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Effect of Gibberellic Acid and Hand Pollination on Quality Parameters of Custard apple (*Annona squamosa* L.) *cv.* Arka Sahan

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ABSTRACT: The current study on the "Effect of Gibberellic Acid and Hand Pollination on the Quality Parameters of custard apple (*Annona squamosa* L.) *cv.* Arka Sahan" was carried out at Krishi Vigyan Kendra, Chittorgarh and Rajasthan College of Agriculture, MPUAT, Udaipur. The experiment was carried out in Randomized Block Design (RBD) with ten treatments and three replications. The results indicated that treatment T_8 (GA_3 150 ppm + hand pollination) gave maximum reducing sugar, non-reducing sugar, total sugar and ascorbic acid while these parameters were minimum in T_1 (control). The titratable acidity was maximum (0.42 %) in T_2 (hand pollination) and lowest in T_1 (control). Maximum TSS (28.02°B) was observed in T_9 (GA_3 200 ppm + hand pollination). Hence, it is concluded that treatment, T_8 (GA_3 150 ppm + hand pollination) was found overall best with respect to the quality parameters of custard apple.

Keywords: Custard apple, Arka Sahan, Gibberellic acid, Hand pollination, Quality parameters.

INTRODUCTION

Custard apple (*Annona squamosa* L.) belongs to the Annonaceae family, chromosome number 2n = 14, and small shrub of genus *Annona*. Custard apple is basically known as sweet apple or sweet sop, and it is the king of arid regions. It is a very delicious, tasty, and intriguing fruit. There are several species of *Annona* which are usually edible and used for direct consumption. (Pritchard and Edwards 2015). Arka Sahan is an interspecific hybrid variety that evolved by mating between Island gem (*Annona Atemoya* Hort.) × Mammoth (*Annona squamosa* L.). It is a very popular variety, and the pulp quality is very fine and sweet, but it having major problem of self-incompatibility, dichogamy, and poor pollination, so they show poor fruit set, a lower yield, smaller fruits, and fruits of worse quality. Self-pollination and fruit set are key limiting factors in annonaceous fruits like Arka Sahan and *Atemoya*, hence, hand pollination must be done (Jalikop and Kumar 2007). Hand pollination is the solution to this problem; flowers must be picked, anthers removed, and pollen collected before being transferred to female flowers with a paintbrush or a puffer, generally a day later. The frequent collection of pollen donor flowers, as well as pollen extraction and application, are significant expenses for this crop (Guirado *et al*., 2001).

Many studies have demonstrated that plant growth regulators, i.e., gibberellins, auxins, and cytokinin, can increase fruit setting and a lower number of seeds in many species without pollination. The application of GA_3, which has been standardized particularly for sugar apples, is presently in extensive use. Savedra (1979) presented the first study on the use of GA_3 in custard apples and described how it acts as a plant growth regulator to increase fruit length and diameter and produce seeds-free cherimoya fruits, among other benefits. Additionally (Mizobutsi and Santos 2016) reported that 1500 ppm of GA_3 effectively develops fruits without seeds and generates sugar apples with high physical and chemical qualities.

Hand pollination is one of the methods for achieving the quality produce, but it is laborious and expensive due to a lack of skilled labour. As a result, there is an

urgent need to replace hand pollination with growth regulators to improve flowering, fruit set, yield, and quality of custard apple.

MATERIAL AND METHODS

The experiment was conducted at Krishi Vigyan Kendra, Chittorgarh and Rajasthan College of Agriculture, MPUAT, Udaipur. The experiment was carried out in a randomized block design (RBD) with ten treatments and three replications on custard apple *cv*. Arka Sahan. Ten flowers were randomly selected for each treatment of tree and treated them with gibberellic acid and hand pollination to improve the quality parameters. GA_3 solutions of various concentrations were prepared by weighing the required quantity of gram of GA_3 dissolved in a small amount of ethanol and making the volume of 1000 ml by using distilled water. The gibberellic acid sprays at various concentrations were applied just after the hand pollination and then second spray was done at the time of fruit set. Balanagar variety of custard apple was as a donor. The fruit were harvested at mature stage and then the quality parameters were analysed which include total soluble acid, reducing sugar, total sugar, non-reducing sugar, titratable acidity, ascorbic acid. TSS was measured with the help of a digital refractometer'. The titratable acidity of custard apple pulp was determined by diluting it with distilled water and titrating it against a standard solution of N/10 sodium hydroxide, using phenolphthalein as an indicator (A.O.A.C., 1995). Ranganna (1986) method was used to assess the reducing sugars and total sugar. The measure of non-reducing sugar, the percentage of reducing sugar, was subtracted from the percentage of total sugar and multiplied by 0.95 (Somogyi, 1952). The details of treatments include: T_1 (control), T_2 (hand pollination), T_3 (GA_3 100 ppm), T_4 (GA_3 150 ppm), T_5 (GA_3 200 ppm), T_6 (GA_3 250 ppm + hand pollination), T_7 (GA_3 100 ppm + hand pollination), T_8 (GA_3 150 ppm + hand pollination), T_9 (GA_3 200 ppm + hand pollination), and T_{10} (GA_3 250 + hand pollination). The collected data was statistically analysed.

RESULT AND DISCUSSION

The results indicated positive influences of GA_3 on the total soluble solid (TSS) content of sugar apple and T_9 (GA_3 200 ppm + hand pollination) recorded the highest TSS content (28.02 ˚B), followed by T_{10} (GA_3 250 ppm + hand pollination) (27.36°B), and T_1 (control) had the lowest amount of total soluble solids (20.24 ˚B) compared with other treatments. Dhananjay's (2017) research on custard apples suggested that increasing the concentration of GA_3 increases the TSS content which may be due to quick metabolic conversion of pectin and starch into soluble molecules and the speedy translocation of sugars from leaves to fruits.

