Int.J.Curr.Microbiol.App.Sci (2019) *8*(9): 1634-1643

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 8 Number 09 (2019)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2019.809.186

Effect of Plant Growth Regulators on Growth Parameter s of Taro [*Colocasia esculenta var. antiquorum (L.) Schott.*]

Navin Kumar Ranjan[1*], S. Sengupta[1], H. C. Lal[2] and M. Chakraborty[3]

[1]*Department of Horticulture, Birsa Agricultural University, Kanke, Ranchi, Jharkhand- 834006, India*
[2]*Department of Plant Pathology, Birsa Agricultural University, Kanke, Ranchi, Jharkhand- 834006, India*
[3]*Department of Genetics and Plant Breeding, Birsa Agricultural University, Kanke, Ranchi, Jharkhand- 834006, India*
**Corresponding author*

Keywords

Plant Growth Regulators, Growth parameters, Colocasia

Article Info

Accepted:
18 August 2019
Available Online:
10 September 2019

A B S T R A C T

Colocasia [*Colocasia esculenta* var. *antiquorum* (L.) schott.], which is also known as Taro, Arvi, Katchu and eddode belongs to the family Aracea is an important edible aroid. Africa ranks first in area and production of colocasia and in India colocasia is favourite among Gujarat, Konkan region of Maharashtra and several other parts of south India. The corm and cormels are the major economic parts of *Arvi.* Corms of colocasia are rich in carbohydrate and protein and nearly one and half time more nutritious than potato. Plant growth regulators are the chemical compounds which have given favourable impact on growth, yield and quality of crops. Though, agronomical practices for taro has been standardized and there is always demand for enhancing its growth from the growers. Hence, the present investigation has been carried out in the the Horticulture Research unit, Department of Horticulture, Faculty of Agriculture, Birsa Agricultural University, Kanke, Ranchi during Kharif season of 2017, where eleven treatments were used namely T_1- Naphthalene acetic acid (25 ppm), T_2- Naphthalene acetic acid (50 ppm), T_3- Indole Acetic Acid (25 ppm), T_4- Indole Acetic Acid (50 ppm), T_5- Maleic hydrazide (50 ppm), T_6- Maleic hydrazide (100 ppm), T_7- Gibberellic acid (100 ppm), T_8- Gibberellic acid (200 ppm), T_9- Ethrel (75 ppm), T_{10}- Ethrel (150 ppm) and T_{11}- Control (water spray only) to find out increment in growth of taro by means of application of growth regulators at the time of 45 days after planting and 105 days after planting on the most accepted variety of taro, Muktakeshi in the state of Jharkhand. Among the eleven treatments used GA_3 at the concentration of 200 ppm was found to record maximum growth parameters in cultivation of taro.

Introduction

Among the tuber crop produced, colocasia [*Colocasia esculenta* var. *antiquorum* (L.) schott.], a member of family Araceae which is native to south central Asia is one of the important tuber crop particularly grown in Africa and Asia and occupies a very selective and special position. Some species are widely cultivated and naturalized in other tropical and subtropical regions. It is grown throughout the humid tropics and in the warmer regions of the temperate zones. *Colocasia* is the most important vegetable crop among the arum family due to its delicious taste, nutritive and medicinal value (Mishra and Roy Chowdhury, 1996). It is mainly cultivated for the edible cormels but the leaves and its young petioles are also cooked and used like spinach. The cormels, corms, leaves and petioles are used as a vegetable and considered as rich source of carbohydrates, proteins, minerals and vitamins. The corm is rich in starch and contains 17- 25% amylase. Planting of *Colocasia esculenta* is normally done during the rainy season but it can be done any time if irrigation facilities are available. The crop is harvested after 6 to 8 months of planting. It grows on all kinds of soil but thrives best in deep, well-drained, well manured, friable loam. Where rainfall is insufficient, the fields are frequently irrigated.

Moreover, the climate of Jharkhand is very favourable for the growth, development and expansion of this crop. Muktakeshi variety of taro has performed well in eastern and southern part of our country including Jharkhand. It is light brown skin coloured high yielding and itching free choicest variety of farmers of state of Jharkhand. Taro is an promising tuber crop for the state of Jharkhand. It can be found in most of the farmers field of Jharkhand on small holding for domestic consumption or as commercial crop.

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 crops. Though, agronomical practices for taro has 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 taro by means of applications of growth regulators at two different stages in the most accepted variety of taro, Muktakeshi in the state of Jharkhand.

