Int.J.Curr.Microbiol.App.Sci (2018) Special Issue-7: 816-821

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Special Issue-7 pp. 816-821**
Journal homepage: http://www.ijcmas.com

Original Research Article

Effect of Bio Regulators on Growth Parameters of Sweet Potato (*Ipomoea batatas* L.)

Ravikant Rajak[1*], S. Sengupta[1], Sudha Verma[1], Apurva Minz[1] and Varsha Rani[2]

[1]Department of Horticulture, Birsa Agricultural University, Kanke, Ranchi, Jharkhand-834006, India
[2]Department of Crop Physiology, Birsa Agricultural University, Kanke, Ranchi, Jharkhand-834006, India
**Corresponding author*

A B S T R A C T

Sweet potato (*Ipomoea batatas* L.*)* locally known as "shakarkand" is an important member of the family *Convolvulaceae*. It is commonly planted in flat to slightly rolling open areas. The crop is known to be a cheap but excellent source of carbohydrates, vitamin A, calcium, and phosphorus. Jharkhand is the 7th largest producer of sweet potato only after Orissa, Uttar Pradesh, Madhya Pradesh, Assam, West Bengal and Bihar. Plant growth regulators are the chemical compounds which have shown favourable impact on growth, yield and quality of sweet potato. Though, agronomical practices for sweet potato have been standardized, but there is always demand for enhancing its growth from the growers. Hence, the present investigation has been carried out in the experimental site of AICRP on tuber crops, Department of Horticulture, Faculty of Agriculture, Birsa Agricultural University, Kanke, Ranchi during the Kharif season of 2016, where fifteen treatments were used namely T1-Triacontanol (250 ppm), T2-Triacontanol (500 ppm), T3- Gibberellic Acid (50 ppm), T4 - Gibberellic Acid (100 ppm), T5 - Naphthalene Acetic Acid (25 ppm), T6 - Naphthalene Acetic Acid (25 ppm), T7 – Indole Acetic Acid (25 ppm), T8 - Indole Acetic Acid (50 ppm), T9 - Ethrel (150 ppm), T10 - Ethrel (300 ppm), T11- Maleic hydrazide (50 ppm), T12 - Maleic hydrazide (100 ppm), T13- Salicylic Acid (100 ppm), T14 - Salicylic Acid (200 ppm), T15 - Control (Only water spray), to find out increment in growth of sweet potato by means of application of growth regulators at the time of planting (vine cutting dipping), 45 days after transplanting and 75 days after transplanting on the most accepted variety of sweet potato, Sree Bhadra, in the state of Jharkhand. Among the fifteen treatments used GA_3 at the concentration of 100 ppm was found to record maximum growth parameters in cultivation of sweet potato.

Keywords

Sweet potato (*Ipomoea batatas* L.), PGR, Growth parameters

Introduction

Sweet potato (*Ipomoea batatas* L.*) an* important member of the family *Convolvulaceae* has originated in America (Mexico, Central America) and the North Western part of South America. It has global importance after wheat, rice, maize, Irish potato and barley. In root and tuber crop production, it ranks second following Irish potato in the world. The crop is well recognized as an excellent and cheap source of carbohydrates, vitamin A, calcium, and phosphorus. It renders nutritional security to poor farmer families and good remuneration to its growers. It is a *dicotyledonous* plant

that belongs to the morning glory family *Convolvulaceae* having chromosome number 2n=6x =90.The plant is a herbaceous perennial vine, bearing alternate heart-shaped or palmately lobed leaves and medium-size sympetalous flowers. The edible tuberous root is long and tapered, with a smooth skin with colour range between yellow, orange, red and brown. Jharkhand is the 7th largest producer of sweet potato only after Orissa, Uttar Pradesh, Madhya Pradesh, Assam, West Bengal and Bihar. Moreover, it is adaptable to tropical and subtropical climates, tolerant to drought and grows under marginal condition of low soil fertility and pH. The climate of Jharkhand is favourable for the growth, development and expansion of this crop. Its choicest variety in Jharkhand, Sree Bhadra has performed well in eastern and southern part of the country including Jharkhand. This variety possesses red skin and is high yielding.

Due to fluctuations in its demand and supply in the market, there is a need to develop measures for its increased production and improved quality. Plant growth regulators are the chemical compounds which have given favourable impact on growth, yield and quality of sweet potato (Singh *et.al*., 1995).

