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Effect of Foliar Application of GA_3, NAA and Urea on Fruit Growth, Retension and Drop in Ber under Kanpur Condition

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ABSTRACT: The current study was conducted from 2019 to 2020 in a well-established ber orchard at the College of Horticulture Chandra Shekhar Azad University of Agriculture and Technology in Kanpur, Uttar Pradesh. A total of 13 uniformly sized and vigorous ber trees were chosen, and different nutrient concentrations of GA_3 (10, 15 and 20 ppm), NAA (20, 30 and 40 ppm), and urea (1.0, 1.5 and 2%) were sprayed on them. Thirteen treatments that were reproduced three times were used in the CRD (Completely Randomized Design) structure of the study. Fruits were examined in a laboratory for their various features. The present study's findings showed that the use of GA_3 20 ppm + NAA 40 ppm + urea 2% (T_{12}) significantly improved the fruit characters of fruit set (170), fruit drop (84.25%), fruit retention (15.75%), volume (15.65 cc, length (4.45cm), weight (15.4 g), diameter (2.98 cm), pulp weight (14.38 g), and pulp stone ratio (14.10).

Keywords: Ber, GA_3, NAA, Urea, Growth and Quality.

INTRODUCTION

Zizyphus mauriatiana, also called the Chinese date, Chinese apple, Jujube, Indian plum, Regipandu, Indian jujube, is a tropical fruit tree that is a member of the Rhamnaceae family. The ber (*Zizyphus mauritiana* Lamk.), a well-known indigenous fruit of China and India, has a long history of being linked to Indian culture. Up to a height of 1500 metres above mean sea level, it can be found in the tropics in both domesticated and wild forms. Even in the most delicate subtropical and tropical environments, it is cultivable. Because of its strong economic returns, low cultivation costs, wide range of adaptation and capacity to endure drought, ber is extensively used. It grows in practically every region of India, both in cultivated fields and in a wild or semi-wild state (Devi *et al.*, 2019). In India, the major ber-growing states are Uttar Pradesh, Bihar, Madhya Pradesh, Punjab, Haryana, Rajasthan, Gujarat, Maharashtra, and Andhra Pradesh. In Uttar Pradesh, the major ber-growing regions are Varanasi, Aligarh, Faizabad, Agra, and the Rae Bareli district. Ber is one of the most well-known and historically significant tropical fruits. It is frequently grown due to its hardiness and capacity for weight in a variety of soil types and weather conditions, including drought. It is a tiny tree or shrub that is 8 to 10 m tall with stipular spines, a spreading crown, and numerous drooping limbs. The trunk has a minimum diameter of 40 cm. The size and form of the fruit might vary. Depending on the type, it may be up to 2.5 cm (1 inch) long and have a range of forms, including oval, ovulate, or round. Crisp white colour flesh is present (Gangadhar *et al.* 2019). This fruit has a wonderful aroma when it is a touch under ripe and a little moist. The fruit's skin is silky, shiny, trim, and tight. Numerous genetic, physiological, dietary, hormonal, and environmental factors influence how the fruit develops. In this scenario, plant growth regulators are essential. These are used to thin out fruits and flowers, propagate plants vegetatively, induce seedlessness artificially, boost fruit output, stop preharvest fruit drop, manage flowering, restrain growth, and regulate preharvest fruit drop. A variety of plant regulators are used to enhance fruit set, fruit drop, size, and quantity of fruit, including NAA, 2,4-D, 2,4,5-T, GA_3, and TIBA. NAA (Auxin) suffocates

the pedicle, which also prevents fruit drop. The fruit pedicle is now more easily visible. High auxin concentrations in the abscission zone stop the fruit from falling. Despite the fact that many scientists have occasionally experimented on a variety of fruit crops, ber is also included in this technique. But in this area, they came up short (Kumar *et al.*, 2022).

Gibberellins are primarily used to regulate physiological processes, but they can also be utilised commercially to enhance the fruit quality of various crops, such as apples, grapes, citrus, grapefruit, and berries. The extension of rachis cells, floral thinning, and grape berry growth are three physiological processes that have all been affected. The capacity of GA_3 to delay fruit senescence has also helped citrus, and a more recent study reveals that GA_3 may even promote apple blooming. In Ber, GA_3 has been reported to encourage fruit set and reduce fruit drop (Gill and Bal 2013).

MATERIAL AND METHODS

The current study was conducted from October 2019 to March 2020 in the College of Horticulture's Fruit Science Department at Chandra Shekhar Azad University of Agriculture and Technology in Kanpur. For the purpose of the experiment, uniform and healthy ber trees were selected, which were about 47 years old and followed the suggested fertiliser doses and other horticultural practices. The entire orchard was kept tidy and regularly cared for throughout the research. 13 ber trees and three distinct branches from each tree were chosen and used as a single unit (for one treatment). Thus, 39 units were chosen from 13 ber trees, and the experiment was carried out in accordance with the plan. The experiment included 13 treatments, each of which included foliar sprays ofGA_3, NAA, Urea and control. The treatments are as follows- T_0 Control (water spray), T_1 (GA_3 @10 ppm), T_2 (GA_3@15ppm), T_3 (GA_3@20ppm), T_4 (NAA@20ppm), T_5 (NAA@30ppm), T_6 (NAA@40ppm), T_7(Urea @1.0%), T_8 (Urea @1.5%), T_9 (Urea 2%), T_{10} (GA_3 10 ppm + NAA 20 ppm + Urea 1.0%), T_{11} (GA_3 15 ppm + NAA 30 ppm + Urea 1.5%), T_{12} (GA_3 20 ppm + NAA 40 ppm + Urea 2%). Foot sprayers with varied solution concentrations were sprayed in the early morning to completely soak a few chosen branches. Only the use of water spray is permitted for control. When the fruit setting stage was active, a uniform spray of plant growth regulators and urea was sprayed to the leaves of each treatment. Fruit drop percent, fruit retention percent, fruit size and weight, fruit pulp weight, fruit yield, and fruit quality were noted after application of different treatments. By counting the initial fruit set prior to spraying and the fruit retained after spraying, fruit drop and fruit retention percentages were calculated. Vernier callipers were used to measure fruit size. Fruit was weighed on an electronic balance during harvest, and the production of fruit per plant was calculated. Weight of pulp was removed from the ber after the stone was removed. The T.S.S. of berries was measured using an Erma hand refractometer, and the levels of total sugars, titratable acidity, and ascorbic acid were assessed using techniques recommended by the A.O.A.C. (1980).