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

Materials and Methods

The present investigation entitled "Effect of plant growth regulators on growth and yield of Colocasia [*Colocasia esculenta* var. *antiquorum* (L.) schott.]," was conducted in the experimental field of the Department of Horticulture, Faculty of Agriculture, Birsa Agricultural University, Kanke, Ranchi during the *Kharif* season of 2017. There were eleven treatments used namely T_1- Naphthalene acetic acid (25 ppm), T_2- Naphthalene acetic acid (50 ppm), T_3- Indole Acetic Acid (25 ppm), T_4- Indole Acetic Acid (50 ppm), T_5- Maleic hydrazide (50 ppm), T_6- Maleic hydrazide (100 ppm), T_7- Gibberellic acid (100 ppm), T_8- Gibberellic acid (200 ppm), T_9- Ethrel (75 ppm), T_{10}- Ethrel (150 ppm) and T_{11}- Control (water spray only) at the time of 45 days after planting and 105 days after planting 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 maximum plant height, girth of stem and number of leaves/plant was observed in T_8 [GA_3 (100 ppm)] (95.68 cm, 26.46 cm & 6.94 cm respectively) followed by treatment T_7 [GA_3 (200 ppm)] (92.53 cm, 23.85 cm & 6.52

cm) in comprasion to others treatments including control (only water spray). The reason for increased plant height that on GA_3 application to cormels, it probably promoted the activity of amylase enzyme which caused hydrolysis of starch. Then the starch would converted into sugars. As the sugar accumulated in the cell, it increased the osmotic potential of the cell which allowed the entry of water into the cell resulted an increase in turgor pressure, causing sprouting of cormels leading to the early emergence. The results of plant height are in consonance to that of Basiouny (1983), Alexopoulos *et al.,* (2006), Nedunchezhiyan *et al.,* (2011)) and Barani *et al.,* (2013).

The possible reason for increased girth of stem is that when GA_3 at 200 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 Poudel (2006), Sarada *et al.,* (2008) and Thapa *et al.,* (2013).

The increase in number of leaves might be due to enhanced photosynthetic activities & efficiency and rapid metabolic processes thereby increase in photosynthates pool and energy 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 Poudel (2006), Khan *et al.,* (2007), Sarada *et al.,* (2008) and Singh (2010).

The data presented in table 2 shows that maximum length and breadth of leaves was observed in T_8 [GA_3 (100 ppm)] (33.77 cm & 22.60 cm respectively) followed by treatment T_7 [GA_3 (200 ppm)] 33.23 cm & 22.27 cm) in comprasion to others treatments including control (only water spray). The increase in leangth & breadth of leaves might be due to increase in meristematic activity of the apical tissue on GA_3 application.

Also GA_3 was 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 Kadiri *et al.,* (1996), Iqbal *et al.,* (2001), Poudel (2006), Sharma (2006), Kumar *et al.,*(2008), Sengupta *et al.,*(2008), Sarada *et al.,*(2008), Helaly (2009), Ud-Deen (2009), Kumar *et al.,*(2011), Sitapara *et al.,*(2011), Rohamare *et al.,*(2013), Chaudhary *et al.,* (2013), Thapa *et al.,*(2013), Chaurasiya *et al.,*(2014), Netam and Sharma (2014) and Kumar *et al.,*(2014).

The data presented in table 3 shows that maximum leaf area and leaf area index was observed in T_8 [GA_3 (100 ppm)] (4219.47 cm^2 & 1.75 respectively) followed by treatment T_7 [GA_3 (200 ppm)] 4164.27 cm^2 & 1.73) in comprasion to others treatments including control (only water spray).

The increase in leaf area probably due to involvement of growth substance in enhancing the metabolic processes of plant growth, photosynthetic efficiency and carbohydrate metabolism.

They might also help in cell division and cell elongation so resulted in more expansion of leaf.Similar results were found by Kumar *et al.,* (2011) and Arvind kumar *et al.,* (2012)
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 Chaudhary *et al.,* (2006), Poudel (2006) and Kumar *et al.,* (2011).

