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Influence of plant growth regulators on yield and quality of Karonda (*Carissa carandas* L.)

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Abstract

An experiment was conducted on 6 year-old- plants of karonda at the Horticultural Research Station of Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal to know the effect of different growth regulators on fruit yield and physico-chemical composition of fruits. There were five treatments viz., NAA at 20, 40 ppm; GA at 20 and 40 ppm and control (water spray) which were sprayed two times i.e., at 50% flowering stage and 21 days after 1st spray. The experiment was conducted following the randomized block design having four replications. The study clearly indicated that plant growth regulators were effective at different concentration in increasing fruit yield and physico-chemical characteristics of fruits. Application of NAA at 20 ppm resulted in maximum fruit set (93.62%), fruit retention (83.0%) and fruit yield (4.07 kg/plant). The treatment also increased fruit weight and pulp content while GA at 20 ppm was found to be the best for increasing TSS (8.87^0B), total sugars (6.05%), ascorbic acid (34.00 mg/100 g) and anthocyanin (3.87 mg/100 g pulp) contents followed by NAA 20 ppm. Considering the over all performance and lower market price, the NAA at 20 ppm is recommended for higher production of quality karonda fruits in new alluvial zone of West Bengal.

Key words : *Fruit quality, fruit yield, karonda, plant growth regulators.*

Introduction

Karonda (*Carissa carandas* L.), also known as karancha (Bengali), belongs to family Aponcyanaceae, originated in India, occurs mostly on sandy or rocky soil in a wild state. It is an evergreen diffuse, spiny shrub, occurs throughout arid tropic and sub-tropics and is grown for its attractive colour edible fruits. It thrives well as a rainfed crop in marginal and wastelands, and the plant hardly needs any care and gives yield with the minimum management. The fruits are eaten as a dessert when ripe. Mature fruits contain a high amount of pectin, which is used for preparation of different products such as jelly, jam, squash, sauce, syrup, etc. which are of great demand in the international market. The fruits are rich in protein, vitamin C and minerals, especially, iron (39.1 mg/100 g), calcium and phosphorus. In spite of high nutritive values and multipurpose uses of karonda, little attention has been paid on production aspect of the crop.

Karonda is usually grown in such land situation, lie waste or marginal land where fruit dropping seems to happen due to lack of nutrients and other factors. Beneficial effect of various plant growth regulators on fruit set and controlling fruit drop has been reported in many underutilized fruit crops like rose apple (Das *et al.,* 2006), aonla (Ghosh *et al.,* 2009), ber (Ghosh *et al.,* 2009), pomegranate (Ghosh *et al.,* 2009) etc. but no report is available regarding beneficial role of plant growth regulators on karonda. Therefore, an investigation was made to determine the effect of plant growth regulators on fruit production and fruit quality of Karonda grown in alluvial soil.

Materials and Methods

The experiment was conducted at the Horticultural Research Station, Mondouri, Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal during 2014-2015 on 6 year old budded karonda plants of local elite type, planted at 2.5 m x 2.5 m spacing. The soil of the experimental orchard was sandy loam having soil pH 6.8, available N, P and K were 230.0, 35.20 and 86.0 kg/ha, respectively. The experimental site belongs to sub-tropical humid climate, where summer and winter are short and mild. The plants were fertilized with cow dung manure at 4 kg and N_{100}-$P_{50}K_{50}$ g/plant/year in two splits i.e. in June and September. The plants were maintained under rain fed condition. The experiment was laid out in Randomized Block Design with four replications having four plants per replication. There were five treatments with two growth regulators *viz.*, NAA at 20, 40 ppm; GA at 20, 40 ppm and control (water spray). These chemicals were thoroughly sprayed early in the

morning, two times along with the control using teepol as surfactant. The first spray was given at 50% flowering stage and 2nd spray was 21 days later.

Fruit set was calculated from the tagged 100 flowers per plant. For observing fruit retention 50 fruits were tagged just after fruit set at pea stage and fruit retention was noted two months after tagging. Fruit yield was calculated by total number of fruits per plant at maturity multiplied with the average fruit weight. Fruit weight was measured at maturity on the basis of 20- fruits taken from each plant randomly with the help of a weighing balance. Pulp was extracted from the known weighted 20 fruits and thus calculated and expressed in percentage. The TSS was measured by hand refracto-meter while acidity, total, sugar and ascorbic acid content of fruit were determined following standard method (A.O.A.C., 1990). Anthocyanin content of fruit was measured by adding a mixture of ethanol and HCl to the sample and then filtering the extract by filter paper, the reading was taken in spectrophotometer at wave length of 535 nm.

