

Original Research Article

Effect of Plant Growth Regulators on Fruit Quality in Cape Gooseberry (*Physalis peruviana*)

Banshidhar Mohan Kumar^{1*}, Birendra Prasad²,
Radhey Shyam Singh³ and Ajay Kumar Das⁴

¹Bihar Agricultural College, Sabour (BAU, Sabour, Bhagalpur), India

²Regional Research Station, Agwanpur, Saharsa (BAU, Sabour, Bhagalpur), India

³Mandan Bharti Agriculture College, Agwanpur, Saharsa (BAU, Sabour, Bhagalpur), India

⁴Krishi Vigyan Kendra, Arwal, (BAU, Sabour, Bhagalpur), India

*Corresponding author

ABSTRACT

Keywords

Cape-gooseberry,
Plant growth
regulator, Fruit
quality

Cape-gooseberry (*Physalis peruviana* L.) though a minor fruit crop has considered great importance recently in respect to high value and medicinal properties. Present investigation was carried out to study the effect of plant growth regulators; namely- 2,4-D, Gibberic Acid (GA₃) and Nephthaline Acetic Acid (NAA) at different concentrations with expectations to play major role on fruit quality of cape-gooseberry. GA₃ 30 ppm spray was the best treatment combination in enhancing the total soluble solid (15.01 °Brix), reducing sugar (2.90 %), Total sugar content (8.64 %) and decreasing the acidity (1.10 %) of fruits. Fruits under 2,4-D 15 ppm spray were significantly richest in ascorbic acid content with 225.56 % as compared to other treatment combinations.

Introduction

Cape-gooseberry (*Physalis peruviana* L), commonly known as Poha, Tepari, Golden berry, Husk berry, being one of the important minor fruit crop, is highly nutritious with good source of vitamins and minerals. It belongs to genus *Physalis* (Family-Solanaceae) having eighty species, amongst all only three namely; *Physalis peruviana* L; *P. pubescens* L. and *Physalis ixocarpa* Brot. have been recognized as eatable fruit bearing species. The *Physalis peruviana* is considered to be the best with respect to taste, precocity and yield (Gupta and Roy, 1980).

The ripe fruits are considered a good source of vitamins, phosphorus, pectin and it can be eaten raw, used in salad, desserts, as a flavouring, and in Jam and Jellies. Fruits are excellent when dipped in chocolate and can be dried and eaten. It is famous for its flavour and having good blending of acid-sugar. The fruits are attractive in colour at maturity and if properly packed can easily be sent to distant market.

Cape-gooseberry is still cultivating sporadically by farmers on small scale with poor quality fruits resulting unable to earn real value of the crop. In this respect plant

growth regulators (PGR) may play important role in quality fruits of the crop. But literatures on the effect of PGRs on quality of fruits are lacking. Keeping in view the above facts and importance, present investigation was formulated to study the effect of plant growth regulators on quality of cape-gooseberry.

Materials and Methods

The present investigation was carried out in the Instructional Garden of Department of Horticulture (Fruit) at Bihar Agricultural College, Sabour (Bihar Agricultural University Sabour, Bhagalpur) Bihar, India during *Rabi* 2005-06. The experimental site is situated in the suburb of Bhagalpur on latitude 26°15'40" north and longitude 87°26'42" east with altitude of 45.75 metre in the vast Indo-gangetic plane of North India. The experimental materials were obtained from the Department of Horticulture.

The experimental plot was virgin fallow and selected for this new investigation. The field was prepared by mixing well rotten 10 tons/ha F.Y.M. uniformly over the entire plots prior a fortnight of transplanting. 80 kg Nitrogen as Urea, 40 kg P₂O₅ as T.S.P. and 40 kg K₂O as Muriate of potash per hectare along with 25 kg B.H.C. 5 per cent were applied uniformly as basal dose. 20-25 days old seedlings were transplanted at 60 x 60 cm. in the well prepared field in randomized block design with three replications during afternoon. All recommended agronomical and intercultural practices were adopted to have a good crop.