Table.1 Effect of Plant growth regulators on plant height, Girth of stem and Number of leaves per plant of taro

Treatments	Plant height (cm)	Girth of stem (cm)	Number of leaves/plant
T_1- Naphthalene Acetic Acid (25 ppm)	87.87	20.37	5.93
T_2- Naphthalene Acetic Acid (50 ppm)	81.13	18.59	5.46
T_3- Indole Acetic Acid (25 ppm)	89.07	21.68	6.38
T_4 - Indole Acetic Acid (50 ppm)	83.93	19.39	5.66
T_5- Maleic hydrazide (50 ppm)	64.67	16.12	4.60
T_6- Maleic hydrazide (100 ppm)	61.82	15.84	4.26
T_7- Gibberellic Acid (100 ppm)	92.53	23.85	6.52
T_8 - Gibberellic Acid (200 ppm)	95.68	26.46	6.94
T_9 - Ethrel (75 ppm)	75.05	17.96	5.26
T_{10} - Ethrel (150 ppm)	71.60	16.94	4.86
T_{11}- Control (Only water spray)	69.93	15.62	4.12
SEm ±	6.07	1.45	0.46
CD (p=0.05)	17.90	4.28	1.36
CV (%)	13.24	13.00	14.59

Table.2 Effect of Plant growth regulators on length of leaves and Breadth of leaves of taro

Treatments	Length of leaves (cm)	Breadth of leaves (cm)
T_1- Naphthalene Acetic Acid (25 ppm)	29.17	21.38
T_2- Naphthalene Acetic Acid (50 ppm)	28.70	20.61
T_3- Indole Acetic Acid (25 ppm)	30.63	21.52
T_4 - Indole Acetic Acid (50 ppm)	27.80	20.64
T_5- Maleic hydrazide (50 ppm)	24.80	18.28
T_6- Maleic hydrazide (100 ppm)	24.28	17.92
T_7- Gibberellic Acid (100 ppm)	33.23	22.27
T_8 - Gibberellic Acid (200 ppm)	33.77	22.60
T_9 - Ethrel (75 ppm)	26.64	19.98
T_{10} - Ethrel (150 ppm)	25.82	19.44
T_{11}- Control (Only water spray)	25.36	18.33
SEm ±	2.12	1.53
CD (p=0.05)	6.26	4.51
CV (%)	13.02	13.07

Table.3 Effect of Plant growth regulators on Leaf area and leaf area Index (LAI) of taro

Treatments	Leaf Area (cm^2)	LAI
T_1- Naphthalene Acetic Acid (25 ppm)	2924.16	1.21
T_2- Naphthalene Acetic Acid (50 ppm)	2588.73	1.07
T_{3-} Indole Acetic Acid (25 ppm)	3349.14	1.39
T_{4-} Indole Acetic Acid (50 ppm)	2574.58	1.07
T_{5-} Maleic hydrazide (50 ppm)	1713.95	0.71
T_{6-} Maleic hydrazide (100 ppm)	1557.19	0.64
T_7- Gibberellic Acid (100 ppm)	4164.27	1.73
T_{8-} Gibberellic Acid (200 ppm)	4219.47	1.75
T_{9-} Ethrel (75 ppm)	2346.79	0.97
T_{10-} Ethrel (150 ppm)	1808.84	0.78
T_{11}- Control (Only water spray)	1580.77	0.65
SEm ±	207.14	0.10
CD (p=0.05)	610.97	0.30
CV (5%)	13.69	16.12

Fig.1 Effect of plant growth regulators on plant height of Colocasia (Taro)