The titratable acidity was recorded highest (0.42%) in T_2 (hand pollination) as compared to T_1 (control) (0.40%), and the minimum titratable acidity was found (0.34%) in T_6 (GA_3 250 ppm). The acidity decreases with the increasing in the concentration gibberellic acid. This may be due to metabolic alterations that include the rapid conversion of organic acids into sugars and their derivatives through processes involving the reversal of the glycolytic pathway or respiration. The results are conformity with previous findings in aonla by Singh and Singh (2015) and sapota by Barkule *et al.* (2018).

Maximum ascorbic acid was reported in T_8 (26.96 mg/100) at the rate of GA_3 150 + hand pollination, which was comparable to treatments T_9 and T_{10} (26.21 mg/100 and 25.87 mg/100), and minimum (20.65 mg/100) in T_1 (control). The continuous synthesis of glucose-6-phosphate, which is regarded as the precursor of vitamin C, throughout the growth and development of fruits may be the cause of the increasing ascorbic acid concentration. These findings agree with those of Srivastava *et al.* (2009); Singh and Singh (2015) in aonla (*Emblica officinalis* Gaertn).

According to the data, T_8 (GA_3 150 ppm + hand pollination) (24.85%) had the highest total sugar content and was shown to be considerably better than all other treatments, while T_1 (control) had the lowest total sugar percentage (19.01%). Similarly, the reducing and non-reducing sugar percentages were maximum in T_8 (GA_3 150 ppm + hand pollination) (22.28% and 2.44%), and the minimum reducing and non-reducing sugar percentages (17.535% and 1.40%, respectively) were recorded in T_1 (control). The reason that the activity of enzymes like amylases, which hydrolyse complex polysaccharides into simple sugars was increased by plant growth regulators. According to certain reports, auxin and gibberellic acid speed up the transfer of metabolites from other areas of the plant to growing fruits. The present results are backed by Singh *et al.* (2007); Patel *et al.* (2017) in aonla.

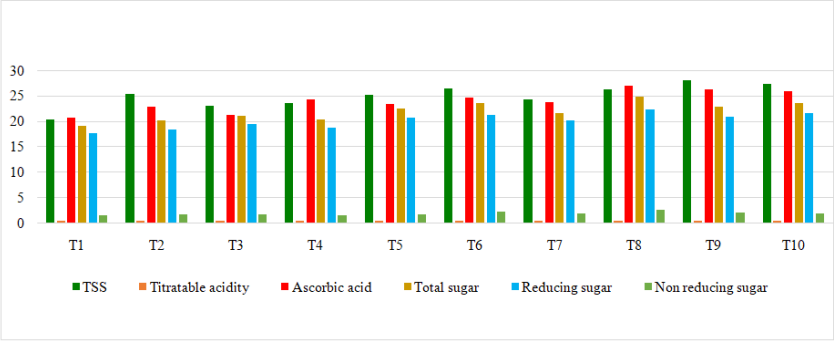

Fig. 1. Effect of gibberellic acid and hand pollination on quality parameters of custard apple.

Table 1: Effect of gibberellic acid and hand pollination on quality parameter of custard apple.

Treatment	TSS (°B)	Titratable acidity (%)	Ascorbic acid (mg/100g)	Total Sugar (%)	Reducing Sugar (%)	Non-Reducing Sugar (%)
T_1: Control	20.24	0.38	20.65	19.01	17.53	1.40
T_2: Hand pollination	25.36	0.42	22.88	20.06	18.33	1.64
T_3: $GA_3$100 ppm	22.93	0.38	21.20	20.98	19.32	1.57
T_4: $GA_3$150 ppm	23.62	0.36	24.32	20.32	18.72	1.52
T_5: $GA_3$200 ppm	25.17	0.35	23.40	22.45	20.72	1.64
T_6:$GA_3$250 ppm	26.40	0.34	24.64	23.48	21.16	2.20
T_7:$GA_3$100 ppm + Hand pollination	24.27	0.40	23.75	21.58	20.07	1.77
T_8:$GA_3$150 ppm + Hand pollination	26.24	0.39	26.96	24.85	22.28	2.44
T_9:$GA_3$200 ppm + Hand pollination	28.02	0.37	26.21	22.83	20.78	1.94
T_{10}:GA_3 250 ppm + Hand pollination	27.36	0.36	25.87	23.46	21.50	1.88
S. Em. ±	0.37	0.006	0.42	0.29	0.26	0.02
CD (p=0.05)	1.11	0.019	1.25	0.8	0.78	0.06

CONCLUSIONS

On the basis of the results obtained in the present investigation it is concluded that the use of GA_3 with hand pollination promoted the improved of fruit quality i.e., TSS, titratable acidity, ascorbic acid, total sugar, reducing sugar, non-reducing sugar and hand pollination had a synergistic effect with gibberellic acid. The best treatment was T_8 at $GA_3$150 ppm with hand pollination, which gave best quality of fruit. Further research is needed to understand the underlying mechanisms and to optimize the concentration and timing of GA_3 application and hand pollination to enhance the quality parameters.

FUTURE SCOPE

The results presented add to a better knowledge of the effects of gibberellic acid and hand pollination on custard apple and emphasize the necessity of further study.

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Conflict of Interest. None.

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