International Journal of Plant & Soil Science

34(22): 1460-1469, 2022; Article no.IJPSS.91448
ISSN: 2320-7035

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

Lingam Meghana Mercy Vidyullatha [a*] and Samir Ebson Topno [a]

[a] Department of Horticulture, Naini Agriculture Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, India.

Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJPSS/2022/v34i2231519

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/91448

Original Research Article

Received 28 June 2022
Accepted 31 August 2022
Published 08 September 2022

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°), 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.

**Corresponding author: E-mail: meghanaelias99@gmail.com;*

1. 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 consume 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 [1].

The mechanism of sex expression in cucurbits is governed by genetical and environmental factors [2]. The application of plant growth regulators has been found to be effective in initiating higher percentage of female flowers and there by modifying the sex ratio and ultimately resulting in more fruiting in cucurbits [3,4]. 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 [5].

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 [6].

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 [7] and Astmon et al. [8]: in *Cucumis melo* L. by Brantely and Warren [9] and in *Lagenaria siceraria* (Moll Standl. by Kalia and Dhillon [10].

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 [11-13]. The productivity in the horticultural system often depends on the manipulation of the physiological activities of the crops by chemical means [14].

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 [15].

IAA also control vegetative growth of plant and helps to increase the plant population per area [16]. 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 [17-19]. According to researchers, 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 [20].

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 [21-26].

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 [27]; Naqvi et al. [28] pointed 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 [29] 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 [30] 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.

2. MATERIALS AND METHODS

The material and methods used in the present investigation include a brief descriptionof the site of experiment, soil properties, climate condition prevalent in the locality during theperiod 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 drown 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 chemicalproperties of soil. The mechanical analysis of the sample soil was done with the half of Bouyoucos hydrometer (1952) method.

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 by15 days interval up 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 Chlorpyriphos @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 reaches 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 nonsignificance 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 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

3. RESULTS AND DISCUSSION

3.1 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.

3.2 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.

3.3 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.

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

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 3. Effect of NAA and IAA on growth, yield and quality of muskmelon

Treatments symbols	Treatments	Days to first male flower appearance	Days to first female flower appearance	Node at 1st male flower appear	Node at 1st female flower appear	No. of male flowers	No. of Female flowers	Sex ratio	No. of fruits per plant	Avg. weight of the fruit (g)	Avg. length of the fruit (cm)	Diameter (cm)	Avg. yield per plant (kg)	Avg. yield per hector (t)	TSS (°Brix)	Vitamin C (mg)
T1	NAA 10ppm	37.6	42.1	5.36	7.33	207.33	3.3	51:1	2	551.7	9.23	18.1	1.1	9.79	8.73	23.41
T2	NAA 20ppm	36.5	42.16	5.46	7.5	169	3.6	47:1	2	569.5	9.7	18.33	1.13	10.12	8.92	22.80
T3	NAA 30ppm	36	41.5	5.23	7	172.33	3.66	48:1	2	620.3	10.4	21.33	1.24	11.02	6.43	21.36
T4	NAA 40ppm	36.8	41	5.1	6.86	174.66	4	49:1	2	625.2	10.43	21.26	1.25	11.11	7.16	24.59
T5	NAA 50ppm	35.83	42	4.76	6.76	182	4.3	42:1	2	640.1	10.9	19.76	1.27	11.37	8.43	21.64
T6	NAA 60ppm	35.66	40.16	4.83	7	184.66	4.6	40:1	2	651	12	21.16	1.3	11.55	8.56	21.59
T7	NAA 70ppm	34.83	40	4.8	6.8	190.33	4.6	41:1	2	625.6	12.4	21.6	1.34	11.97	9.6	23.02
T8	NAA 80ppm	34.5	38.83	4.1	5.83	167.66	5.3	**39:1**	2.3	673.6	13.43	22.53	1.4	12.46	11.30	23.96
T9	IAA 100ppm	38	43.33	5.43	7.5	180.33	3.6	50:1	2.3	334.8	8	18.83	0.78	6.94	8.4	21.89
T10	IAA 200ppm	35.66	41.5	4.7	7.66	187.33	3.3	57:1	2.3	349.4	8.93	18.2	0.81	7.24	8.31	22.11
T11	IAA 300ppm	35.33	41.16	4.9	6.5	192.33	3.3	59:1	2.3	355.6	7.4	19.9	0.82	7.37	8.86	21.23
T12	IAA 400ppm	36.16	41.5	4.9	6.6	187.6	3.66	55:1	2.6	361	8.66	20.2	0.96	8.54	10.98	22.67
T13	IAA 500ppm	36.33	41.16	4.0	6.16	182.66	4	52:1	2.67	369.1	9.03	20.6	0.98	8.74	10.51	23.17
T14	IAA 600ppm	35.83	40.8	3.9	5.66	178.66	4.3	50:1	3	373.5	9.73	20.93	1.12	9.97	9.03	22.97
T15	IAA 700ppm	35 .5	39.16	3.76	5.4	166.33	4.66	48:1	3.3	384.9	9.96	21.13	1.28	11.40	10.55	30.96
T16	IAA 800ppm	33.3	38.4	3.26	5.33	161.66	5.66	39.1	3.3	393.3	10.1	21.43	1.3	11.63	10.03	23.14
T0	Control	40.5	45.83	7.33	12	220	2.33	72:1	2	223.5	8.5	12.83	0.44	3.97	8.03	20.64
	F-Test	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	S	**S**
	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

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 T_0 (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 T_{16} with (27.3) which is statistically at par value while the lower number of leaves in T_0(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 per 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 per 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 per 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 [31] 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).