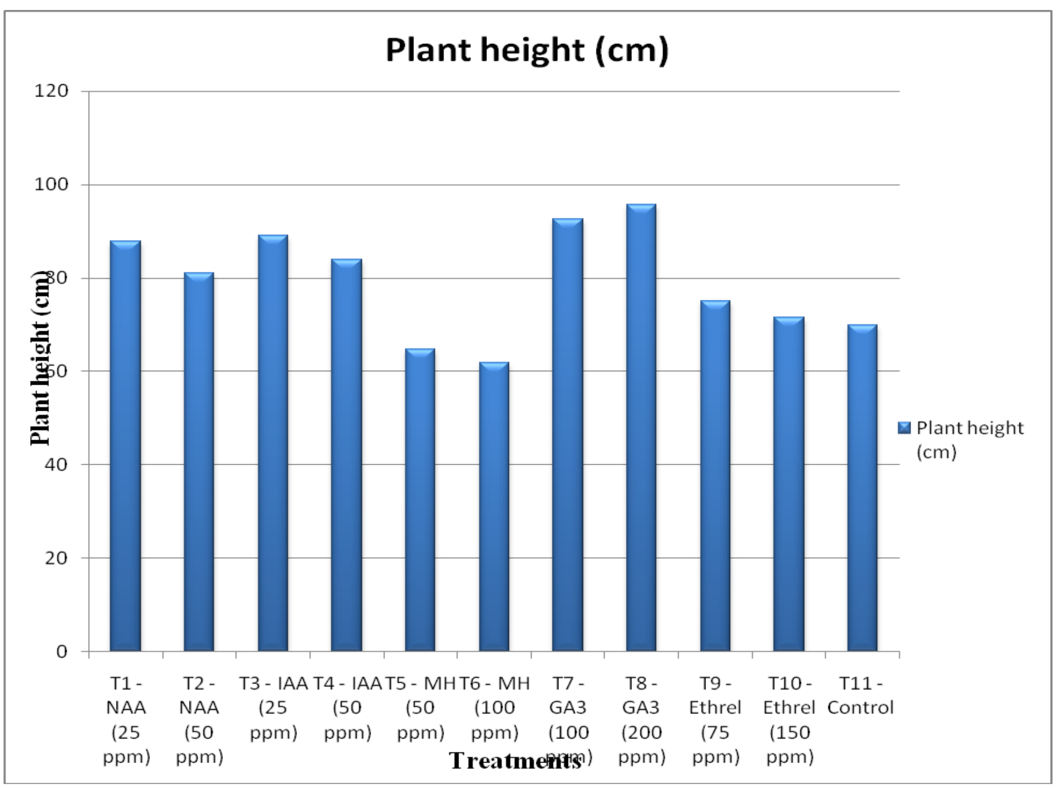


Fig.2 Effect of plant growth regulators on Girth of stem of Colocasia (Taro)

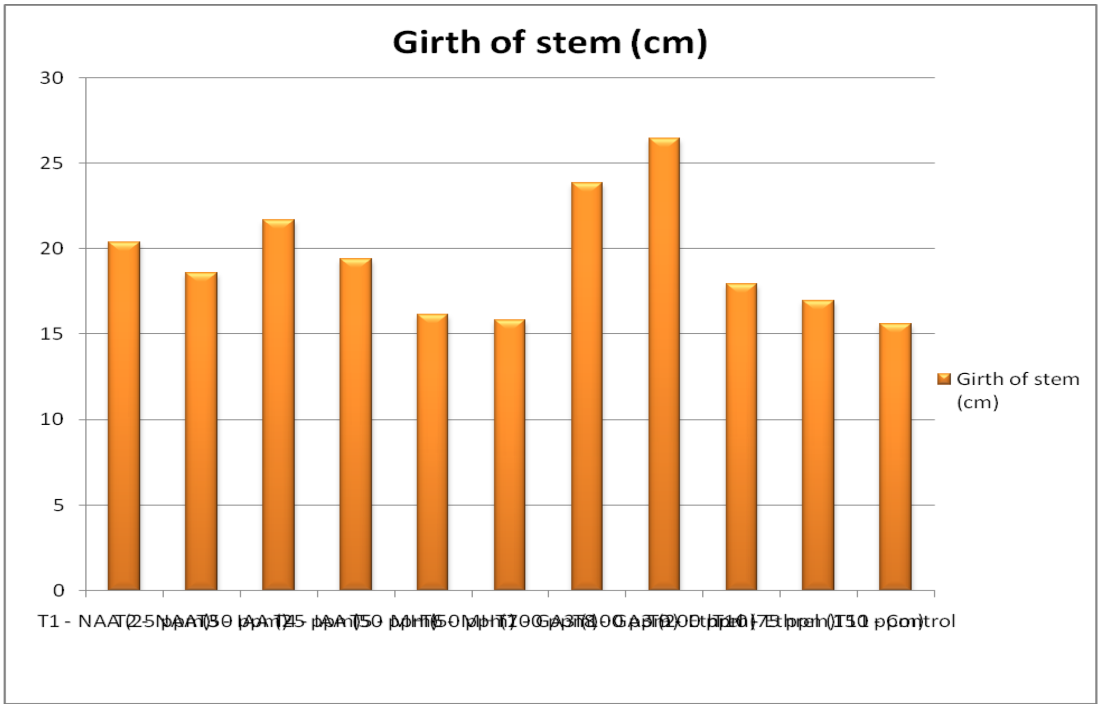


Fig.3 Effect of plant growth regulators on number of leaves/plant of Colocasia (Taro)