Though, agronomical practices for sweet potato have been standardized, but there is always demand for enhancing its growth and yield. Hence, the present investigation has been formulated to find out feasibility of increment in growth parameters of sweet potato by means of application of growth regulators at three different stages in the most accepted variety of sweet potato, Sree Bhadra in the state of Jharkhand.

Hence, present study was undertaken with the objectives to evaluate growth of sweet potato with application of different bio regulators in the context of several growth parameters.

Materials and Methods

The present investigation "Effect of Bioregulators on growth of Sweet potato (*Ipomoea batatas* L.) was conducted in the experimental site of AICRP on tuber crops under the Department of Horticulture, Faculty of Agriculture, Birsa Agricultural University, Kanke, Ranchi during the *Kharif* season of 2016. There were fifteen treatments used namely T_1-Triacontanol (250 ppm), T_2-Triacontanol (500 ppm), T_3-Gibberellic Acid (50 ppm), T_4 - Gibberellic Acid (100 ppm), T_5 - Naphthalene Acetic Acid (25 ppm), T_6 - Naphthalene Acetic Acid (25 ppm), T_7 – Indole Acetic Acid (25 ppm),T_8 - Indole Acetic Acid (50 ppm), T_9 - Ethrel (150 ppm), T_{10} - Ethrel (300 ppm), T_{11}- Maleic hydrazide (50 ppm), T12 - Maleic hydrazide (100 ppm), T_{13}- Salicylic Acid (100 ppm), T14 - Salicylic Acid (200 ppm), T_{15} - Control (Only water spray) at the time of planting (vine cutting dipping), 45 days after transplanting and 75 days after transplanting which was carried out in randomised block design with three replications. The effect of several treatments on growth parameters was analysed.

Results and Discussion

The data presented in table 1 shows that vine length and internodal length of sweet potato which was 147.7 cm and 4.40 cm respectively was recorded maximum in treatment T_4 [GA_3 (100 ppm)] followed by treatment T_3 [GA_3 (50 ppm)] in which vine length and internodal length was observed to be 143.6 cm and 4.23 cm respectively as compared to other treatments including control (only water spray). This may be due to the fact that GA_3 application to tubers,

promoted the activity of amylase enzyme which caused hydrolysis of starch. The starch would then be converted into sugars. As the sugars accumulated in the cell, it increased the osmotic potential of the cell which allowed the entry of water into the cell resulting in an increase in turgor pressure, causing sprouting of tubers leading to the early emergence. The results of vine length are similar to that of Alexopoulos *et al.,* (2006), Nedunchezhiyan *et al.,* (2011) and Barani *et al.,* (2013).

The data presented in table 2 shows that maximum girth of stem, length & breadth of leaves was observed in T_4 [GA_3 (100 ppm)] (2.36 cm, 9.65 cm & 9.13 cm respectively) followed by treatment T_3 [GA_3 (50 ppm)] (2.22 cm, 9.33 cm & 8.85 cm)in comparison to other treatments including control (only water spray).The possible reason for increased girth of stem is that when GA_3 at 100 ppm was applied to the plant through foliar application, it increased the meristematic activity of lateral meristem resulting in the rapid cell division and cell elongation led to the increase in the girth of stem. These results are in line to the findings of Sarada *et al.,* (2008), Sud (2008) and Thapa *et al.,* (2014). The increase in length & breadth of leaves might be due to increase in meristematic activity of the apical tissue on GA_3 application. Also GA_3 is involved in increasing photosynthetic activity, efficient translocation and utilization of photosynthates causing rapid cell division, cell elongation and cell differentiation at growing region of the plant leaves leading to stimulation of growth. Similar findings were observed by Thapa *et al.,* (2014), Chaurasiya *et al.,* (2014), and Kumar *et al.,* (2014).

Table.1 Effect of Bio regulators on vine length & intermodal length (cm) of sweet potato (*Ipomoea batatas* L.)

