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EFFECT OF GIBBERELLIC ACID (GA_3) ON FRUIT YIELD AND QUALITY OF CAPE GOOSEBERRY (*PHYSALIS PERUVIANA* L.)

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ABSTRACT
Cape gooseberry (*Physalis peruviana* L.) is an herbaceous or soft-woody, perennial plant and is grown for its edible fruits that have high nutritional value and potential health benefits. The ripe fruits are eaten fresh and also used for making a number of preserved products including sauces and jam. The aim of the present study was to determine the effect of GA_3 on yield and fruit quality of Cape gooseberry, when applied as foliar spray with different concentrations. The experiment comprised of five levels of GA_3 (50, 100, 150, 250 and 300 ppm) along with control and was conducted in Laboratory of the Department of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi (U.P.) during the year 2012-2013. The study showed that increasing the concentration of gibberellic acid it helped to increase the fruit size, fruit weight, total soluble solids and ascorbic acid level considerably upto 250 ppm. while, acidity of fruit decreased with the increase in concentration of gibberellic acid and was found to be minimum at application of 250 ppm gibberellic acid. It was also observed that the increase in concentration at 300 ppm had detrimental effect on fruit quality of Cape gooseberry. So, it can fairly be concluded that the foliar application of gibberellic acid at 250 ppm is quite effective to improve the physico-chemical properties of Cape gooseberry.

KEYWORD: Ascorbic acid, Cape gooseberry, GA_3, and Physico-chemical

INTRODUCTION

Cape gooseberry (*Physalis peruviana* L.) belonging to family Solanaceae, is grouped under minor underexploited fruit crops of the world. It is grown very well under temperate, tropical and sub-tropical climatic conditions. The ripe fruits are eaten fresh and also commonly used for making sauces and jam. The crop is available in lean period (March-April), when the fruit availability becomes scare in the market (Ali and Singh, 2016). Mature fruit is round and orange skinned with many edible seeds. Fruits are small 1-3.5cm diameter, yellow orange in colour and are covered by larger crescent papery epilyx (Chattopadhyay, 1996). It contains a cross section of bioflavonoid (Vitamin P), which help with anti- inflammation and act as natural blood thinners. On account of wide adaptability and high productivity, the crop possesses enormous potentiality of cultivation to meet the demand of fruits in the market and preservation industries. When application of gibberellins is done exogenously, it is effective in elongation of fruits like grape berries and accelerating the rats of elongation and cell division in the sub apical meristems region. The activity of apical meristem is quite independent of the presence and absence of gibberellins. Keeping this knowledge, the present investigation was carried out to study the efficiency of gibberellic acid (GA_3) on fruit quality of Cape gooseberry under subtropical eastern Uttar Pradesh conditions.

MATERIALS & METHODS

The experiment was conducted at Research Farm and all the physico-chemical analysis was done in the Laboratory of Department of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, during 2012-2013. The average precipitation of the area is 1100 mm, which is mostly received during rainy season. The average maximum and minimum temperatures of the planting time during September -October go to 32.35ºC and 25.75ºC, respectively. During the coldest months of Dec–Jan. the average maximum temperature goes to 19.44ºC with average minimum of 10.82ºC. Varanasi is situated at an altitude of 129.23 meters above mean sea level and lies between 25º 15´ north latitude and 60º 03´ east longitude. The soil of experimental field was sandy loam of average fertility with pH 7.12; Electrical conductivity is 0.45dSm^{-1}. Sand (50.96), silt (29.81) and clay (19.23) percent with the average available N, P and K in the top soil was 282.24, 20.16 and 168 Kg ha^{-1} soil, respectively. The seeds were sown in the bed at a depth of 1 cm in the rows in nursery. The seeds started to germinate within 20 days of sowing. Weeding and irrigation were done as and when required until the seedlings attain the height of 15 cm. The seedling were uprooted from nursery and transplanted in previously well prepared field at spacing of 90×60 cm in the evening of 24 September, 2012. After transplanting the seedlings were irrigated lightly. Gap filling was done at the places of dead seedling as and when

required. The crop was irrigated at an interval of 15 days from October to February and after 10 days from February onwards. The spray of fungicide (Carbendazime) along with monochrotophos in recommended concentration was done during the growth period of the crop.