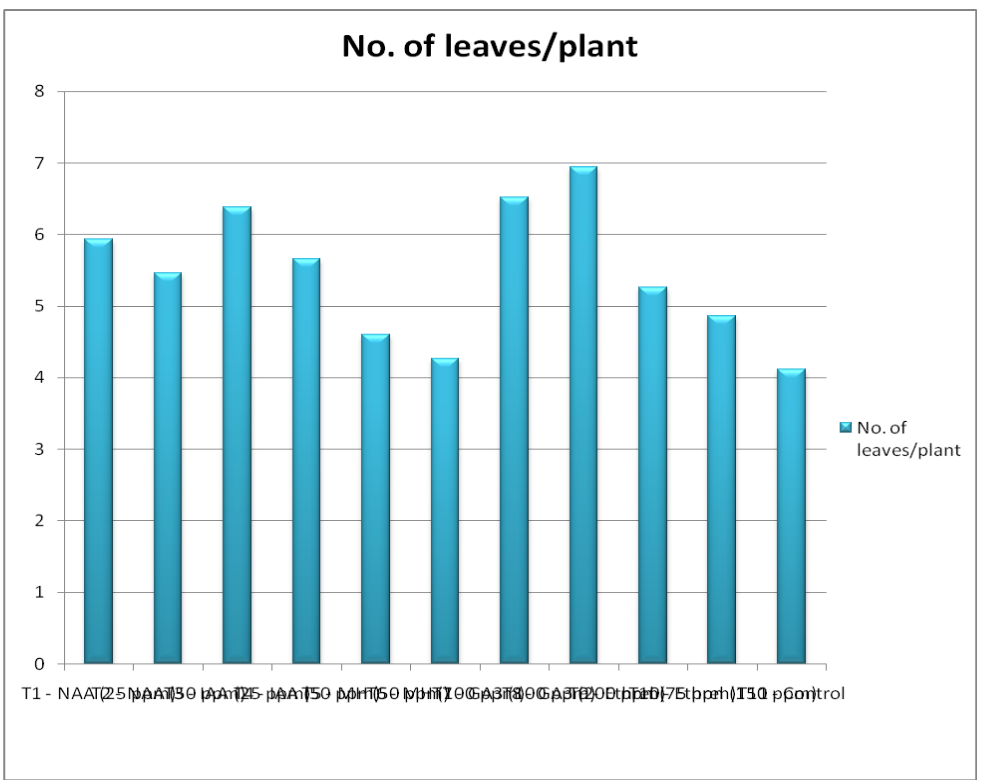


Fig.4 Effect of plant growth regulators on Leaf length of Colocasia (Taro)

