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Foliar Spray of NAA and GA_3 Influences on Fruit Quality Attributor Traits in Phalsa cv. Sharbati

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Original Research Article

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ABSTRACT

An experiment entitled & quot; Effect of plant growth regulators on Effect of NAA and GA_3 on Quality, Yield and Yield Attributary Traits in phalsa at the Horticulture Garden of Chandra Shekhar Azad University of Agriculture and Technology, Kanpur (U.P.) during 2018-2019. Phalsa fruits are small and abundantly produced. They don't mature within a certain time, which makes them difficult to grow. They have to spend more money on labour for a considerable amount of time to select They study aimed to study the influences of NAA and GA_3 plant growth regulators at four different concentrations-10, 20, 30, and 40 ppm compared to a control (water spray). Total soluble solids (^{0}Brix), Ascorbic acid (mg/100g), Acidity (%), T.S.S. Acidity ratio were measured. The results revealed that T_{13} (40 ppm NAA + 40 ppm GA_3) enhances the quality attributes of phalsa. Under the control treatment, the acidity (%) showed maximum however, the application of plant growth regulators produced minimum acidity (%) content.

Keywords: NAA; GA_3; PGR; growth; quality and phalsa.

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1. INTRODUCTION

The phalsa (*Grewia subinaequalis* D.C.), a fruit that can be grown anywhere from a kitchen garden to a well-planned orchard plantation, is a significant indigenous fruit because of its adaptability and the cooling effect it provides, both of which are useful in the treatment of illnesses. It is a member of the major jute-producing family, which also includes other plants. In India, it's really prevalent. Along the slopes of the Himalayas, phalsa can be seen growing wild production Phalsa berries have a juice content of 50 to 60%, 11% sugar, 2 to 2.5% acidity, 14.4% carbohydrate, 1.5% protein, 0.9% fat, 129 mg pulp/100 g, 89 mg phosphorus, 3.1 mg iron, traces of vitamin C, and 49 IU of vitamin B1 [1].

In Uttar Pradesh, West Bengal, Punjab, Madhya Pradesh, and Bihar it is cultivated commercially. Along with these, it is also minimally grown in the states of Maharashtra, Gujarat, and Andhra Pradesh [2-5]. Despite the lack of exact data, it is believed that India has 0.0002 million acres of this crop under cultivation. Phalsa is a deciduous plant with a propensity of losing its leaves in the winter, which allows it to tolerate cold. In the axis of the leaves of the young stalk, Phalsa develops fruit in clusters [6,7]. It mostly serves as fresh fruit and is refreshing. Auxins and gibberellins, two growth agents, have been used successfully to increase fruit set and production in numerous fruit crops, including phalsa. Similar findings were made by Chandra et al. [8].

Foliar feeding plant growth regulators improved better formation and translocation of food, as well as hormonal signalling by gibberellins [9-11]. Fruit characteristics such as length, width, pulp-stone ratio, and weight of 50 fruits were increased as a result. Gibberellins' reductions in acidity as a result of hormone administration [could be related to an increase in carbs being transported and an increase in metabolism as a result of the conversion of acids to sugar]. Numerous studies on fruit crops, like Singh et al. [12] and Byas et al. [13].

Attest to the improvement in fruit quality brought about by gibberellins. By synthesizing the catalytic activity of numerous enzymes and co-enzymes that are crucial for the manufacture of ascorbic acid, plant growth regulators may also raise the ascorbic acid concentration in fruits.for and colleagues' early maturation of phalsa fruits and other physio-chemical characteristics, such as fruit length and width, the weight of 50 fruits, pulp-stone ratio, ascorbic acid contents, total soluble solids, and sugars through better formation and translocation of carbohydrates, to be improved by plant growth regulators Kacha et al., [14]. Phalsa fruits are little and abundantly produced. They don't mature within a certain time, which makes them difficult to grow. They have to spend more money on labour for a considerable amount of time in to select fruit [15-17]. Fruit must also be thrown out right away because it cannot be kept for more than a few hours.

2. MATERIALS AND METHODS

The present investigation was carried out in the Horticulture Garden Department of Fruit Science, College of Horticulture, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur during the year 2018-2019.

