



ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(4): 2341-2344
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www.thepharmajournal.com

Received: 27-02-2023

Accepted: 30-03-2023

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Effect of plant growth regulators on growth, yield and quality of sponge gourd (*Luffa cylindrica* L.)

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Abstract

An experiment was conducted during *Zaid* season 2021 at Horticulture Research Farm, Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (Uttar Pradesh). To find out the effect of plant growth regulator on growth, yield and quality of sponge gourd (*Luffa cylindrica* L.). The experiment have different concentrations of GA₃ applied as foliar spray of ppm at true 2 leaf and 4 leaf stage, There are 9 treatments laid out in Randomized Block Design (RBD) in three replications. The results showed that the treatment with T₅ GA₃ (50 ppm) 4 leaf stage, was found to be the best out of 8 treatments in terms of vine length and results maximum at 20,40,60 and at harvest, days to first appearance of female flowers. Yield parameters like days to first harvest (64.21), fruit weight (165.73 g), fruit length (28.56 cm), maximum no. of fruits/plant (12.66), (TSS 4.75⁰ Brix), yield tonne per hectare (16.78).

Keywords: Growth, yield, quality, growth regulators

Introduction

Sponge gourd [*Luffa cylindrica* L.] is an important vegetable crop having chromosomes (2n=26). It is an annual climbing plant and cross pollinated in nature. It is difficult to assign with accuracy the indigenous area of *Luffa* species. They have a long history of cultivation in tropical countries of Asia and Africa. Indo-Burma is reported to be the centre of diversity for sponge gourd and is originated in subtropical Asian region particularly India. Sponge gourds are cultivated both on a commercial scale and in kitchen gardens throughout India. *Luffa* requires a long warm season for best production. It also grows best during the rainy season. Due to its hard seed coat, there is a problem with seed germination when the temperature is low. Application of plant growth regulator (GA₃) significantly increased the biochemical and physiological characters in Sponge Gourd (sugar content reducing, non-reducing and total sugars), and total phenol content and yield parameters. Thus, the aim of this investigation is to evaluate the yield parameters and quality parameters of Sponge gourd. Keeping the above point the present investigation related Effect of Plant Growth Regulator (GA₃) on Growth, Yield and Quality of Sponge gourd (*Luffa cylindrica* L.) in mind, following are the objectives will be undertaken for research study.

Objectives

1. To find out the best concentration of (GA₃) at 2 and 4 leaf stage on growth, yield, quality on sponge gourd,
2. To find the economics of the production

Materials and Methods

The present investigation was carried out to study the Effect of plant growth regulators on growth, yield and quality of sponge gourd (*Luffa cylindrica* L.). The experiment was carried out during *Zaid* season 2021 at Research farm in Department of Horticulture, Naini Agriculture Institute, Sam Higginbottom University of Agriculture, Technology and sciences, Prayagraj (U.P). Allahabad is situated at an elevation of 78 meters above sea level at 25.87⁰North latitude and 81.15⁰E longitude. This region has a sub-tropical climate prevailing in the South-East part of U.P. with both the extremes in temperature, i.e., the winter and the summer. In cold winters, the temperature sometimes is as low as 32°F in December – January and very hot summer with temperature reaching up to 115°F in the months of May and June. During winter, frosts and during summer, hot scorching winds are also not uncommon. The experiment materials consist of TMSG-1609 from Trimurthi Plant Sciences Pvt. Ltd.

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Hyderabad. A total of nine treatments were tried including control in RBD an replicated thrice. The treatments consisted of different levels of GA₃ at different leaf stages i.e., 2 and 4, along with control. The ppm solutions were prepared from respective solutions and ingredients. Three plants were randomly selected for recording observations on growth, yield and quality attributing parameters. The data collected during course of investigation were subjected to statistical analysis by adopting appropriate method of analysis of variance as described by Fisher (1950).

Results and Discussion

Growth Attributes

Vine length

GA₃ had a significant effect on vine length of 396.86 cm was recorded in T₅ (GA₃ 50 ppm) followed by 376.47cm in T₆ (GA₃ 100 ppm 4 Leaf), whereas shortest vine length 289.70 cm was recorded in T₀ control.