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.,[32] in cucumber**,** Hidayatullah et al*.,* [33] in bottlegourd and Baset Mia et al*.,* [34] 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 [35]. 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 [36]. 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 [36]. 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 [37], 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 [38] 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 [39].

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 [40]. Where NAA80ppm have recorded the highest TSS (ºBrix) in muskmelon. Similar, findings as seen in mango by (Kaur, 2017) by using NAA.

4. 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.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Chaudhry Q, Scotter M, Blackburn J, Ross B, Boxall A, Castle L, Aitken R, Watkins R. Applications and implications of nanotechnologies for the food sector. Food additives and contaminants. 2008;25(3):241-58.
2. Nitsch JP, Kurtz Jr EB, Liverman JL, Went FW. The development of sex expression in cucurbit flowers. American Journal of Botany. 1952 Jan 1:32-43.
3. Ram Asrey, Singh GN, Shukla HS, Rajbir Singh.. Effect of seed soaking with Gibberellic acid on growth and fruiting of muskmelon (*Cucumis* melo L.). Haryana journal of horticultural sciences. 2001;30(3-4):277-278.
4. Randhawa KS, Singh K. Modification of sex expression and sex ratio in muskmelon (*Cucumis* melo L.) by different plant growth substances. Plant sciences. 1970;1:69-76.
5. Heslop-Harrison J. The experimental modification of sex expression in flowering plants. Biological Reviews. 1957 Feb;32(1):38-90.
6. Nickell S. The determinants of occupational success in Britain. The Review of Economic Studies. 1982 Jan 1;49(1):43-53.
7. Choudhury B, Phatak SC. Sex expression and fruit development in cucumber (*Cucumis sativus* L.) as affected by gibberellin. Indian Journal of Horticulture. 1959;16(4):233-5.
8. Atsmon D, Lang A, Light EN. Contents and recovery of gibberellins in monoecious and gynoecious cucumber plants. Plant Physiology. 1968 May;43(5):806-10.
9. Brantley BB, Warren GF. Sex expression and growth in muskmelon. Plant physiology. 1960 Sep;35(5):741.
10. Dhillon MK, Kalia VK, Gujar GT. Insect-pests and their management: Current status and future need of research in quality maize. InMaize: Nutrition dynamics and novel uses 2014 (pp. 95-103). Springer, New Delhi.
11. Saimbhi MS, Chadha ML. The response of three musk-melon (*Cucumis* melo L.) varieties differing in sex form and their F1-hybrids to foliar sprays of 2-chloroethylphosphonic acid (ethrel). Indian Journal of Horticulture. 1974;31(4):360-363.
12. Young Koung LWC, Ezura V. Efficient plant regeneration organo-genesis in winter squash (*Cucurbita* maxima). Plant Science. 2003;164:413-418.
13. Zhang J, Gong GY, Shi JT, Zhang HY, Ren Y, Guo SG, Gao JP, Shen HL, Xu Y. Inheritance of sex forms in watermelon (*Citrullus lanatus*). Scientific Horticulture. 2015;193:367-373.
14. Yeshitela T, Robbertse PJ, Fivas J. Effects of fruit thinning on 'sensation'mango (Mangifera indica) trees with respect to fruit quantity, quality and tree phenology. Experimental agriculture. 2004;40(4): 433-44.
15. Prajapati YK, Pathak M, Khan MK. A comparative study of flow boiling heat transfer in three different configurations of