2.1 Experimental Design and Treatments

Sharbati Phalsa cultivar tress that was uniform healthy, and well established were chosen for the experiment's goal, the tress, which were around 15 years old, were maintained in good condition by adhering to the recommended Fertilizer doses and other horticultural practices. As a consequence, 39 units were selected on 13 Phalsa tresses, and the experiment proceeded as planned. The experiment included Thirteen treatments, each of which included foliar spray of NAA, GA_3 and control. The treatments were follows- T_1Control (water spray), T_2 (10 ppm NAA), T_3 (20 ppm NAA), T_4 (30ppm NAA), T_5 (40ppm NAA), T_6 (10 ppm GA_3), T_7 (20 ppm GA_3), T_8 (30 ppm GA_3), T_9 (40 ppm GA_3), T_{10} (10 ppm NAA + 10 ppm GA_3), T_{11} (20 ppm NAA + 20 ppm GA_3), T_{12} (30 ppm NAA + 30 ppm GA_3), T_{13} (40 ppm NAA + 40 ppm GA_3). The spraying was carried out when buds were fully swollen in 2019 on randomly tagged plants and the second spraying was done at the full fruit setting stage.

2.2 Parameters of Study

2.2.1 Total soluble solids (^{0}Brix)

Total soluble solids of berry juice were determined with the help of a Hand Refractometer. The TSS was expressed in Brix^0. The temperature was mild above or below 20^{0}C [18].

2.2.2 Ascorbic acid (mg/100 g)

Ascorbic acid was extracted from the pulp by macerating 5 g of sample with 3%

metaphosphoric acid (MPA) solution. The extract was filtered and volume made to 25 ml in a volumetric flask. Two ml of the aliquot was taken and titrated against standardized blue dye till the light pink color appeared which was taken as an end point [19].

2.2.3 Acidity (%)

It was estimated in the laboratory of Horticulture, Department of Fruit Science C.S.A.U.&T. in Kanpur terms 20 ml fruit juice solution was pipetted into a 100 ml flask and then distilled water was added to up to 100 ml. shaken well to dissolve. About 0.25 ml of diluted fruit juice was pipetted into a 250 ml beaker, and three drops of Phenolphthalein indicator were added. The burette was filled with N/10 NaOH solution and the juice was titrated with alkali solution until the pink end point was reached. End point developed readings were recorded and the percentage acidity was calculated by the following formula and expressed in terms of citric acid.

Titrable acidity (%) =×100

2.2.4 T.S.S. Acidity ratio

T.S.S. was worked out with the help of a Hand Refractometer as above and acidity obtained as above said methods gave their ratio which was calculated mathematically.

2.3 Statistical Analysis

2.3.1 Standard error of mean

The standard error (S.E.) and critical difference (C.D.) values were calculated by the following method as described below,

Formula:

$$\mathrm{SE(Mean)}\pm = \sqrt{\frac{2\mathrm{MSE}}{\mathrm{r}}}$$

Where,

MSE = Mean sum of square due to error
r = Number of replication
t = Number of treatment

2.3.2 Critical difference

The critical difference at 5% at level of probability was workout to compare treatment means wherever “F” test will be significant.

The calculation of C.D. at 5% was calculated with the help of following formula:

C. D.=

$$SEm \pm \sqrt{2} \times tabulated\ value\ error\ d.f.\ at\ 5\%$$

Where,

C. D.= Critical difference
SE (m) ± = Standard error of mean

3. RESULTS AND DISCUSSION

3.1 Results

Fruit quality including total soluble solids, ascorbic acid, ascorbic acid, acidity, and T.S.S Acidity ratio were dramatically enhanced by foliar spray of GA_3 and NAA the biochemical components of fruit were changed over control by application of the mentioned Plant Growth Regulators.

Total soluble solid (^{0}Brix): The foliar spray of T_{13}(40 ppm NAA + 40 ppm GA_3), showed the highest significant (P<0.05) total soluble solids (20.12°Brix). The plants that were left untreated (Control) showed the lowest total soluble solids (16.60°Brix) (control). Total soluble solids ranged from 16.60 to 20.12°Brix, with treatment T_{13} (40 ppm NAA + 40 ppm GA_3) being applied over control resulting in a maximum of 40.24%. This increase in total soluble solids of treated juice may be the result of a rise in plant hormone-mediated mobilization of carbohydrates from the source to sink fruit. In addition, these growth regulators stimulated enzymatic activity, converted carbohydrates into simple sugar, and released nitrogen, which strengthened the fruit juice and increased the amount of total soluble solids in the berry fruit.

