

Effect of Naphthalene acetic acid & Indole acetic acid on Growth, Yield and Quality of Muskmelon (*Cucumis melo*.L)

ABSTRACT

The present experiment was carried out during *Zaid* 2021. In order to study the “Effect of Naphthalene Acetic Acid and Indole Acetic Acid on Growth, Yield and Quality of Muskmelon (*Cucumis melo*.L). The trail was conducted at Biotechnology polyhouse, Department of Horticulture, Naini Agriculture Institute and Prayagraj. The foliar spray two growth regulators like Naphthalene Acetic Acid and Indole Acetic Acid were spray separately at different concentration (NAA @10ppm, 20ppm, 30 ppm, 40 ppm, 50 ppm, 60 ppm, 70 ppm, 80 ppm. IAA @ 100 ppm, 200 ppm, 300 ppm, 400 ppm, 500 ppm, 600 ppm, 700 ppm, 800 ppm. The result revealed among all the treatments foliar application of NAA (80 ppm) is significantly gave positive impact on growth, yield and quality parameters i.e. Vine length (153.96 cm), number of days for 1st male flower (33.6 Days), No. of days for 1st female flower (38.83 Days), No. of Node at which 1st Male flower appears (4 . 1), No. of Node at which 1st Female flower appears (5 . 83) No. of Male flowers (207.33), No. of Female flowers(5.3) fruits per plant (3), diameter of the fruit (22.53 cm), length of the fruit(13.4cm), fruit yield per plant (1.4 kg), fruit yield per hectare (12.46 t), total soluble solids (11.30 Brix^o), gross returns (3,73,800 Rs/ha), net returns (2,39,844 Rs/ha) and Benefit: cost ratio (2.79) were obtained among all other treatments with foliar application of NAA @80 ppm compared to other treatments.

Keywords: *Muskmelon, NAA, IAA, growth, yield, Economics.*

Introduction

Muskmelon (*Cucumis melo* L.) is an annual with a similar type of growth like cucumber. The leaf lobes are more rounded than those of cucumber and the crop requires slightly higher temperature for optimum growth than does the cucumber. Fruit maturity is achieved within about 85 to 120 days depending upon the variety, region, soil and climate. Muskmelon fruit is a fleshy pepo, varying considerably in shape, size and appearance according to the variety. Most varieties have ten longitudinal sutures and ribs, a few varieties lack such ribbing. In the mature fruit, the surface and ribs become covered with a network of corky tissue: in some varieties it is sparse while in others it is thick and dense. When the fruits of most varieties reach the edible maturity, a slight crack appears at the point of their attachment to the stem. When this crack completely encircles the attachment, the fruit has reached its edible maturity and is also ready for seed harvest. A single muskmelon fruit may contain about 400 to 600 seeds, which resemble those of cucumber in their size and appearance.

Muskmelon (*Cucumis melo* L.) has high nutritive value and it is grown widely in India as well as in whole world and consumed as vegetable. Muskmelon is rich in vitamin C (antioxidant) so it is also good for health. Muskmelon is low in sugar and calories because of high per cent of water present in it which are useful for those who want to reduce body weight. The nutritive value varies from variety to variety. A rough analysis of the food value is given below. (**Choudhury et al., 2000**).

The mechanism of sex expression in cucurbits is governed by genetical and environmental factors (**Nitsch et al., 1952**). The application of plant growth regulators has been found to be effective in initiating higher percentage of female flowers and thereby modifying the sex ratio and ultimately resulting in more fruiting in cucurbits. A relationship between growth substances and sex expression probably exist in these plants. During the flowering period, a high auxin level in the vicinity of differentiating primordium and staminate organs by a low level favors the formation of pistillate organs. (**Heslop-Harrison, 1957**).

Plant growth regulators, other than nutrients, usually are organic compounds. They are either natural or synthetic compounds and are applied directly to a plant to alter its life processes or structure in some beneficial ways so as to enhance yield, improve quality and facilitate harvesting. (**Nickell, 1982**).

The modification in sex expression by exogenous application of plant growth regulators and certain chemicals had received considerable attention in cucurbitaceous crops such as *Cucumis sativus* L. by **Choudhury and Phatak (1959)** and **Astmon et al. (1968)**: in *Cucumis melo* L.

by **Brantely and Warren** (1960) and in *Lagenaria siceraria* (Moll Standl. by **Kalia and Dhillon** (1966).

Charles Darwin was the first who proposed the existence of auxin in 1880. It was the first class growth regulator that was discovered. Auxins are those compounds that give positive effect on formation of bud, enlargement of cell and root initiation and they are also helpful for the formation of other growth hormones.