microchannels. International Journal of Heat and Mass Transfer. 2015;85:711-22.3.
16. Latimer JG. Growth retardants affect landscape performance of zinnia, impatiens, and marigold. HortScience. 2019;26(5):557–560. Available:https://doi.org/10.21273/hortsci.26.5.557
17. Hilli JS, Vyakarnahal BS, Biradar DP, Hunje R. Effect of growth regulators and stages of spray on growth, fruit set and seed yield of ridge gourd (*Luffa acutangula* L.). Karnataka Journal of Agricultural Sciences. 2010;23(2):239-242.
18. Hossain D, Karim MA, Pramanik MHR, Rahman AAMS.. Effect of gibberellic acid (GA3) on flowering and fruit development of bittergourd (*Momordica* charantia L.) International Journal of Botany. 2006;2(3):329-332.
19. Nelson José Montaño, Jesús Rafael Méndez Natera. Effect of indole-3-acetic acid and naphthalene acetic acid on length and width of muskmelon (*Cucumis melo* L.) Eastern University. School of Agricultural Engineering Scientific Journal UDO Agricola; 2009.
20. Dyer D, Cotterman JC, Cotterman CD, Kerr PS, Carlson DR. Cytokinins as Metabolic Stimulants Which Induce Pod Set. In: Plant Growth Substances, Pharis, R.P. and S.B. Roods (Eds.). Springer-Verlag, New York. 1990;457-467.
21. Chaudhary DC, Patel NM, Rathva VD, Nurbhanej MH. Effect of growth substances on growth, flowering, yield and quality attributes of watermelon (*citrullus lanatus thunb mansf*.) cv. durgapura lal (rw-177-3). International Journal of Agriculture Sciences. 2016;8(40):1825-1828.
22. Chaudhry NY, Khan AS. Improvement of Pistillate flowers yield with GA3 in heavy metals treated plants. Plant Growth Regulation. 2006;50:211-217.
23. Chaurasiya J, Verma RB, Ahmad M, Adarsh A, Kumar R, Pratap T. Influence of plant growth regulators on growth, sex expression, yield and quality of muskmelon (*Cucumis melo L*.) Ecology Environment & Conservation. 2016;22:S39-S43.
24. Choudhury B, Babel YS. Studies on sex expression, sex ratio and fruit set as affected by different plant regulator sprays in (*Lagenaria siceraria* (Molina) Standl). Horticulture Science. 1969;1:61-71.
25. Dalai S, Singh MK, Singh KV, Kumar M, Malik S, Kumar V. Effect of foliar application of GA3 and NAA on growth, flowering, yield and yield attributes of cucumber (*Cucumis sativus* L.). Annals of Horticulture. 2015;8(2):181-194.
26. Daryono BS, Prasetya E, Sumarlina S, Sartika D, Subiastuti AS. The effect of ethepon treatment on the formation of flower in melon (*Cucumismelo* L.). Digital Press Life Sciences. 2018;1:00002.
27. Younis ME, Tigani SE. Comparative effect of growth substances on the growth, flowering and fruiting of tomato plants. Acta Agron. Acad. Soc. Hung. 1977;26:895-903.
28. Naqvi SSM, S.M. Alam S. Mumtaz, Hanif M. Effect of Co and Ag ions and naphthalene acetic acid on cotton (*Gossypium hirsutum* L.) yield. Pak. Cottons (Karachi, Pakistan). 1998;42:65-69.
29. Alam SM, Khan MA. Fruit Yield of Tomato as Affected by NAA Spray. Asian Journal of Plant Sciences. 2002;1: 24-24. DOI: 10.3923/ajps.2002.24.24.
30. Dutta P, Banik AK. Effect of foliar feeding of nutrients and plant growth regulators on physico-chemical quality of sardar guava grown in red and lateritic tract of West Bengal. Acta Horticulturae. 2007;735:407-411. DOI: 10.17660/ActaHortic.2007.735.57.
31. Chhonkar VS, Singh SN. Effect of Naphthalene acetic acid on growth, quality and yield of tomato. Ind. J Hort. 1959;16(4):236-242.
32. Vadigeri BG, Madalgeri BB, Sheelavantar MN. Effect of ethrel and gibberellic acid on yield and quality of two cucumber varieties. Karnataka J. Agric. Sci. 2001;14(3):727-730.
33. Hidayatullah T, Mahmood M, Farooq M, Khokhar A, Hussain SI. Plant growth regulators affecting sex expression of bottlegourd (*Lagenaria sinceraria molina*) plants. Pakistan Journal of Agricultural Research. 2012;25(1):163-168.
34. Baset Mia MA. Altered sex expression by plant growth regulators: An overview in medicinal vegetable bitter gourd (*Momordica charantia* L.). Journal of Medicinal Plant Research. 2014;8(8):361-367 DOI:10.5897/JMPR10.032
35. El-Zawily AI, Arafa AE. Effect of ethephon and indole-3-acetic acid on growth,

flowering and fruiting of summer squash (*Cucurbita pepo* L.). Zagazig University, Research Bulletin. 1981;240:1-2.

36. El-Kholy E, Hafez H and Naeem F. Effect of some growth regulators on yield and quality of sweetmelon and muskmelon. J Agric Sci Camb. 1982;98:645–649
37. Y. Reenata Devi and P. Madhanakumari. Effect of Plant Growth Regulators on Floweringand Yield of Muskmelon (*Cucumis Melo* L.). Plant Archives. 2015;15(2):899-901.
38. Shabana HR, Jawad KS, Benjamin ND, AL-Aie BA. Effect of some growth regulators at depressed period at development on the physical properties of Zahdi and Sayer cultivars. Baghdad Palm & Date Res. Cent. Bul. 1976;3/ 1976.
39. Dhar AC, Patel KR, Shah CK. Role of ascorbic acid in auxin induced cell elongation--a cytochemical study. Histochemistry, 1980;69(1):101-9. DOI: 10.1007/BF00508371.
40. Chaurasiya J, Verma RB, Ahmad M, Adarsh, Anupam & Kumar, R. & Pratap, T. Influence of plant growth regulators on growth, sex expression, yield and quality of muskmelon (*Cucumis melo* L.). Eco. Env. And Cons. 2016;22:S39-S43.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/91448