Treatments	Vine length (cm)	Internodal length (cm)
T_1-Triacontanol (250 ppm)	119.2	3.90
T_2-Triacontanol (500 ppm)	140.5	4.13
T_3- Gibberellic Acid (50 ppm)	143.6	4.23
T_4-Gibberellic Acid (100 ppm)	147.7	4.40
T_5 -Naphthalene Acetic Acid (25 ppm)	117.1	3.80
T_6 - Naphthalene Acetic Acid (25 ppm)	120.7	4.00
T_7 – Indole Acetic Acid (25 ppm)	112.0	3.63
T_8 - Indole Acetic Acid (50 ppm)	109.9	3.48
T_9 - Ethrel (150 ppm)	109.6	3.41
T_{10} - Ethrel (300 ppm)	101.1	3.17
T_{11}- Maleic hydrazide (50 ppm)	109.2	3.20
T_{12} - Maleic hydrazide (100 ppm)	108.5	3.31
T_{13}- Salicylic Acid (100 ppm)	115.1	3.60
T_{14} - Salicylic Acid (200 ppm)	116.7	3.70
T_{15} - Control (Only water spray)	98.2	2.93
SEm ±	8.94	0.22
CD (5%)	25.89	0.63
CV (5%)	13.13	10.29

Table.2 Effect of Bioregulators on Girth of stem, Length of leaves and Breadth of leaves (cm) of sweet potato (*Ipomoea batatas* L.)

Treatments	Girth of stem (cm)	Length of leaves (cm)	Breadth of leaves (cm)
T_1-Triacontanol (250 ppm)	1.95	8.93	8.49
T_2-Triacontanol (500 ppm)	2.14	9.19	8.70
T_3- Gibberellic Acid (50 ppm)	2.22	9.33	8.85
T_4 - Gibberellic Acid (100 ppm)	2.36	9.65	9.13
T_5 - Naphthalene Acetic Acid (25 ppm)	1.87	8.79	8.27
T_6 - Naphthalene Acetic Acid (50 ppm)	1.97	9.07	8.58
T_7 - Indole Acetic Acid (25 ppm)	1.79	8.56	8.05
T_8 - Indole Acetic Acid (50 ppm)	1.78	8.50	8.00
T_9 - Ethrel (150 ppm)	1.75	8.45	7.93
T_{10} - Ethrel (300 ppm)	1.63	8.13	7.61
T_{11}- Maleic hydrazide (50 ppm)	1.71	8.25	7.79
T_{12} - Maleic hydrazide (100 ppm)	1.73	8.41	7.87
T_{13}- Salicylic Acid (100 ppm)	1.82	8.63	8.14
T_{14} - Salicylic Acid (300 ppm)	1.85	8.69	8.19
T_{15} -Control (Only water spray)	1.49	7.84	7.28
SEm ±	0.09	0.30	0.31
CD (5%)	0.26	0.88	0.89
CV (5%)	8.23	6.18	6.47

Table.3 Effect of Bioregulators on Number of leaves per plant & Leaf area Index (LAI) of sweet potato (*Ipomoea batatas* L.)

Treatments	Number of leaves/plant	LAI
T_1-Triacontanol (250 ppm)	101.6	4.59
T_2-Triacontanol (500 ppm)	110.4	5.25
T_3- Gibberellic Acid (50 ppm)	113.28	5.55
T_4 - Gibberellic Acid (100 ppm)	121.12	6.55
T_5 - Naphthalene Acetic Acid (25 ppm)	99.52	4.17
T_6 - Naphthalene Acetic Acid (50 ppm)	107.04	4.82
T_7 - Indole Acetic Acid (25 ppm)	95.04	3.72
T_8 - Indole Acetic Acid (50 ppm)	93.92	3.54
T_9 - Ethrel (150 ppm)	89.92	3.38
T_{10} - Ethrel (300 ppm)	87.36	3.01
T_{11}- Maleic hydrazide (50 ppm)	88.32	3.15
T_{12}-Maleic hydrazide (100 ppm)	89.44	3.28
T_{13}- Salicylic Acid (100 ppm)	96.16	3.80
T_{14} - Salicylic Acid (200 ppm)	97.12	3.91
T_{15}-Control (Only water spray)	80.96	2.55
SEm ±	8.06	0.43
CD (5%)	23.35	1.25
CV (5%)	14.25	18.27

The data is presented in table 3 shows the maximum number of leaves per plant (121.12) was observed in treatment T_4 [GA_3 (100 ppm)] as compared to other treatments followed by T_3 [GA_3 (50 ppm)] (113.28). The increase in number of leaves might be due to enhanced photosynthetic activities & efficiency. Also rapid metabolic processes thereby increase the photosynthates pool which along with increased cell division and elongation processes resulted to force the plant to produce more number of branches and leaves. Similar findings with respect to number of leaves were also reported by Khan *et al.*, (2007), Sarada *et al.*, (2008) and Singh (2010).