Plant growth regulators are used in horticulture to improve crop growth by increasing fruit number, fruit set and size. Improved vegetative growth and production traits can increase crop productivity. The productivity in the horticultural system often depends on the manipulation of the physiological activities of the crops by chemical means (**Yeshitela et al., 2004**).

The physiological processes like growth and development of the plant, enhancement of the fruit color, flower differentiation, fruit ripening, tissue growth, etc. are controlled by the appropriate application of plant growth regulators IAA & NAA (**Prajapati et al., 2015**).

IAA also control vegetative growth of plant and helps to increase the plant population per area (**Latimer, 2019**). The plant regulators have positive role on growth, flowering, fruiting, and the fruit yield of cucumber. In fact, the application of growth regulators enhance the production of cucumber including other vegetables and fruits in respect of superior quality and better growth. According to **Gianfagua (1987)**, plant growth regulators can modify development by interfering with the biosynthesis, metabolism, or translocation of endogenous hormones, or by supplying endogenous hormones when plant levels are low. The increase in flowering can produce more fruits and, together with the increase in size, it would increase production in fruit crops (**Dyer et al., 1990**).

IAA is natural occurring hormone while NAA, IBA, 2-4D etc. are synthetic in nature. Apical dominance, root induction, control fruits drops, regulation of flowering, parthenocarpy, phototropism, geotropism, herbicides, inhibit abscission, sex determination, xylem differentiation, nucleic acid activity.

Sex expression the treatment with growth regulators has been found to change sex expression in cucurbits, okra and pepper. GA3 (10-25 ppm), IAA (100 ppm) and NAA (100 ppm) when sprayed at 2-4 leaf stage in cucurbits, then they have been found to increase the number of female flowers. The combination of NAA150 ppm + ethrel 250 ppm also increased number of fruits per vine. **Li and Hayata (2005)**, point out that the application of indole-3- acetic acid in the cultivation of zucchini (*Cucurbita pepo L.*) could be closely related to the setting and growth of the fruit.

Younis and Tigani (1977); Naqvi et al. (1998) point out that naphthalene acetic acid (NAA) has an effect on fruit retention in several vegetables and produces an increase in yield in many fruit crops. **Alam and Khan (2002)** point out that naphthalene acetic acid (NAA) reduces fruit drop, increases the number of fruit and yield in tomato crop, application of IAA in the crop of the pin (*Citrullus lanatus* Mansf.) found the longest fruits and the application of ANA decreased the width of the fruit. Instead, they coincide with the results obtained in other crops by **Dutta and Banik (2007)** who found with the application of naphthalene acetic acid (NAA) before flowering and three weeks after fruit set, a significant increase in length. and diameter of the guava fruit.

MATERIALS AND METHODS

The material and methods used in the present investigation include a brief description of the site of experiment, soil properties, climate condition prevalent in the locality during the period of experiment, statistical, particulars of treatments, planting material used and sampling techniques, are given below:

A field experiment was conducted during 25th February 2021 to 30th May 2021. In polyhouse at microbiology department, Department of Horticulture, Jacob Institute of Biotechnology and Engineering, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.).

The experimental field has an even topography with a gentle slope and good drainage. The sample were drawn from each replication of experimental plot at 0-15 cm depth before sowing of the crop and a composite sample was made to determine the physical and chemical properties of soil. The mechanical analysis of the sample soil was done with the half of Bouyoucos hydrometer (1952) method.

Sand 60% , clay

The experiment entitled, was conducted in spring to summer season adapting randomized block design consisting of 10 treatments and three replications. The experiment was laid out in simple randomized block design consisting of one hybrid variety with three replications. The different treatments were allocated randomly in each replication. The field was ploughed thoroughly and break the clods and brought soil to a fine tilth with the help of spade and rake. Thereafter field was leveled properly with rakers and ridges are made, Fertilizers in both inorganic and source forms were used. Urea was used as a nitrogen fertilizer, SSP as a phosphorus fertilizer, and Mop as a potash fertilizer. Organic manure was used in the form of decomposed farmyard manure (FYM) and vermicompost. After that sowing is done, The Replanting operation was

carried out by removing weak and dead plants in order to maintain healthy plant population. The first weeding was done with the help of khurpi 15 days after sowing, and the second weeding was done 30 days after sowing followed by 15 days interval up to last Harvest. The experimental crop was given irrigation by flooding of regular intervals of 6-7 days and depending upon soil moisture at required stages of the crop. Application of Chlorpyrifos @2ml/L for control of red pumpkin beetle and Neem oil @3ml/L for control of leaf miner by using sprayer. Emamectin+Thymoxon @50g/15L for the control of sucking pest, dusting of Malathion for control of ants & termites. Fruits were harvested when they reach full slip stage. i.e., when the fruit is detached from the plant naturally. As it was impractical to record observations on every plant due to the large plant population size, the technique of random sampling was used to record observations of various plant growth parameters throughout the study. As a representative sample of the entire population, plants were randomly selected from each plot by adopting random sampling technique.