Results and Discussion

The results from the investigation (Table 1) revealed that application of plant growth regulators resulted in increasing fruit set, fruit retention and consequently improved the yield. The fruit set (93.6%) and fruit retention (83.0%) was significantly highest in the plants sprayed with NAA at 20 ppm followed by GA at 20 ppm (91.50% and 80.8% respectively). In control, the fruit set and fruit retention were lowest (76.5% and 68.3% respectively). Beneficial role of NAA application in increasing fruit, set and fruit retention may be explained from the fact that exogenous application of auxin may help to increase its endogenous level which resulted in more fruit set in one hand and prevent the formation of abscission zone in other hand (Tomaszewska and Tomaszewska, 1970) resulting more fruit retention.

A significant and positive role on fruit yield was observed with the application of plant growth regulators (Table 1). All the treatments were better as compared to the control. Highest fruit yield (4.07 kg/plant) was recorded with foliar application of 20 ppm NAA and was more than double compared to control plants (1.55 kg/plant). Highest fruit yield with NAA 20 ppm was due to maximum fruit set and its retention. Beneficial effect of NAA at lower dose in yield increment was also noted by several workers in ber (Ghosh *et al.,* 2009), pomegranate (Ghosh *et al.,* 2009), aonla (Ghosh *et al.,* 2009), bael (Uniyal and Misra, 2015), etc. It was observed that effectiveness of NAA or GA concentration in yield increment was drastically reduced at their respective higher dose.

Fruit weight was significantly improved with the application of growth regulators and NAA at 20 ppm resulted in highest fruit weight 9.04 g as against 7.03 g in control (Table 2). Increase in fruit weight due to NAA application may be due to cell elongation and division with increased enzymatic activity (Leopld, 1958: Weaver, 1972). Pulp content, another important physical parameter in karonda from the point preservation of significantly varied in different treatments. The maximum pulp percentage 79.49% was found with treatment of NAA 20 ppm followed by 76.85% with GA 20 ppm and the lowest pulp content was noted from the control fruits (68.60%).

The total soluble solids content in the fruits was significantly increased with the growth regulators application and both NAA and GA were effective in this regard. Highest TSS content was measured from the fruits of the plants sprayed with GA 20 ppm (8.87^0 Brix) followed by NAA 20 ppm (8.25^0 Brix). In control plants, the TSS was measured lowest (6.25^0 Brix). Beneficial effect of NAA and GA in improving TSS content was also noted in ber and pomegranate (Ghosh *et al.,* 2009). Fruit acidity did not vary significantly in different treatments. Total sugar, ascorbic acid and anthocyanin contents in the fruits were also increased with the application of growth regulators. Highest total sugars (6.05%), ascorbic acid (34.00 mg/100 g pulp) and anthocyanin (4.00 mg/100 g pulp) contents were recorded from the fruits of the plant sprayed with GA 20 ppm followed by NAA 20 ppm (5.95%, 32.50 mg and 3.87 mg/100 g pulp, respectively). The fruits from the control plants showed the lowest values in all the chemical parameters. Similar observation was recorded by Dutta *et al.,* (2006), who reported that NAA 20 ppm was effective in improving physical characters of the fruits of rose apple and water apple while GA 20 ppm was effective in improving the chemical constituents of above mentioned fruits. The results reported by Yadav and Chaturvedi (2005) are more or less in agreement with the present findings, who reported increment of TSS and total sugar contents in ber with the application of GA_3 at 30 ppm. Improvement in TSS and total sugar contents in the fruits due to GA and NAA application may be explained from the fact that application of these growth regulators after fruit set probably improved the internal physiology of leaves thereby causing better translocation of vital components in the fruit and assimilation as well as utilization of photosynthates in developing fruits leading to improvement in sugar contents (Ghosh *et al.,* 2009). Increase in ascorbic acid content in the fruit might be due to catalytic activity of plant bio-regulators on its biosynthesis from its precursor glucose-6-phosphate or inhibition of its conversion into dehydro ascorbic acid by enzyme ascorbic acid oxidase or both (Brahmachari and Rani, 2001).