Plants were sprayed twice with the following treatments before flowering at 15 days interval *i.e.* T_0- Control (sprayed with only water), T_1-(50ppm), T_2-(100ppm), T_3- (150ppm), T_4- (250ppm), T_5-(300ppm). Five plants in each plot were randomly selected and tagged properly to record data. Fruits were collected at harvest stage in a weekly basis and total number of fruits, fresh weight of fruits, fruit diameter, T.S.S., vitamin C and acidity were studied at ripe stage of fruits following standard method of AOAC (2000). Ten ripe fruits were taken from each plot and weighed with physical balance to the precision of milligrams. Then, weight of one fruit was measured. The size of five fruit which were drawn at random from each treatment was measured in millimeters with the help of a Digital Vernier Callipers. Fruits were randomly selected from each treatment and macerated in pestle and mortar for juice extraction. Total soluble solid, (TSS) of the juice was determined with the help of Erma hand refractrometer (0-32% range). The values were corrected at 20^0C and expressed in degree Brix. The titrable acidity and ascorbic acid contain were determined by AOAC (2000) methods.

Statistical Analysis

The experimental treatments were formulated under randomized block design with three replications. The data were recorded for selected parameters and analyzed statistically at 5% level of significance following statistical method suggested by Panse and Sukhatme (1985).

RESULTS & DISCUSSION

Fruit yield (g/plant)

The ultimate objective of a trial to obtain maximum crop yield and foliar application of gibberellic acid increased the fruit yield per plant as well as per hectare. It is discerned from data presented in Table 1 that yield of fruit per plant was significantly increased by application of different concentrations of gibberellic acid. The yield per plant varied from 626.31g to 309.36g depending upon the concentrations. The maximum yield per plant (626.31g) was recorded with gibberellic acid (250mg/L) clearly followed by 150mg/L (569.75g), 100mg/L (533.12 g), 300mg/L (470.23g), 50mg/L (459.94g). The minimum yield and 309.36g was recorded under control. All the treatments were found to be significantly superior to control. However, the concentration of 300mg/L gibberellic acid did not respond significantly. These results are in close conformity with the findings of Naeem *et al.* (2001) in tomato, Sorte *et al*. (2001) in brinjal, Wanyama *et al*.(2006) in Cape gooseberry, Meena *et al*. (2017) in okra and Kaur *et al.* (2013) in Cape gooseberry.

TABLE 1: Effect of different concentrations of gibberellic acid (GA_3) on yield, fruit size and weight of fruit

Treatment	Yield (g/plant) With calyx	Size of fruit (mm)		Weight of fruit (g)	
		Length	Weadth	With calyx	Without calyx
T_0	309.36	22.68	21.73	6.83	5.67
T_1	459.94	22.99	22.44	7.35	6.19
T_2	533.12	23.24	22.82	7.84	6.69
T_3	569.75	23.92	23.46	7.94	6.75
T_4	626.31	26.87	24.52	8.03	6.99
T_5	470.23	22.83	22.39	7.36	6.32
SEm (±)					
CD at 5%	27.10	0.62	0.32	0.71	0.71

Physical parameters of fruits

Length of fruit (mm)

It is obvious from data presented in Table 1 that there was a significant increase in length of fruit by application of different levels of gibberellic acid. The maximum fruit length (26.87 mm) was noted with spray of gibberellic acid (250mg/L) while, the minimum fruit length (22.68 mm) was noted under control. However, (300mg/L) not give the good response as compare to others. These results are in close conformity with the findings of Meena and Dhaka (2003) in tomato, Thapa *et al*. (2003) in chilli, Ayub *et al*. (2010) in tomato, Tohamy *et al.* (2012) and Kaur *et al*. (2013) in Cape gooseberry.