The aqueous solution of three important plant growth substances namely; 2,4-D (5, 10, and 15 ppm), Gibberellic acid (GA₃- 10, 20 and 30 ppm), NAA (10, 20, 30 ppm) for treatment and Distilled water for control

were prepared. These aqueous solutions including distilled water were sprayed with the help of Ganesh Hand Sprayer after 30, 45 and 60 days of transplanting during afternoon for its maximum effectiveness. Ten plants from each treatment were selected randomly for recording observations excluding border plants for different characters.

Methods of estimation

Total Soluble Solids (T.S.S.)

The total soluble solids (T.S.S.) in three freshly extracted juice samples of cape-gooseberry was estimated with the help of hand refractometer and expressed as per cent of total soluble solids.

Acidity percentage

10 ml juice from three samples in each treatment was titrated against standard solution N/10 NaOH using phenolphthalein as indicator. The appearance of pink colour indicated the end point. Acidity was calculated in terms of anhydrous citric acid.

Reducing sugar

Reducing sugar was estimated with the help of method given by Lane and Eyon (1923). Copper titration method as suggested by A.O.A.C. (1975)

Total sugar

The total sugar was obtained by titration with Fehling solution.

Ascorbic acid (Vitamin C)

Naturally occurring form of vitamin C in cape-gooseberry is ascorbic acid. For its determination, 20 grams pulp was taken and

50 ml of 3 per cent metaphosphoric acid was added to it. Aliquot of the filtrate was titrated against 0.025 per cent 2, 6-dichlorophenol indophenols dye solution to a faint pink and point which persisted for fifteen seconds. The vitamin C content of fruit was expressed as milligrams of ascorbic acid per 100 g of pulp (A.O.A.C., 1975).

The experimental data were subjected for statistical analysis using Analysis of variance following Randomized Block design. The standard errors of the plots and treatment means as well as the critical difference were worked out accordingly.

Results and Discussion

Cape-gooseberry (*Physalis peruviana* L.) though a minor fruit crop has assumed great importance recently in respect to quality and medicinal properties. The crop is newly popularized in the farming community while still cultivating traditional land races having low quality fruit. It is a well known fact that PGR plays important role in improving growth and yield but in this experiment we find out the effect of growth regulators on quality of the fruit.

Total Soluble Solids (⁰Brix)

The total soluble solids (TSS) content of treated fruit was estimated and observed that application of 2,4-D, GA₃ and NAA on an average was moderately effective to enhance the TSS of the fruit over control. Among different treatment combinations, GA₃ 30 ppm proved to be the best treatment in increasing the TSS (15.01 ⁰Brix) of fruit having non-significant value, while minimum TSS was found under control. This might be due to the fact that growth regulator increase TSS content by accelerating the biochemical reactions.

Maurya *et. al.* (1994) also observed the maximum increase in TSS of cape-gooseberry fruit with the application of 2,4-D 5 ppm as compared with control. The total soluble solid is a very important constituent of fruit quality. This content in cape-gooseberry is approximately 16 per cent (Singh, 1984).

Acidity

The organic acids present in fruits influence the flavour, colour, keeping quality, texture, metabolic reaction and maturity of the fruits. Minimum percentage of acid content in the fruit was estimated and evident 1.25 per cent with control (Distilled water spray) i.e. none of the treatment combination could decrease significant acidity of the fruit. The acids under the influence of chemicals might have either been fastly converted in sugar or might be used in respiration or both. Our results are also corroborating findings of Kaur G. *et. al.* (2013) and Tiwari *et al.*, 2016.