The data recorded during the course of investigation were subjected to statistical analysis as per method of analysis of variance (Fisher, 1950). The significance and non-significance of the treatment effect were judged with the help of f' value (variance ratio) was compared with the table value at 5% level of significance. If calculated value exceeded then the value, the effect of considered to be significant. The significant difference between the means was tested against the critical difference at 5% level of significance.

Table No 1. Treatment details

Treatment	Treatment Details
T ₀	CONTROL
T ₁	NAA 10 PPM
T ₂	NAA 20 PPM
T ₃	NAA 30 PPM
T ₄	NAA 40 PPM
T ₅	NAA 50 PPM
T ₆	NAA 60 PPM
T ₇	NAA 70 PPM
T ₈	NAA 80 PPM
T ₉	IAA 100 PPM
T ₁₀	IAA 200 PPM
T ₁₁	IAA 300 PPM
T ₁₂	IAA 400 PPM
T ₁₃	IAA 500 PPM
T ₁₄	IAA 600 PPM
T ₁₅	IAA 700 PPM
T ₁₆	IAA 800 PPM

Result and Discussion

Effect of NAA and IAA on the Growth of Muskmelon.

The maximum No. of Leaves at 30,60 & 90 DAS is recorded in the T8 (15, 28.3, and 70.66) and T16 (16.6, 27.3, and 69.66) T8 is NAA @80 PPM & T16 is IAA @ 800 PPM.

The maximum VINE LENGTH at 30,60 & 90 DAS is recorded in the T8 (17, 103.16, and 153.96 CM) and T16 (14.66, 103.16, and 152.86 CM) T8 is NAA @80 PPM & T16 is IAA @ 800 PPM.

Maximum No. of days for the 1st male flower T8 (33.6 Days) & T16 (33.3 Days) T8 is NAA@ 80 ppm and T16 is IAA @ 800 ppm, these two treatments promoted early flowering

Maximum No. of days for the 1st female flower T8 (38.83 Days) & T16 (38.4 Days) T8 is NAA@ 80 ppm and T16 is IAA @ 800 ppm, these two treatments promoted early flowering No. of Node at which 1st Male flower appears T8 (4.1) & T16 (3.26) here T8 is NAA @ 80 ppm and T16 is IAA @ 800 ppm, these two treatments promoted early flowering No. of Node at which 1st Female flower appears T8 (5.83) & T16 (5.33) here T8 is NAA @ 80 ppm and T16 is IAA @ 800 ppm, these two treatments promoted early flowering Maximum No. of Male Flowers were recorded in T8 (207.33) and T16 (220) here T8 is NAA @ 80 ppm and T16 is IAA @ 800 ppm. Maximum No. of Female Flowers were recorded in T8 (5.3) and T16 (5.6) here T8 is NAA @ 80 ppm and T16 is IAA @ 800 ppm.

Effect of NAA and IAA on Yield and yield components of Muskmelon.

Maximum No. of fruits were recorded in T16 (3.3) and T15 (3.3) and T8 (2.3) here T16 is IAA @ 800 ppm , T15 is IAA @ 700 ppm and T8 is NAA @ 80 ppm. Maximum length of the fruit is recorded in T8 (13.4) and T7 (12.4) here T8 is NAA @ 80 ppm and T7 is NAA @ 70 PPM.

Maximum diameter of the fruit is recorded in T8 (22.53 CM), T7 (21.6 CM) and T16 (21.4 CM) here T8 is NAA @80PPM and T7 NAA @ 70 PPM and T16 IAA @ 800PPM.

Maximum Yield per Plant is recorded in T8 (1.4 kg\plant), T7 (1.3kg\plant) and T16 (1.3kg\plant) here T8 is NAA@80 PPM, T7 is NAA @ 70 PPM and T16 is IAA@800 ppm.

Maximum Yield per Plot is recorded in T8 (8.4 kg\plant), T7 (8.08kg\plant) and T16 (7.77kg\plant) here T8 is NAA@80 PPM, T7 is NAA @ 70 PPM and T16 is IAA@800 ppm.

Maximum Yield per Hectare is recorded in T8 (12.46 t\ha), T7 (11.97t\ha) and T16 (11.63t\ha) here T8 is NAA@80 PPM, T7 is NAA @ 70 PPM and T16 is IAA@800 ppm.