Days to appearance of female flowers in 50% plants

Analysis of days to first appearance of female flower data shows the significant result. The minimum days to appearance

of first male flowering recorded in T₅ GA₃ 50 ppm 4 Leaf (48.8) followed by T₀ control (50.61), whereas maximum days to appearance of female flowers in 50% flowers T₈ GA₃ 200 ppm 4 Leaf (50.72).

Days to appearance of male flowers in 50% plants

Analysis of days to first appearance of male flower data shows the significant result. The minimum days to appearance of first male flowering recorded in T₇ GA₃ 150 ppm 4 Leaf (33.49) followed by T₄ GA₃ 100 ppm 2 Leaf (35.91) whereas maximum days to appearance of male flowers in 50% flowers T₅ GA₃ 50 ppm 4 Leaf (36.00).

Days to first harvest

Analysis of days to first harvest data shows the significant result. The minimum days to appearance of first harvest recorded in T₀ Control (67.92) followed by T₄ GA₃ 100 ppm 2 Leaf (67.20) whereas maximum days to first harvest in T₅ GA₃ 50 ppm 4 Leaf (64.21)

Effect of gibberellic acid on vine length of Sponge gourd

Table 1: Effect of plant growth regulator on growth parameters of Bitter gourd (*Luffa cylindrica* L.)

Treatments	Vine length (cm)	Days to first appearance of female flowers	Days to first appearance of male flowers	Days to first harvest
T ₀ Control (water spray)	289.70	50.61	33.77	67.92
T ₁ GA ₃ (25 PPM) 2-leaf stage	320.26	49.57	35.01	66.27
T ₂ GA ₃ (50 PPM) 2-leaf stage	326.52	50.27	34.85	67.06
T ₃ GA ₃ (75 PPM) 2-leaf stage	360.29	49.27	34.97	66.09
T ₄ GA ₃ (100 PPM) 2-leaf stage	333.29	50.37	35.91	67.20
T ₅ GA ₃ (50 PPM) 4-leaf stage	396.86	48.89	36.00	64.21
T ₆ GA ₃ (100 PPM) 4-leaf stage	376.47	50.07	34.74	66.94
T ₇ GA ₃ (150 PPM) 4-leaf stage	341.25	50.25	33.49	67.11
T ₈ GA ₃ (200 PPM) 4-leaf stage	330.19	50.72	33.91	67.38
F-test	S	S	S	S
SE(d)	0.128	0.497	0.688	0.311
C.D at 5%	0.274	1.062	1.470	0.664

Quality Attributes

Fruit weight

Analysis of Fruit weight data shows the significant result. The maximum fruit weight recorded in T₅ GA₃ 50 ppm 4 Leaf (165.73) followed by T₄ GA₃ 100 ppm 2 Leaf (156.23) whereas minimum fruit weight in T₁ control (136.73). During early stages of fruit development GA₃ directly or indirectly influences the cell number, size and density.

Length of the fruit

Analysis of Length of fruit data shows the significant result. The maximum length of the fruit recorded in T₅ GA₃ 50 ppm 4 Leaf (28.56) followed by T₈ GA₃ 200 ppm 4 Leaf (25.20) whereas minimum fruit length in T₀ control (17.20). This may be due to higher photosynthesis and respiration occurs in treated plants compared to Control (water spray) there by increasing accumulation of carbohydrates resulted in increasing weight and length of the fruit.

Fruit diameter

Analysis of Fruit diameter data shows the significant result. The maximum fruit diameter recorded in T₈ GA₃ 200 ppm 4 Leaf (8.39) followed by T₇ GA₃ 150 ppm 4 Leaf (8.23) whereas minimum fruit diameter in T₀ control (6.41). The function of fertilized ovule or the seed in relation to growth of

the fruits is to synthesize hormones which initiate to maintain a metabolic gradient along with the translocation of food towards fruits.

Number of fruits

Analysis of Number of fruits data shows the significant result. The maximum number of fruits per plant recorded in T₅ GA₃ 50 ppm 4 Leaf (12.66) followed by whereas T₃ GA₃ 75 ppm 2 Leaf (11.07) minimum number of fruits in T₀ control (8.16). NAA and GA₃ suppresses the male flowers and promote the female flowers which results in a greater number of fruit set there by increasing the number of fruits.