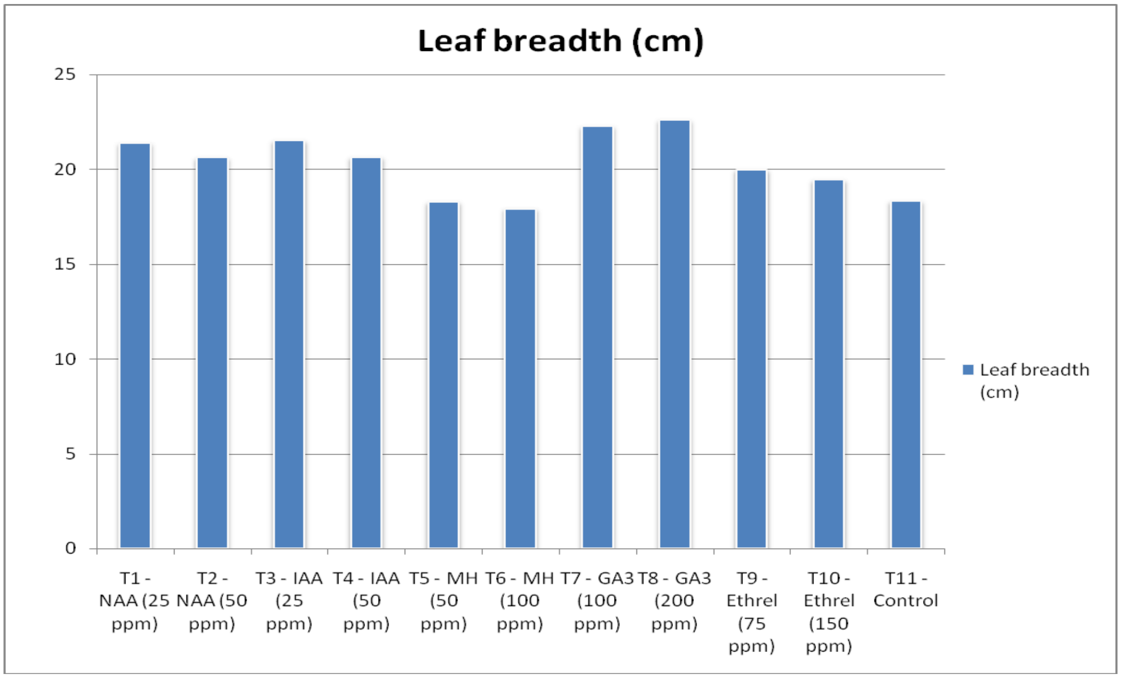


Fig.5 Effect of plant growth regulators on Leaf breadth of Colocasia (Taro)

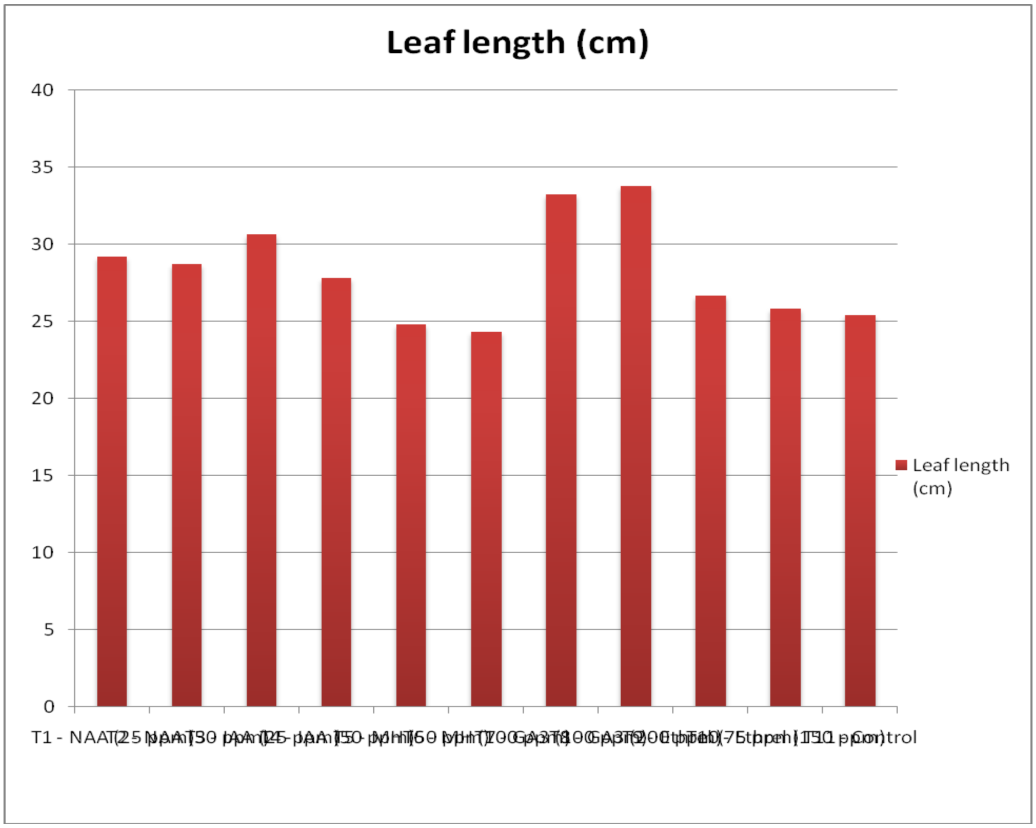


Fig.6 Effect of plant growth regulators on Leaf Area (cm^2) of Colocasia (Taro)