Reducing sugar

Amongst all the treatments, 30 ppm concentration of GA₃ proved to the best treatment combination in increasing the reducing sugar (4.90 per cent) while lowest reducing sugar level was observed in the control. This increase of sugar contents might be due to fact that gibberellins are responsible for synthesis of α - amylase which converts starch into the reducing sugars. Decrease in acid content and increase of sugar level enhance sweetness of fruits with better acceptability to the consumers. Increase in sugars with the application of gibberellic acid application was also reported by Wanyama *et al.* (2006) in Cape gooseberry and Saleem *et al.* (2008) in sweet orange.

Total sugar

From the perusal of the data presented, it is obvious that maximum total sugar content (8.64%) was observed at the 20 ppm concentration of GA₃ although the value was not significant statistically, whereas the

minimum total sugar content (8.30%) was observed for control. Our results are also in conformity of the findings of Maurya *et. al.*, 1994 as higher total sugar content was with 5 ppm 2,4-D spray on cape-gooseberry.

Table 1: Anova table for effect of growth regulators on quality traits

Particulars	d.f.	T.S.S. (⁰ Brix)	Acidity(%)	Reducing sugar(%)	Total Sugar (%)	Ascorbic acid (mg)
Replication	2	0.0884	0.0010	0.0421	0.0424	56.8414
Treatment	9	7.1396	0.0437	0.9801	0.3419	2260.7947
Error	18	11.5739	0.0476	0.9562	4.4117	1767.6995
CD 5%		NS	NS	NS	0.85	17.00
CV		5.52	4.44	4.97	5.86	4.68

Ascorbic acid (Vitamin C)

Ascorbic acid is the natural occurring form of vitamin C and cape-gooseberry is a good-source of vitamin C i.e. 54 mg/100g of fruit. On scrutiny of the data, it is apparent that ascorbic acid content was significantly affected with the application of 2,4-D at 15 ppm concentration by 225.56 mg with respect to the control (192.01 mg.). This increase in ascorbic acid content may be due to the catalytic influence of auxins on the biosynthesis of ascorbic acid from sugar. Increase in ascorbic acid content with 2,4-D treatment was also observed in cape-gooseberry by Maurya *et. al.* 1994.

In conclusion, the chemical composition and Quality of fruits were studied in the laboratory by collecting random samples from the experimental plots. GA₃ 30 ppm spray was the best treatment combination for the Total Soluble Solids contents (15.01 ⁰Brix), Acidity (1.10%) and reducing sugar (4.31%) of fruits while total sugar was

maximum at GA₃ 20 ppm. Plants treated with 2,4-D 15 ppm produced significantly richer in ascorbic acid content with 225.56 mg. as compared to other treatments.

References

- A.O.A.C. (1975). Official method of analysis. Assoc. of Official analytical chemist Washington D.C. 12th edition.
- Gupta, S. K. and Roy, S. K (1980). Multipurpose Cape-gooseberry, *Indian Hort*, 24 (4): 11.
- Kaur, G., Kaur, A. P., Singh, B. and Singh, S. (2013). Effect of plant growth regulators on fruit quality of cape gooseberry (*Physalis peruviana* L.) cv. ALIGARH. *Internat. J. agric. Sci.*, 9(2): 633-635.
- Maruya, K. R. Singh A. K. and Singh, R. (1994). Effect of 2,4-D on yield and quality of cape-goose berry. *Bihar Journal Expec. Hort.*, 2:44-45.
- Saleem, B.A., Malik, A.U., Pervez, M.A., Khan, A.S. and Khan, M.N. (2008).

- Spring application of growth regulators affects fruit quality of Blood Red sweet orange. *Pak. J. Bot.*, 40(3): 1013-1023.
- Singh, O. P. and Phogat. K. P. S. ((1984). Effect of growth regulators on fruit drop. Size and quality of litchi Cv. Calcuttia. *Punjab Hort J.* 24 (1-4): 83-88.
- 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.
- Wanyama, D.O., Wamocha, L.S., Nagamau, K. and Sonkko, R.N. (2006). Effect of gibberellic acid on growth and fruit yield of greenhouse-grown Cape gooseberry. *African Crop Sci. J.*, 14(4): 319-323.