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Efficiency of some chemicals on crop regulation of Sardar guava

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ABSTRACT

A field investigation was carried out to evaluate the efficiency of some chemicals and bioregulators in crop regulation by deblossoming of summer season's flowers of guava in order to get high quality fruits in winter season by avoiding rainy season crop. The experiment was conducted at Horticultural Research Station, Mondouri of Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal, India. The treatments for summer deblossoming were application of NAD@40 ppm (T_1); NAD@60 ppm (T_2); NAA@250 ppm (T_3); NAA@500 ppm (T_4); Urea@10% (T_5); Urea@15% (T_6); manual deblossoming (T_7); and control (T_8) following randomized block design with three replications in Lucknow-49 cultivar of guava. The results indicated that all the treatments were effective in summer deblossoming and improved the physico-chemical quality of fruits during both the season over control, however, manual deblossoming did not produce fruits in rainy season. The beneficial effects of the treatments tried were observed to be more prominent in winter crop than the rainy season crop. Among the treatments, deblossoming with NAD@60 ppm showed maximum increase in fruit morphological characters *viz.* length, diameter, volume, weight, specific gravity, pulp weight, core weight, pulp percentage and pulp thickness over the control in winter crop, while in rainy season crop deblossoming with Urea@15% showed highest increase in morphological characters. With regard to fruit quality parameters, the NAD@60 ppm induced maximum increase in TSS (13.12 °B), total sugars (8.85%), TSS: acid ratio, total sugars: acid ratio, vitamin C (187.60 mg/100 g) and maximum decrease in titratable acidity over control in winter season as well as in rainy season crop. The observations also revealed highest benefit: cost ratio (7.84:1) by summer deblossoming with NAD@60 ppm.

1. Introduction

Guava (*Psidium guajava* L.) is the fifth most important fruit crop of India as well as a popular fruit crop of tropical and subtropical areas of the world. It is easily available with reasonable price thus, named as "apple of tropics" and "super fruit" (Nimisha et al., 2013) for its rich nutraceutical values. In West Bengal of India, commercial orchards are seen in the districts of North and South 24 Paraganas (Baruipur, Jainagar), West Midnapur (Jhargram, Gokulpur), Burdwan (Kanksa), and recently, the coverage in Nadia and Murshidabad districts of West Bengal, India is increasing very fast (Maji and Das, 2008a,b, 2013a,b,c; Maji et al., 2008) as a profitable crop. In general, guava flowers twice in a year, *i.e.*, in April–May and August–September, of which fruits ripen in rainy and winter season, respectively. In West Bengal, two flowering periods (rainy, *i.e.*, April–May and winter, *i.e.*, September–October) were observed by Mitra (1983), but in Terai region three flowering seasons were observed by Singh and Kumar (1993). The heaviest flowering is observed mainly for rainy season cropping. But, the fruits of rainy season crop are rough, insipid in taste, poor in quality, less nutritive and are heavily attacked by many insects, pests, and diseases. On the other hand, fruits in winter season are superior in size, quality, taste, less attacked by pests and diseases and fetch higher price than rainy season crop.

Several investigations (Dubey et al., 2002; Dutta and Banik, 2006; Sahay and Kumar, 2004; Sahay and Singh, 2001; Tiwari and Lal, 2007) were made to reduce the rainy season crop and to get more winter season crop by means of root exposure and root pruning, shoot pruning, mechanical flower thinning and chemical thinning by the use of Urea, growth substances like naphthalene acetic acid (NAA), naphthalene acidamide (NAD), 2,4-dichlorophenoxy acetic acid (2,4-D), dinitro-ortho-cresol (DNOC) *etc.* Some other methods, like withholding of irrigation water, defoliation *etc.* were also practiced. But, the results of these experiments

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were not similar and the responses differed according to cultivars, tree conditions, soil types and agro-climatic conditions. Considering these facts, an attempt has been made to evaluate the role of some chemicals and bioregulators to regulate cropping of guava grown in Gangetic plains of West Bengal, India. The aim of the study was to produce fruits of guava in off time and to enhance fruit quality as well as to make the fruits available throughout the year. Accordingly, the infestation of pests and diseases will be minimized and growers will be benefited economically.

2. Materials and methods

2.1. Plant materials

The present experiment was conducted at Horticultural Research Station, Mondauri, of Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal, India. The 14 years old orchard of guava cv. L-49 commonly known as Sardar was identified and healthy plants with almost uniform growth were selected for the treatments.