Breadth of fruit (mm)

Experimental results have clearly shown in Table 1 that breadth of fruit increased considerably by allocation of different concentrations of gibberellic acid (GA_3). The breadth of the fruit was significantly influenced by gibberellic acid when compared to control. The fruit breadth was varied from 21.73mm to 24.52mm.The maximum breadth (24.52mm) was observed under gibberellic acid (250mg/L) followed by gibberellic acid (150mg/L) 23.46mm, gibberellic acid (100mg/L) 22.82mm, gibberellic acid (50mg/L) 22.44mm and gibberellic acid (300mg/L) 22.39mm. The minimum breadth (21.73mm) was observed under control. These results are in close conformity with the findings of Meena and Dhaka (2003) in tomato and Kaur *et al*. (2013) in Cape gooseberry.

Fruit weight

Weight of fruit was greatly influenced by different concentrations of gibberellic acid exhibited in Table-1. Spray of 250mg/L gibberellic acid (T_4) produced maximum weight of fruit (6.99 g without calyx and 8.03g with calyx). The weight of fruit increased with increase in concentration of gibberellic acid from zero to 250mg/L. but an increase in concentration of gibberellic acid (300mg/L) did not give

significant impact. These results are in close conformity with the findings of Naeem *et al.* (2001) in tomato and Kaur *et al.* (2013) in Cape gooseberry.

Quality parameters

Titratable acidity (%)

Acidity of fresh ripe fruit was determined in form of anhydrous citric acid. It is clear from data presented in Table 2 that different concentrations of gibberellic acid greatly influenced acid content of fruit. The acidity of fruit varied from 0.83 % to 1.15 %. The minimum acid content (0.83%) was observed with gibberellic acid (250mg/L), whereas, the maximum acidity (1.15%) was noted under control. Other treatments also reduced the acid content of fruit significantly when compared with control. However, T_5 (300mg/L) did not gave significant difference over its lower concentrations. There is negative relation between GA_3 and acidity but after 250mg/L the acidity increased (Tiwari *et al*., 2016). Reduction in acidity might have been due to increase in TSS of fruits (Tiwari *et al*., 2016).

TABLE 2: Effect of different concentrations of gibberellic acid on Acidity (%), TSS and ascorbic acid content of fruits

Treatment	Acidity (%)	TSS(^{0}Brix)	Ascorbic acid (mg/100g)
T_0	1.15	12.55	45.10
T_1	0.99	13.82	46.20
T_2	0.92	14.40	47.30
T_3	0.86	14.47	49.50
T_4	0.83	15.00	51.70
T_5	1.02	13.25	46.20
CD at 5%	0.17	1.46	4.19

Total Soluble Solid (TSS)

Total Soluble Solids (TSS) of fruit was significantly influenced due to the foliar application of different concentrations of gibberellic acid has been exhibited in Table 2. It is evident from the data that there was a significant effect of gibberellic acid on TSS of fruit, while acidity of fruit was decreased with increasing concentration of total soluble solids and it was reached at peak with the spray of 250mg/L gibberellic acid which was closely followed by 150mg/L GA_3. These results corroborate the findings of earlier worker who reported that the spray of gibberellic acid enhanced the TSS of Cape gooseberry fruit (Tohamy *et al.*, 2012 and Kaur *et al.*, 2013)

Ascorbic acid (mg/100g of pulp)

Foliar application of different concentrations of gibberellic acid significantly increased the ascorbic acid content of Cape gooseberry fruits (Table 2). It is obvious from data that ascorbic acid content of fruit was significantly increased due to increase concentration of gibberellic acid. The highest ascorbic acid (51.7 mg) was recorded with gibberellic acid (250mg/L) followed by gibberellic acid (150mg/L) 49.5 mg, gibberellic acid (100mg/L) 47.3mg, gibberellic acid (50mg/L) 46.2mg, gibberellic acid (300mg/L) 46.2mg/100g edible part. The lowest ascorbic acid (45.1 mg) was noted under control. Higher concentration of gibberellic acid from zero to 250mg/L was most effective for increasing ascorbic acid content. However, increasing the concentration of GA_3 beyond 250ml/L did not impart beneficial impact on ascorbic acid content of fruit.