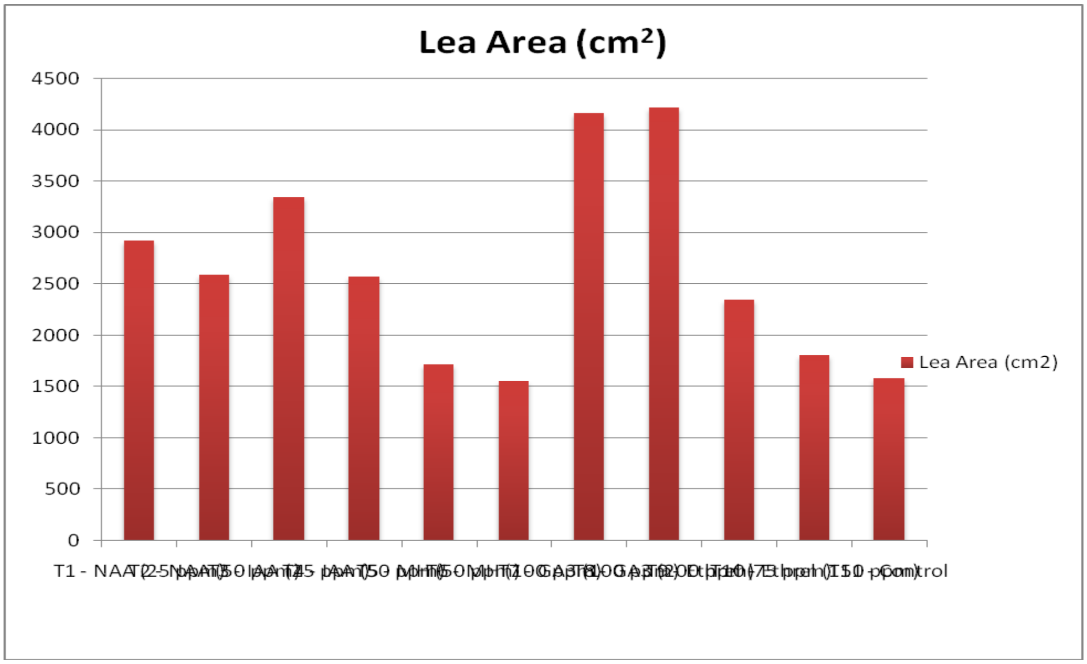
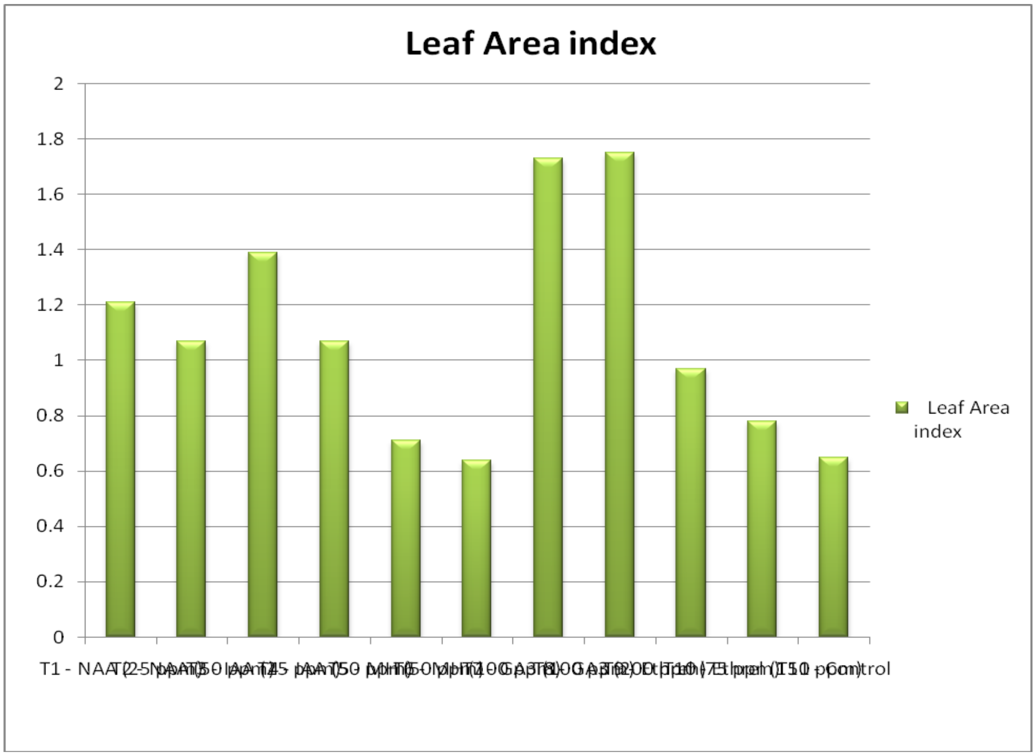


Fig.7 Effect of plant growth regulators on Leaf area index of Colocasia (Taro)



Thus, on the basis of results obtained in one year investigation (2017-18), it can be concluded that foliar spray of plant growth regulators increases the vegetative growth. The present investigation revealed that the effective concentration of undertaken plant growth regulators can be used to improve the growth of taro especially treatment with GA_3 @ 200 ppm & GA_3 @ 100 ppm. Considering these parameters, it is inferred that GA_3 at 200 ppm can be administered with a view for getting maximum net returns in cultivation of taro.