The highest LAI (6.55) found in T_4 [GA_3 (100 ppm)] followed by T_3 [GA_3 (50 ppm)] [5.54] as compared to other treatments including control is shown in table 3. LAI increased due to increase in number of leaflets and concomitant increase in total leaf area. Similar findings regarding leaf area index were reported by Mallick *et al.*, (2009), Poudel (2006) and Kumar *et al.*, (2011).

Thus, on the basis of results obtained in one year investigation (2016-17), it can be concluded that foliar spray of bio-regulators increase the vegetative growth. The present investigation revealed that the effective concentration of undertaken bio-regulators can be used to improve the growth of sweet potato especially treatment with GA_3 @ 100 ppm & GA_3 @ 50 ppm. Considering these parameters, it is inferred that GA_3 at 100 ppm can be administered with a view for getting maximum net returns in cultivation of sweet potato.

References

Alexopoulos, A. A., Akoumianakis, K. A. and Passam, H. C. 2006. Effect of plant growth regulators on the tuberization and physiological age of potato (*Solanum tuberosum* L.) tubers grown from true potato seed. *Can. J. Plant Sci.* 86: 1217–1225.

Barani, M., Akbari, N. and Ahmadi, H. 2013. The effect of gibberellic acid (GA3) on seed size and sprouting of potato tubers (*Solanum tuberosum* L.). *Afr. J. Agric. Res.,* 8 (29): 3898-3903

Chaurasiya, J., Meena, M.L., Singh, H.D., Adarsh, A. and Mishra, P.K. 2014. Effect of GA_3 and NAA on growth and yield of cabbage (*Brassica oleracea* var. *capitata* L.) cv. Pride of india, *The Bioscan*, 9 (3): 1139-1141.

Kumar, A., Biswas, Tarun K., Singh, N. and Lal, E.P. 2014. Effect of Gibberellic Acid on Growth, Quality and Yield of Tomato (*Lycopersicon esculentum* Mill.) *IOSR J. of Agric. and Veterinary Sci.*7 (7):28-30.

Kumar, D., Singh, B.P., Rawal, S., Minhas, J.S. and Pandey, S.K. 2011. Rehabilitation of frosted potato crop through plant growth regulators *Potato J.* 38 (1): 18-25.

Mallick, S., Ghosh, R. K. and Pal, D. 2009. Effect of triacontanol on the growth and yield of potato. *J. of Crop and Weed*, 5 (2): 154-156.

Nedunchezhiyan, M., Jata, S. K., Mukherjee, A. and Misra, R. S. 2011. Impact of Growth Regulators on Cormel Production and Dormancy Breaking in Elephant Foot Yam (*Amorphophallus paeoniifolius* (Dennst.) Nicolson). *Journal of Root Crops*.37 (1): 24-28.

Poudel, P. 2006. Effect of plant growth regulators on yield and yield component of sweet pepper during spring – summer at Kalyanpur, Chitwan, *Institute of Agriculture and Animal Science.* 1 (29): 57.

Sarada, C., Giridhar K and Reddy, T.

Yellamanda 2008. Effect of bio regulators and their time of application on growth and yield of coriander (*Coriandrum sativum*) *Journal of Spices and Aromatic Crops* 17 (2): 183-186.

Singh, S.P. 2010. Response of Plant Growth Regulator on Growth and Yield of Fenugreek (*Trigonella Foenum-Graecum* L.), *Asian J. of Hort*. 5 (1): 234.

Sud, G.S. 2008. Effect of triacontanol on the growth and success of litchi nursery plants, *Himachal Journal of Agricultural Research,* 34 (1):53-55

Thapa U., De, N., Prasad P.H., and Rai, A.K. 2014. Study the Efficacy of Brassinolide and Triacontanol on Green and Seed Yield of Spinach – Beet (*Beta vulgaris* Var. *bengalensis*), *Trends in Biosciences,* 7 (10): 870-875.