CONCLUSION

Foliar application of gibberellic acid is quite effective to increase yield and quality of fruit in Cape gooseberry. It increased number of fruit, fruit size, fruit weight, yield per plant as well as per hectare, along with better quality of fruit in terms of TSS, acidity and ascorbic acid. On the basis of above finding gibberalic acid (250 ppm) is optimum recommendation for maximum qualitative yield of Cape gooseberry.

REFERENCES

A.O.A.C. (2000) Official Methods of Analysis (6th Ed.), Association of Official Agricultural Chemists, Washington, D.C.

Ali, A. and Singh, B.P. (2016) Studies on production potential of cape gooseberry (*Physalis peruviana* L.) in sodic soil under varying agronomic manipulations. Journal of Applied and Natural Science 8(1), 368 - 374

Ayub, R.A. and Rezende, B.L.A. (2010) Gibberellic acid contribution to tomato fruit size. Biotemas 23(4), 25-28.

Chattopadhyay, T.K. (1996) Cape gooseberry. In T.K., Chattopadhyay (Ed.), A textbook on pomology vol.-Π. Kalyani Publishers, Culcutta India, 209- 314.

Kaur, G., Kaur, A. P., Singh, B. and Singh, S. (2013) Effect of plant growth regulators on fruit quality of Capegooseberry (*Physalis peruviana* L.) cv. Aligarh. International Journal of Agricultural Sciences 9(2), 633-635.

Meena S. S. and Dhaka R. S. (2003) Effect of plant growth regulators on growth and yield of brinjal under semi-arid conditions of Rajasthan. Annals of Agricultural Research 24(3), 516-521.

Meena, V.K., Dubey, A.K., Jain, V.K, Tiwari, A. and Negi P. (2017) Effect of plant growth promoters on flowering and fruiting attributes of okra [*Abelmoschus esculentus* (L.) Moench]. Crop Research 52(1, 2 & 3), 37-40.

Naeem, N., Mohammad, I., Khan, P. and Niaz, M. (2001) Effect of gibberellic acid on growth and yield of tomato CV. Roma. Journal of Biological Science 1(6), 448-450,

Panse, V. G., Sukhatme, P.V. (1985) Statistical Methods for Agricultural Workers. (4th Ed.), ICAR, New Delhi, 347.

Sorte, P.N., Damke, M.M., Rafeekher, M., Goramnagar, H.B. and Bobade, P.M. (2001) Influence of GA and IAA on growth, yield and fruit quality of different varieties of brinjal. Journal of Soils and Crops11 (1), 128-131.

Thapa, U., Pati, M.K., Chattopadhay, S.B., Chattopadhyay N. and Sharangi, A. B. (2003) Effect of growth regulators on growth and seed yield of chilli (*Capsicum annuum* L.). Journal of Interacademicia 7(2),151-154.

Tiwari, A., Pal, A.K., Singh, S.P., Singh, S., Singh, B.K., and Singh, P. (2016) Evaluation of guava cultivars for quality pulp production. Research in Environment and Life Sciences 9(11), 1406-1408.

Tiwari, A., Pal, A.K., Singh, S., Singh, S.P. and Patidar, V.L. (2016) Physico-chemical attributes and organoleptic assessment of guava (*Psidium guajava* L.) cultivars grown in eastern Uttar Pradesh. Journal of Applied and Natural Science, 8(4), 1731-1734.

Tohamy, E.I., W.A., H.M. El-Abagy, Badr, M.A., Ghoname, A.A. and Abou-Hussein S.D. (2012) Improvement of productivity and quality of Cape gooseberry (*Physalis peruviana* L.) by foliar application of some chemical substances. Journal of Applied Science Research 8(4), 2366-2370.

Wanyama, D.O., Wamocha , L.S., Ngamau K. and Ssonkko, R.N. (2006) Effect of Gibberellic Acid on Growth and Fruit Yield of Greenhouse Grown Cape Gooseberry. African Crop Science Journal 14 (4), 319-323.