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.

Arvindkumar, P.R., Vasudevan, S.N., Patil, M.G. and Rajrajeshwari, C. (2012). Influence of NAA, triacontanol and boron spray on seed yield and quality of bitter gourd (*Momordica charantia*) cv. Pusa vishesh, *Asian J. Hort.*, 7 (1):36-39.

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.

Chaudhury, S., Islam, N., Sarkar, M.D. and Ali, M.A. (2013).Growth and yield of summer tomato as influenced by plant growth regulator. *Intl. J. Sustain. Agric.*,5 (1): 25-28.

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.

Iqbal, H.F., Tahir, A., Khalid, M.N., Ul-Haq, I. and Ahmad, A.N. (2001). Response of chickpea (*Cicer arietinum* L.) growth towards the foliar application of Gibberellic acid at different growth stages.

Kadiri, M., Mukhtar, F., and Agboola, D. A. (1996-1997). Responses of sorne Nigerian vegetables to plant growth regulator treatments.*Rev. Biol. Trop.* 45 (1): 23-28.

Kumar P. N., Reddy Y. N., Chandrashekar R. (2008). Effect of growth regulators on flowering and corm production in gladiolus. *Indian J. of Hort.*,65 (1): 73-78.

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, R., Saravanan, S., Bakshi, P.and Srivatava, J.N. (2011). Influence of plant growth regulators on growth, yield and quality of Strawberry (fragaria X Ananassa Duch) Cv. Sweet Charlie, *Progressive Hort.*, 43 (2).

Misra, RS.and Roy Chowdhury, S. 1996. Phytophthora leaf blight of taro: effect on dry matter production. Journal of Root Crops 22:54-57.

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). *J. of Root Crops*.37 (1): 24-28.

Netam, J. L. and Sharma, R. (2014).Efficacy of plant growth regulators on growth characters and yield attributes in brinjal (*Solanum melongena* L.) cv. Brinjal 3112. *IOSR J. of Agric. and Veterinary Sci*.7 (7): 27-30.

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

Rohamare, Y., Nikam, T. D. and Dhumal, K. N. (2013).Effect of foliar application of plant growth regulators on growth, yield and essential oil components of Ajwain (*Trachyspermum ammi* L.). *Intl. J. Seed Spices*. 3(2): 34-41.

Sarada, C., Giridhar K and Reddy, T. Yellamanda (2008).Effect of bioregulators and their time of application on growth and yield of coriander (*Coriandrum sativum*) *J. of Spices and Aromatic Crops*17 (2): 183-186.

Sengupta, D. K.,Maity, T. K. and Dasgupta, B.(2008). Effect of growth regulators on Growth and rhizome production of ginger (*Zingiber officinale* Rosc.) in the hilly region of Darjeeling district.*J. of Crop and Weed*, 4 (2): 10-13.

Sharma, M. D. (2006). Effect of plant growth regulators on growth and yield of brinjal at Khajura, Banke*J. Inst. Agric. Anim. Sci*. 27:153-156.

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.

Sitapara, H.H., Vihol N.J., Patel, M. J. and Patel J.S. (2011). Effect of growth regulators and micro nutrient on growth and yield of cauliflower cv. ‘Snowball-16’*The Asian J. of Hort*. 6 (2): 348-351.

Thapa, U., Das, R., Mandal, A. R. and Debanath, S. (2013). Influence of GA_3 and NAA on growth, yield and quality attributing characters of sprouting broccoli (*Brassica oleracea* L. var. *Italica* Plenk) *Crop Res.* 46(1, 2 & 3): 192-195.

Ud-Deen, Md. M. (2009).Effect of plant growth regulators on growth and yield of mukhi kachu.*Bangladesh J. Agril. Res*., 34 (2): 233-238.

How to cite this article:

Navin Kumar Ranjan, S. Sengupta, H. C. Lal and Chakraborty, M. 2019. Effect of Plant Growth Regulators on Growth Parameter s of Taro [*Colocasia esculenta var. antiquorum (L.) Schott*.]. *Int.J.Curr.Microbiol.App.Sci.* 8(09): 1634-1643.
doi: https://doi.org/10.20546/ijcmas.2019.809.186