2.2. Treatment application

The experiment comprised with deblossoming of summer flowers by the use of NAD@40 ppm (T_1); NAD@60 ppm (T_2); NAA@250 ppm (T_3); NAA@500 ppm (T_4); Urea@10% (T_5); Urea@15% (T_6); manual deblossoming (T_7); and water spray as control (T_8). Water-soluble chemicals (NAD, Urea) were sprayed with water and NAA was sprayed after dissolving in alcohol and after making solution of respective concentration. The chemicals were sprayed at 50% blooming stage and again at 10 days after first spray during summer flowering. In manual deblossoming all the flowers and fruits were removed by hands.

2.3. Recording of observations

The observations were recorded for its pomological characters, *i.e.*, physico-chemical characteristics of fruits and economic analysis for cost of cultivation. Fruit morphological characters like-fruit size was measured in terms of length and diameter of fruits with the help of vernier calipers, average fruit weight was determined by digital weighing balance and volume was measured by water displacement technique of selected sampled fruits. The specific gravity was calculated by dividing weight of fruit by its volume. Fruits were cut into pieces carefully and pulp portion was separated to measure the weight of pulp, core and thickness of pulp *etc.* The chemical qualities *viz.* TSS, titratable acidity, total sugars, TSS: acid ratio, Vitamin C content *etc.* were determined following standard method of AOAC (2000).

2.4. Statistical analysis

The treatments were applied following randomized block design and were replicated thrice. Observations were recorded for 2 years. The pairs of treatments were compared with the use of LSD-Duncan's Multiple Range Test (DMRT) analyzed in SPSS-10.0 software. Groupings of pooled values of 2 years data were marked by English alphabets indicating the highest value with 'a' and subsequent values alphabetically in decreasing order. The pooled values with the same letter (a, b, c, d *etc.*) in a column indicate that they do not differ significantly at 5% level of significance.

3. Results

3.1. Effect of crop regulating chemicals on physical characters of fruits

The results (Tables 1 and 2) showed that in general, the morpho-physical qualities of guava fruits were greatly improved in winter season cropping as compared to rainy season cropping and all the crop regulating treatments were found effective to improve fruit physical characters than the control. Table 1 indicated that the length, diameter, volume, and weight of fruits were increased in rainy season when the plants were treated with Urea@15% even after deblossoming. But, in winter, summer deblossoming with NAD@60 ppm followed by NAA@500 ppm caused a marked increase in fruit size (length, diameter), volume and weight of 7.82 cm, 7.15 cm, 150.79 cc, and 189.58 g, respectively in winter. Increase in fruit size and weight in rainy season with application of Urea@15% might be due to the residual effect of nitrogen present in Urea. Similarly, specific gravity also increased significantly (1.26 g/cc) by treatment T_2 (NAA@60 ppm) in winter. Table 2 represented the pulp characters of guava as influenced by crop regulating chemicals. It was observed that the pulp weight and thickness were recorded maximum (142.77 g and 1.72 cm, respectively) with the application of NAD@60 ppm followed by NAA@500 ppm. It was evident that Urea@15% increased pulp in rainy cropping (66.11%) but it was recorded maximum (74.90%) in winter when the plants were treated with NAD@60 ppm. As a result, core: pulp ratio reduced considerably to 0.34 in winter from 0.67 in rainy cropping (under T_2-NAD@60 ppm). Fig. 1 showed the relation between increase in fruit weight and volume and clearly revealed that fruit weight increased at a higher rate in relation to fruit volume in winter compared to rainy season.

3.2. Effect of crop regulating chemicals on chemical qualities of fruits

Table 3 clearly showed that all the crop regulation treatments greatly influenced the qualities of fruits in both the seasons, however, better improvement in fruit quality was observed during winter season. The present investigation showed that the plants when treated with NAD@60 ppm (T_2), produced fruits with superior quality in respect of higher TSS and total sugars content during both the seasons (11.73 and 13.12 °B TSS, 6.71% and 8.85% total sugars, respectively in rainy and winter cropping). Though, the application of Urea@15% also improved fruit quality in rainy season, but more pronounced effect was noted with the application of NAD@60 ppm, NAA@500 ppm and also by manual deblossoming. Flower thinning with NAD@60 ppm, NAA@500 ppm, Urea@15% and manual removal of flowers also increased vitamin C content of fruits in both the seasons as compared to the control plants. Although, titratable acidity was increased with application of chemicals in winter, but did not affect the fruit quality as TSS: acid ratio also increased due to more increase in TSS. There was a linier co-relation between Vitamin C and TSS: acid ratio (Fig. 2).

3.3. Economic feasibility of crop regulation

It is evident from the data presented in Table 4 that the summer deblossoming with NAD at both concentrations (40 and 60 ppm) were found to be the promising treatments for crop regulation of guava in the economic point of view. There were few fruits recorded during rainy season under various crop-regulating treatments as compared to control plants. Interestingly, NAD@60 ppm produced more number of fruits (371.16 plant^{-1}) during winter