Table 1. Effect of plant growth regulators on fruit set, fruit retention, fruit yield and physical characteristics of fruits of karonda

Treatment	Fruit set (%)	Fruit retention (%)	Yield /plant (kg)	Fruit weight (g)	Pulp content (%)
NAA 20 ppm	93.6 (75.35)	83.0 (65.65)	4.07	9.04	79.49
NAA 40 ppm	84.8 (67.05)	76.4 (60.94)	2.90	8.13	74.42
GA 20 ppm	91.5 (73.05)	80.8 (64.01)	3.59	8.56	76.85
GA 40 ppm	81.7 (64.67)	72.6 (58.44)	2.49	8.00	70.64
Control	76.5 (61.00)	68.3 (55.73)	1.55	7.03	68.60
SEm (±)	0.41	0.64	0.08	0.16	0.49
CD 5%	1.29	2.01	0.26	0.49	1.53

Figures in the parenthesis are angular transformed values

Table 2. Effect of plant growth regulators on chemical composition of karonda fruits

Treatment	TSS (^{0}Brix)	Acidity (%)	Total sugars (%)	Ascorbic acid (mg/100g)	Anthocyanin content (mg/100g)
NAA 20 ppm	8.25	2.12	5.95	32.50	3.87
NAA 40 ppm	7.25	2.32	5.85	30.25	3.15
GA 20 ppm	8.87	2.07	6.05	34.00	4.00
GA 40 ppm	8.21	2.34	5.90	31.25	3.67
Control	6.25	2.48	4.20	28.50	2.95
SEm (±)	0.18	0.01	0.01	0.03	0.06
CD 5%	0.57	NS	0.03	0.99	0.20

References

A.O.A.C. 1990. Official Methods of Analysis. Association of Official Agriculture Chemists (15th Edn.), Washington, D. C.

Brahmachari, V. S. and Rani, R. 2001. Effect of growth substances on fruit cracking, productivity, ripening and quality of litchi. *Orissa J. Hort.,* 29: 44-45.

Das, B. C. Maji, S.; Singha S. S.; Dutta, P. and Dhua, R.S. 2006. Growth regulator in controlling fruit drop of Rose apple (Syzigium jambos) grown in West Bengal. Proceedings of the National Symposium on Production, Utilization and Export of Underutilized Fruits with Commercial Qualities. pp. 168-173.

Dutta, P. Das, B. C.; Singha, S.; Dhua, R. S.; Hasan, M. A and Kundu, S. 2006. Effect of plant growth regulator on physio-chemical qualities of Rose apple and Water apple grown under West Bengal condition. Proceedings of the National Symposium on Production, Utilisation and Export of Underutilized Fruits with commercial utilities. pp. 126-131.

Ghosh, S.N., Bera, B. Kundu, A., and Roy, S. 2009. Effect of plant growth regulators on fruit retention, yield and physico-chemical characteristics of fruits in ber 'Banarasi Karka' gown in closing spacing. *Acta Hort*., 840: 357-362.

Ghosh, S.N., Bera, B., Roy, S. Kundu, A. and Dutta Roy, S.K. 2009 Effect of nutrients and plant growth regulators on fruit retention, yield and physico-chemical characteristics of aonla cv.NA-10. *J. Hort. Sci.,* 4(2): 164-166.

Ghosh, S.N., Bera, B., Roy, S.and Kundu, A. 2009 Effect of plant growth regulators on yield and quality in pomegranate cv.Ruby. *J. Hort. Sci*., 4(2): 158-160.

Leopld, A.C. 1958. Auxin uses in the control of flowering and fruiting. *Ann. Rev. of Pl. Physio.,* 9: 281-310.

Tomaszewska, E. and Tomaszewska, M. 1970. Endogenous growth regulators in fruit and leaf abscission. Zeszyty Nauk Biol., Copernicus Univ. Torun Pol. 23 : 45-53.

Weaver, R.Z.1972. Biological effects and mechanism of action. *In: Plant growth substances in agriculture,* S. Chand and Company Ltd., Ram Nagar, New Delhi-110055, pp.90-117.

Yadav, D. N and Chaturvedi, O. P. 2005. Influence of GA_3 and trace elements on fruit drop, growth and quality of ber (zizyphus mauritiana) cv. Banarasi Karaka. *Farm Science Journal,* 14 (1): 27-28.

Uniyal Shweta and Misra, K.K. 2015. Effect of plant growth regulators on fruit drop and quality of bael under Tarai condition of Uttarakhand. *Indian J. Hort.,* 72(1): 126-129.