Effect of NAA and IAA on Quality parameters

Maximum Vitamin C content is recorded in T15 (30.96mg\100g) and T4 (24.59mg\100g) here T15 is IAA @ 700 PPM and T4 is NAA @ 40 ppm.

Maximum TSS Content is recorded in T8(11.30) and T12 (10.98) here T8 is NAA@80PPM and T12 is IAA@400PPM.

Treatment combinations	No. of leaves 30 DAS	No. of leaves 60 DAS	No of leaves 90 DAS	Vine length 30 DAS (m)	Vine length 60 DAS (m)	Vine length 90 DAS (m)
NAA 10ppm	10.33	21.67	47.33	11.33	99	149.9
NAA 20ppm	10	22	49	13	99.13	150.5
NAA 30ppm	11	21.5	48.66	13.33	99.3	149.6
NAA 40ppm	10.6	23	49.66	13	99.16	149.66
NAA 50ppm	10.67	22.33	50.33	13.66	98.66	150.4
NAA 60ppm	14.6	24.67	66	13.16	101	151.5
NAA 70ppm	14	25	65.66	16	102.66	152.61
NAA 80ppm	15	28.3	70.66	17	103.16	153.96
IAA 100ppm	10.66	22.3	44.33	13.8	99.5	149
IAA 200ppm	11.6	23.66	45	14.33	99.83	149.26
IAA 300ppm	11.6	23.67	45.33	14.5	99	149.33
IAA 400ppm	11	23	48	13.5	99.3	149.8
IAA 500ppm	11.3	24	48	15.33	99.66	151.3
IAA 600ppm	11.6	25.33	49.33	14	100	151.16
IAA 700ppm	15.6	26.33	66	14.3	101.55	151.26
IAA 800ppm	16.6	27.3	69.66	14.66	103.06	152.86
Control	9.6	20.67	43.33	11	97.66	146.16
F- Test	S	S	S	S	S	S
S.Ed (±)	0.77	1.25	1.75	0.89	1.61	1.08
C.D at 5%	1.57	2.54	3.57	1.82	3.27	2.21
CV	7.78	6.41	4.03	7.88	1.97	0.88

Table 2. Effect of NAA and IAA on the growth of Muskmelon.

The results recorded pertaining to No. of leaves 30 DAS are presented in table 2.

Application of growth regulator i.e, T16(IAA 800 PPM) recorded significantly the highest with (16.6) followed by T15 with (15.6) which is statistically at par value while the lower number of leaves in T0(9.6). The results recorded pertaining to No. of leaves 60 DAS are presented in table 2. Application of growth regulator i.e, T8 (IAA 80 PPM) recorded significantly the highest with (28.7) followed by T16 with (27.3) which is statistically at par value while the lower number of leaves in T0(20.7). The results recorded pertaining to No. of

leaves 90 DAS are presented in table 2. Application of growth regulator i.e, T8(NAA 80 PPM) recorded significantly the highest with (70.66) followed by T16 with (69.66) which is statistically at par value while the lower number of leaves in T0(43.33).

The results recorded pertaining to Vine length 30 DAS are presented in table 2 Application of growth regulator i.e, T8(NAA 80 PPM) recorded significantly the highest with (17cm) followed by T7(NAA 70 PPM) with (16 cm) which is statistically at par value while the lower number of leaves in T0(11cm). The results recorded pertaining to Vine length 60 DAS are presented in table 2. Application of growth regulator i.e, T8(NAA 80 PPM) recorded significantly the highest with (103.16cm) followed by T16(IAA 800 PPM) with (103 cm) which is statistically at par value while the lower number of leaves in T0(97.66cm). The results recorded pertaining to Vine length 90 DAS are presented in table 2. Application of growth regulator i.e, T8(NAA 80 PPM) recorded significantly the highest with (153.96cm) followed by T16(IAA 800 PPM) with (152.86 cm) which is statistically at par value while the lower number of leaves in T0(146.86cm). The significant increase in vine length in treatment of NAA 80 ppm might be the result of its stimulatory effect on plant growth due to cell elongation and rapid cell division in growing protein. **Chhonkar and Singh (1959)** opined that the increase in vine length under application of NAA was on account of its stimulatory effect on absorption of available nutrients present in the soil or by the modification in plant root system through the associated microflora of the soil similar results were also reported by **Das and Das (1996)** in pumpkin due to application of NAA (150 ppm).