Ascorbic acid (mg/100 g): The results of the experiments revealed a substantial difference in the ascorbic acid contents of the Phalsa fruit when gibberellin and naphthalene acetic acid, was applied; all of the treatments were determined to be significantly different from the control. The treatment of T_{13} (40 ppm NAA + 40 ppm GA_3) resulted in the highest ascorbic acid concentrations (29.86 mg/100g) that could be produced. The control treatment (T_1) had an impact on the lowest ascorbic acid concentration (24.67 mg/100 g). The increase in ascorbic acid content has been demonstrated due to metabolic activities involving specific enzymes. The

Table 1. Influences of foliar spray of NAA and GA_3 on total soluble solid (^oBrix), ascorbic acid (mg/100 g), Acidity (%), T.S.S. acidity ratio of Phalsa cv. Sharbati

Sr. No.	Treatments	Total Soluble Solid (^obrix)	Ascorbic Acid (mg/100g)	Acidity (%),	T.S.S. Acidity Ratio
1.	T_1Control (00 ppm water spray)	16.60	24.67	1.87	8.88
2.	T_2 (10 ppm NAA)	17.25	25.89	1.52	11.35
3.	T_3 (20 ppm NAA)	18.15	26.81	1.44	12.60
4.	T_4(30ppm NAA)	18.65	27.63	1.36	13.71
5.	T_5(40ppm NAA)	18.88	28.86	1.31	14.41
6.	T_6(10 ppm GA_3)	18.64	26.96	1.61	11.58
7.	T_7(20 ppm GA_3)	18.77	27.83	1.57	11.95
8.	T_8(30 ppm GA_3),	19.31	28.49	1.52	12.70
9.	T_9 (40 ppm GA_3)	19.50	29.66	1.46	13.26
10.	T_{10}(10 ppm NAA + 10 ppm GA_3)	18.65	27.66	1.54	12.11
11.	T_{11}(20 ppm NAA + 20 ppm GA_3)	18.86	28.89	1.48	12.74
12.	T_{12}(30 ppm NAA + 30 ppm GA_3)	19.92	29.27	1.36	14.65
13.	T_{13}(40 ppm NAA + 40 ppm GA_3)	20.12	29.86	1.31	15.36
SEm (±)		**0.147**	**0.099**	**0.028**	**0.082**
C.D. at 5% level		**0.304**	**0.205**	**0.059**	**0.171**

ascorbic acid content improvement may be attributable to the actual synthesis of glucose-6 phosphate during fruit growth and development, which is thought to be a precursor to ascorbic acid (vitamin C). With the use of plant growth regulators like GA_3 and NAA as well as the strengthening of the nitrogen nutrient.

Acidity (%): The data scenario showed that NAA and GA_3 reduced the acidity of Phalsa fruit. Treatment of T_5 (40ppm NAA), T_{13}(40 ppm NAA + 40 ppm GA_3) and T_1Control (00 ppm water spray) displayed 1.31 and 1.87% acidity content, respectively.

T.S.S. Acidity ratio: Increasing concentrations NAA progressively improved the T.S.S. acidity ratio irrespective of the growth regulators. Treatment T_{13}(40 ppm NAA + 40 ppm GA_3) caused significant improvement revealing 15.36. However, foliar spray of GA_3 improved the T.S.S. acidity ratio significantly. Plants under control showed a significantly P ($P<0.05$) poorest ratio (8.88). Treatment of 10, 20, 30 and 40 ppm GA_3 expressed the ratio of 11.58, 11.95,12.70 and 13.26. The interaction of NAA and GA_3 caused further improvement in ratio and expressed 12.11, 12.74, 14.65 and 15.36 ratio.

3.2 Discussion

The TSS was significantly increased (20.12 ^{0}Brix) with the treatment of T_{13}(40 ppm NAA + 40 ppm GA_3) followed by T_{12}(30 ppm NAA + 30 ppm GA_3) (19.92^{0}Brix). The increase in of soluble solids was expressed in ^{0}Brix. The present findings are in conform with those reported by Sandhu and Bal (1990) in bear and Biswas (1988) in guava.

NAA & GA_3 gave significantly increased Ascorbic acid (29.86mg/100g), It might be due to an increase in the synthesis of catalytic activity of several enzymes and co-enzymes which are instrumental in ascorbic acid synthesis.

Kacha (2012) in phalsa also reported increased TSS and acidity with NAA 40 ppm followed by NAA 30 ppm. Lower concentration of both i.e.10 ppm each of NAA (1.52%) and GA_3 (1.61%) caused greater acidity content. The reason for decreasing acidity might be due to hormones application (GA_3 and NAA) owing to increased translocation of carbohydrates and increased metabolism due to of conversion of acids to sugar.

4. CONCLUSION

From the present investigation it can be concluded that T_{13}(40 ppm NAA + 40 ppm GA_3) increased Total soluble solid (^{o}Brix), Ascorbic acid (mg/100g), T.S.S. Acidity ratio and Acidity (%) maximum in under control treatment. The TSS acidity ratio was induced greater under the foliar application of T_{13}(40 ppm NAA + 40 ppm GA_3). Phalsa grower may be recommended the application of these plant growth regulators for obtaining better return under the agro-climacteric conditions of Central Uttar Pradesh.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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