield. Then are four types of brinjal flowers viz, long styled, medium styled, pseudo short styled and true short tyled. It is possible to get fruit from long styled and medium styled flowers. No fruit set occurs from pseudo short styled and true short styled flowers. Pseudo short styled and true short styled flowers are converted into long styled and medium styled flowers when they were treated with different growth regulators. Plant growth regulators help prevent flower drop and increase fruit set. So the effectiveness of NAA depends on its application frequency. Therefore, the present investigation was carried out to find out the suitable application frequency of NAA for higher yield in brinjal.

MATERIALS AND METHODS

The experiment was conducted at the research field of Regional Horticulture Research Station, Shibpur, Narsingdi during the rabi season (October to March) of 2016-2017. The experiment was laid out in Randomized Complete Block Design (RCBD) with five treatments NAA (NAPHTHALENE ACETIC ACID) was sprayed days after transplanting (DAT) and also considering the flower initiation stage (FIS) of brinjal viz. T_0 = Distilled water spray (control), T_1 = Spraying at 15 DAT days interval after transplanting, T_2 = Spraying at 15 DAT and at 1st FIS. T_3 = Spraying at 15 DAT and then thrice spray at 15 days interval starting from 1st FIS, T_4 = One spray before 7 days of first FIS and thrice spary at 7 days interval starting from 1st FIS, T_5 = One spray before 15 days of 1st FIS and thrice spray at 15 days interval starting from 1st FIS. The used concentration of NAA was 40 ppm. The unit plot size consisted of two plots each measuring 5.6 m² (5.6 m x 1.0 m) with 8 plants. Therefore, each unit plot occupied 16 plants. Forty two day old seedlings (4 leaf stages) were transplanted on 05 December, 2016 with spacing 100 cm row to row and 70 plant to plant distances. Cowdung, Urea, TSP, MoP, Sulphur, Boron and magnesium were applied @ 15 t, 375, 150, 250, 10, 1.5, 2 kg/ha. The entire quantity of cowdung, TSP, sulphur, and half of MoP were applied during land preparation The remaining half of MoP and eatire urea were applied in three equal installments at 20,40 and 60 days after transplanting. Insecticides were sprayed when required. Irrigation was given to the plant at 15 days interval after transplanting. Weeding was done as and when necessary. Fruit harvest started at March 03, 2017 and continued to June 14, 2017. The data were recorded on plant height at last harvest, number of leaves/plant, leaf area/plant, specific leaf weight, chlorophyll content index (CCI), Fv/Fm, percent of long styled flower, percent of medium styled flower, dry matter accumulation of plant, number of fruits/plant, fruit set percent, single fruit weight, fruit yield/plant. The yield of/plot was converted ton per ha. Data on CCI (Chlorophyll Content Index) was taken by Chlorophyll Content Meter (Model: CCM-200, Opti-sciences,USA) at 50 days after planting at the third leaf from tip. Leaf area (cm²) was measured by Leaf Area Meter, CL-202, CID, INC. The changes in fluorescence yield reflect changes in photochemical efficiency and heat dissipation.

The polyphasic rise of fluorescence transients was measured by an ADC Infrared Gas Analysis plant Efficiency Analyzer (PEA, Handsatech Instruments Ltd., King's Lynn, UK). The leaf discs were previously adapted to the dark for 20 minutes. The fluorescence data were collected at 10.00 a.m to 2.00 p.m at 50 days after transplanting. F_0 is the amount of light absorbed initially to raise the fluorescence from a low level to maximum value F_m after dark adaptation. $F_v = F_m - F_0$ which is the variable. Ratio of F_v/F_m is a dark adapted test used to determine maximum quantum yield. This ratio is also an estimate of the maximum portion of absorbed quanta used in PS II reaction centers. Collected data were statistically analyzed (Gomez and Gomez, 1983) and means were separated by DMRT by using MSTAT-C program.

RESULTS AND DISCUSSION

Effects of application frequency of NAA

Naphthalene acetic acid (NAA) was applied to brinjal days after transplanting (DAT) and combination with initial flowering stage (FIS) to observe the physio-morphological characters and the yield of brinjal during the growing condition of Rabi season (October to March). Application frequency of (NAA) had significant effect on most of the parameters except plant height, number of leaves/plant, leaf area/plant, leaf dry weight/plant and single fruit weight (Tables 1, 2 and 3). Plant height (94.74cm) and leaf area/plant (6367 cm²) were found maximum using Spraying at 15 DAT and at 1st FIS (T_2) treatment and no. of leaf/plant (146.23) were found using one spray before 7 days of first FIS and thrice spray at 7 days interval starting from 1st FIS T_4 treatment. The maximum stem dry weight/plant (215.7g) was obtained from T_2 treatment followed by T_4 (210.4g) treatment and the lowest from control T_0 . Maximum root dry weight (73.21g) was found from T_4 being no difference with T_2 and T_5 treatment. The T_4 treatment produced significantly maximum fruit dry weight/plant (143.27 g), and total dry weight/plant (548.58g) being identical with T_4 treatment. The control treatment T_0 gave the lowest fruit dry weight and total dry weight/plant (Table 2)

Table 1. Effect of application frequency of NAA on plant height, leaf number and leaf area in brinjal

| Treatment | Plant height (cm) | Leaves number / plant | Leaf area / plant (cm ²) |
|---------------|-------------------|-----------------------|--------------------------------------|
| T_0 | 83.12e | 129.41 | 5832d |
| T_1 | 90.14bc | 132.32 | 5875d |
| T_2 | 94.74a | 142.87 | 6367a |
| T_3 | 89.46d | 134.42 | 6032c |
| T_4 | 92.40c | 146.23 | 6186b |
| T_5 | 91.10b | 139.13 | 6114b |
| Level of sig. | * | ns | * |
| CV (%) | 6.69 | 5.12 | 7.71 |