	S.Ed (±)	0.80	0.94	0.34	0.64	2.70	0.58	7.16	0.39	28.29	7.16	1.23	0.26	13.32	1.99	0.89
	C.D at 5%	1.63	1.91	0.70	1.30	5.49	1.18	14.59	0.79	57.62	14.59	2.51	0.53	27.12	4.05	1.81
	CV	2.72	2.78	8.71	11.27	1.75	17.55	19.38	20.21	7.27	19.38	7.57	20.63	20.55	20.78	4.72

Table 3. Effect of NAA and IAA on Growth, Yield and Quality of Muskmelon.

Application of growth regulator i.e, T16(IAA 800PPM) recorded significantly the least Days to 1st male flower emergence (33.3) followed by T8 with (33.8) which is statistically at par value while the maximum no of days was taken by T0(40.5). The study revealed that IAA & NAA promotes earliness. NAA effect has got in sex expression and delayed the staminate flowering process for 25 to 30 days compared to control in muskmelon. Earlier finding confirmed with **Vadigeri et al., (2001)** in cucumber, **Hidayatullah et al., (2012)** in bottlegourd and Baset **Mia et al., (2014)** in bittergourd. Application of growth regulator i.e, T16 (IAA 800ppm) recorded significantly the least no of male flowers (161.66) followed by T15 and T8 with 139.13 and 141.66 respectively. while, the highest no of male flowers was recorded in T0 (253.26). IAA, increased earliness and the increase in the production as a result of using some growth regulators might contribute much to the increase of both pistillate flowers and mean weight per fruit (**El-Zawily & Arafa, 1981**). Application of growth regulator i.e, T8 (NAA 80PPM) recorded significantly the least sex ratio (39:1) followed by T16 and T6 with 39:1 and 40:1 respectively. while, the highest sex ratio was recorded in T0(72:1). The results are conformity with the findings of (**E. EL-KHOLY 1982**). Whereas NAA 80 ppm and IAA 800 ppm has recorded as the best Male to Female sex ratio in Muskmelon. Application of growth regulator i.e, T16 (IAA 800 ppm) recorded significantly the highest average number of fruits (3.3) followed by T15 and T14 with 3.3 and 3 which are statistically at par respectively. While, the least no of fruits was recorded in T0(2). The results are conformity with the findings of (Nelson 2009). The plants treated with IAA obtained the highest number of fruits/plant (1.68) greater than that obtained in NAA. Where IAA 800ppm have reported most no of fruits per plant in muskmelon. Similar, findings are seen in Sweet melon (**E. EL-KHOLY 1982**). Application of growth regulator i.e, T8(NAA 80ppm) recorded significantly the highest average fruit weight (673.6g) followed by T7 and T6 with 625.6g and 651g which are statistically at par respectively. While, the least average fruit weight was recorded in T0(223.5g) followed by T9

(334.8). The results are conformity with the findings of treatment NAA 80ppm by **(Y. Reenata Devi 2015)**, recorded highest average fruit weight in muskmelon. Which, showed similar results even after spraying with NAA concentrations at different concentrations in my experiment. Similar, findings are seen in Muskmelon Naphthaleneacetic acid (NAA) in concentrations between 50 to 200 ppm applied to the fruit in the growth process increased the size, weight of the fruit and improved fruit quality in date palms (Shabana et al., 1976) by **(Nelson José 2009)**.

Application of growth regulator i.e, T15 (IAA@700ppm) recorded significantly the highest vitamin C (30.96) followed by T4 (24.59) which are statistically at par respectively. while, the least average fruit yield was recorded in T0 (20.64). The results are conformity with the findings of treatment NAA & IAA. IAA treatment to the roots raises the content of ascorbic acid per cell with a parallel increase in size of cell. Involvement of ascorbic acid in IAA induced cell elongation is discussed. **(A.C. Dhar et al., 1980)**.

Application of growth regulator i.e, T8 (NAA 80ppm) recorded significantly the highest TSS (11.30) followed by T12 (10.9) which are statistically at par respectively. While, the least TSS was recorded in T0 (8.03). The results are conformity with the findings of **(Chaurasiya, 2016)**. Where NAA80ppm have recorded the highest TSS (°Brix) in muskmelon. Similar, findings as seen in mango by (Kaur, 2017) by using NAA.

CONCLUSION

The results from the present investigation concluded that T8(NAA 80 PPM) performed the best in the following parameters No. of Leaves is recorded in the T8 (70.66) Vine length at is recorded in the T8 (153.96 cm) Yield per Hectare is recorded in T8 (12.46 t\ha), TSS Content is recorded in T8(11.30), T8 NAA@80ppm found to be superior for fruit yield and it showed highest gross return, net return and benefit cost ratio. The use of Plant growth regulators will improve the plant conditions.

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