Average yield per plant

Analysis of Average yield per plot shows the significant result. The maximum Average yield per plot recorded in T₅ GA₃ 50 ppm 4 Leaf (2098.07) followed by T₃ GA₃ 75 ppm 2 Leaf (1678.189) whereas minimum average yield per plant in T₀ control (1115.75). Increase in fruit yield per plant in treated plants may be due to the plants remains physiologically active to build sufficient food to develop fruits which results in maximum average yield.

Yield tonne per hectare

Analysis of Yield tonnes per hectare shows the significant

result. The Yield tonnes per hectare recorded maximum in T₅ GA₃ 50 ppm 4 Leaf (16.78) followed by T₃ GA₃ 75 ppm 2 Leaf (13.42) whereas minimum yield tonnes per hectare in T₁ control (8.92). Increasing the yield in treated plants may be

attributed to the reason that plants remain physiologically active to build sufficient food for the developing flowers and fruits which leads to higher yield.

Effect of GA₃ on yield parameters of Sponge gourd

Treatments	Fruit weight (g)	Fruit length (cm)	Fruit diameter (cm)	No. of fruits	Average yield per plant (g)	Average tonne per hectare (t)
T ₀ Control (water spray)	136.73	17.20	6.41	8.160	1,115.75	8.926
T ₁ GA ₃ (25 PPM) 2-leaf stage	138.96	18.73	6.61	8.957	1,244.68	9.957
T ₂ GA ₃ (50 PPM) 2-leaf stage	147.50	20.90	6.84	9.110	1,343.71	10.750
T ₃ GA ₃ (75 PPM) 2-leaf stage	151.50	22.26	7.32	11.07	1,678.18	13.426
T ₄ GA ₃ (100 PPM) 2-leaf stage	156.23	20.63	7.38	10.15	1,585.77	12.686
T ₅ GA ₃ (50 PPM) 4-leaf stage	165.73	28.56	7.43	12.66	2,098.07	16.785
T ₆ GA ₃ (100 PPM) 4-leaf stage	144.93	22.40	7.30	10.39	1,506.43	12.051
T ₇ GA ₃ (150 PPM) 4-leaf stage	145.86	23.36	8.23	9.13	1,332.25	10.658
T ₈ GA ₃ (200 PPM) 4-leaf stage	137.96	25.20	8.39	9.24	1,275.74	10.206
	S	S	S	S	S	S
SE(d)	0.491	0.311	0.115	0.156	24.953	0.216
C.D at 5%	1.050	0.664	0.245	0.333	53.354	0.463

Conclusion

From the present investigation, it is concluded that the plant growth regulators treatments rendered their significant effect on the better germination, growth, yield and quality of the sponge gourd crop. The treatment T₅ of GA₃ (50 ppm) 4 leaf stage recorded best in vine length at harvest, days to first appearance of female flowers in 50% plants, days to first harvest, fruit weight in grams (g), length of the fruit (cm), number of fruits per plant, average yield per plant (g), yield (t/ha), TSS (°Brix), with the highest Benefit Cost ratio was recorded (2.06). The treatment, T₈ of GA₃ (200 ppm) 4 leaf stage recorded best performance with respect to parameters like fruit colour (RHS), fruit diameter (cm) and with the highest Cost of cultivation. days to first appearance of male flowers in 50% plants was recorded in treatment T₇ of GA₃ (150 ppm) 4 leaf stage.

Acknowledgements

It is a genuine pleasure to express my deep sense of thanks to my Guide, my inspiration Mr. Deepanshu, Assistant Professor, Department of Horticulture, Naini Agricultural Institute, SHUATS, Prayagraj, To the chairperson Prof. (Dr). Alok Milton Lal, Professor, Head, Department of Biochemistry and Bio Engineering, SHUATS, Co-advisor, Dr. Devi Singh, Associate Professor, Department of Horticulture, SHUATS, members Dr. Vijay Bahadur, Associate Professor, Head, Department of Horticulture, SHUATS and Dr. Vishal Vincent Henry, Assistant Professor, Department of Mathematics and Statistics, SHUATS for providing help in various ways and offering valuable suggestions during the course of the research work.

Competing Interests

Authors have declared that no competing interests exist.

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