Table 2. Effect of application frequency of NAA on specific leaf weight, chlorophyll content and F_v/F_m values in brinjal

| Treatment | Specific leaf weight (g/cm ²) | Chlorophyll index (CCI) | F_v/F_m |
|---------------|---|-------------------------|-----------|
| T_0 | 0.1183 | 35.71c | 0.7103c |
| T_1 | 0.1235 | 34.06cd | 0.7013cd |
| T_2 | 0.1256 | 42.13a | 0.7513a |
| T_3 | 0.1223 | 34.32cd | 0.6834d |
| T_4 | 0.1248 | 40.21b | 0.7418ab |
| T_5 | 0.1192 | 34.42cd | 0.7116c |
| Level of sig. | ns | * | * |
| CV(%) | 5.04 | 4.12 | 4.71 |

Means having uncommon letters in a column are significantly different at 5% level by Tukey's W test.

* indicate significant at 5% level of probability; NS: Not significant

Table 3. Effect of application frequency of NAA on dry matter accumulation of brinjal

| Treatment | Dry matter accumulation of plant (g) | | | | |
|----------------|--------------------------------------|--------------|--------------|---------------|---------------|
| | Leaf dry wt. | Stem dry wt. | Root dry wt. | Fruit dry wt. | Total dry wt. |
| T ₀ | 105.13 | 183.8 d | 61.54 d | 79.42 d | 429.89 d |
| T ₁ | 113.12 | 206.3 c | 67.36 b | 101.32 c | 488.10 c |
| T ₂ | 118.23 | 215.7 a | 71.38cd | 143.27a | 548.58 a |
| T ₃ | 117.36 | 206.1 c | 65.35c | 112.23 b | 501.04 b |
| T ₄ | 118.54 | 210.4 b | 73.21 a | 140.52 a | 542.67 a |
| T ₅ | 116.11 | 209.4b | 71.63 ab | 117.14 b | 514.28 b |
| Level of sig. | ns | * | * | * | * |
| CV (%) | 5.61 | 4.56 | 5.18 | 6.23 | 3.54 |

Means having common letters in a column are not significantly different at 5% level by Tukey's W test

* indicate significant at 5% level of probability; NS: Not significant

T₀ = Distilled water spray (control)

T₁ = Spraying at 15 days interval after transplanting

T₂ = Spraying at 15 days interval after transplanting and at 1st flower initiation stage

T₃ = Spraying at 15 days interval after transplanting and then thrice spray at 15 days interval starting from 1st flower initiation stage

T₄ = One spray before 7 days of first flower initiation and thrice spray at 7 days interval starting from 1st flower initiation stage

T₅ = One spray before 15 days of first flower initiation and thrice spray at 15 days interval starting from 1st flower initiation stage

Fv/Fm = dark adapted test used to determine maximum quantum yield.

Table 4. Effect of application frequency of NAA on flower type, yield attributes and yield of brinjal

| Treatment | Long styled flower (%) | Medium styled Flower (%) | Fruit/plant (no.) | Fruit set (%) | Single fruit wt. (g) | Fruit yield /plant (kg) | Fruit yield (t/ha) |
|----------------|------------------------|--------------------------|-------------------|---------------|----------------------|-------------------------|--------------------|
| T ₀ | 59.52 d | 8.03c | 12.31c | 31.18d | 104.5 | 1.34c | 16.64c |
| T ₁ | 68.12 c | 11.21ab | 13.10 c | 47.17b | 106.8 | 1.35 c | 17.84c |
| T ₂ | 82.41 a | 13.32a | 21.32a | 54.71a | 106.3 | 2.32a | 29.17a |
| T ₃ | 77.58 b | 10.72a | 14.04c | 38.67bc | 107.7 | 1.47b | 20.18b |
| T ₄ | 71.03 bc | 11.92ab | 19.21b | 51.43a | 106.1 | 2.04a | 26.19a |
| T ₅ | 73.28 b | 10.65a | 14.62c | 43.12b | 108.3 | 1.54b | 21.23b |
| Level of sig. | * | * | * | * | Ns | * | * |
| CV (%) | 5.37 | 9.65 | 7.32 | 8.38 | 6.03 | 5.12 | 6.13 |

Means having uncommon letters in a column are significantly different at 5% level by Tukey's W test.

* indicate significant at 5% level of probability; NS: Not significant

The T₂ treatment gave the highest value in case of long styled flower (82.41%), medium styled flower (13.32%), number of fruits/plant (21.32), fruit set percent (54.71%), yield/plant (2.32 kg) and fruit yield per hectare (29.17 t) (Table 3). However, there was no significant difference between T₂ treatment and T₄ treatment with regard to long styled flower percentage, medium styled flower percentage, number of fruits/plant, fruit set percentage, fruit yield/plant and fruit yield t/ha. The lowest values of long styled flower percentage, medium styled flower percentage, number of fruits/plant, fruit set percent, fruit yield/plant and fruit yield t/ha were obtained from control T₀.

CONCLUSION

From the study, it can be concluded that NAA (40 ppm) can be sprayed 15 days interval after transplanting and at 1st flower initiation stage for getting better yield of brinjal.

CONFLICT OF INTEREST

There is no conflict of interest.

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