RESULTSANDDISCUSSION

Fruit Drop and Fruit Retention. By spraying plant bio-regulators and urea at various concentrations, it is evident from the data in Table 1 that fruit drop percentage was greatly decreased and fruit retention % was significantly raised. From the plants sprayed with the mixture of GA_3 20 ppm + NAA 40 ppm + Urea 2%, significant reductions in fruit drop (84.25%) and maximum fruit retention (15.75%) were observed. Maximum fruit loss (93.15%) and minimal fruit retention (6.85%) were, however, observed under control. This better control of fruit drop and enhancement of retention of more fruits on the plants may be the result of the effect of various chemicals on the metabolic activities of the plant and improved source-sink relationships, which favourably influenced the metabolic status. This increased fruit retention and reduced fruit drop may be the result of these factors. Similar results were also reported by Zang and Lei (2000); Umashankar *et al.* (2002) in guava, Singh *et al.* (2001); Sharma *et al.* (2011); Devi *et al.* (2019); Gangadhar *et al.* (2019) in ber.

Fruit size and weight. Applications of plant bio-regulators and urea were observed to improve average fruit length and width (Table 1). With the combination spray of GA_3 20 ppm + NAA 40 ppm + Urea 2%, the maximum fruit length (4.45 cm) and width (2.98 cm) were measured, whilst the lowest fruit length (3.21 cm) and width (2.15 cm) were measured under control. The involvement of GA_3, NAA, and urea in hormone metabolism, enhanced cell division, elongation, and expansion of cells may be the cause of the potential increase in fruit size. According to Lal *et al.* (2001); Lal and Dhaka (2003); Sharma *et al.* (2011); Gami *et al.* (2019) in ber, these results are consistent.

The spraying of plant bio-regulators and urea, either together or separately, greatly increased the weight of the fruit (Table1). The optimum treatment in the current investigation was determined to yield fruits with the highest weight: GA_3 20 ppm + NAA 40 ppm + Urea 2%. (15.40 g). Fruits with the smallest weight (11.12 g) were nevertheless produced under control. The synthesis of more photosynthates and their translocation to the fruits have been improved by this chemical and plant bio-regulators, which may have boosted the weight of fruit in the current study. These result are in conformity with those of Singh *et al.* (2001); Gami *et al*. (2019) in ber.

Table 1: Effect of foliar application of GA_3, NAA and Urea on fruit growth, retension and drop in ber under Kanpur condition.

Symbols	Treatments	Fruit drop (%)	Fruit retention (%)	Fruit Length (cm)	Fruit width (cm)	Fruit volume (cc)	Fruit weight (g)	Pulp weight (g)	Stone weight (g)	Pulp/stone ratio
T_0	Control (water spray)	93.15	6.85	3.21	2.15	10.61	11.12	9.89	1.23	8.04
T_1	GA_3 10 ppm	87.80	12.20	4.35	2.91	15.30	15.05	13.92	1.13	12.32
T_2	GA_3 15 ppm	87.25	12.75	4.32	2.89	15.21	14.95	13.81	1.14	12.11
T_3	GA_3 20 ppm	86.85	13.15	4.26	2.85	15.00	14.74	13.59	1.15	11.82
T_4	NAA 20 ppm	86.25	13.75	4.04	2.71	14.20	14.02	12.86	1.16	11.70
T_5	NAA 30 ppm	88.90	11.10	3.97	2.66	13.95	13.76	12.58	1.18	10.66
T_6	NAA 40 ppm	89.15	10.85	4.02	2.69	14.12	13.91	12.74	1.17	10.89
T_7	Urea 1.0 %	85.75	14.25	4.20	2.81	14.75	14.53	13.37	1.16	11.53
T_8	Urea 1.5 %	85.45	14.55	4.25	2.85	14.95	14.74	13.61	1.13	12.04
T_9	Urea 2%	85.10	14.90	4.32	2.89	15.20	14.95	13.83	1.12	12.35
T_{10}	GA_3 10 ppm + NAA 20 ppm + Urea 1.0 %	84.85	15.15	4.36	2.92	15.35	15.10	14.01	1.09	12.85
T_{11}	GA_3 15 ppm + NAA 30 ppm + urea 1.5%	84.55	15.45	4.420	2.96	15.55	15.30	14.25	1.05	13.57
T_{12}	GA_3 20 ppm + NAA 40 ppm + Urea 2 %	84.25	15.75	4.45	2.98	15.65	15.40	14.38	1.02	14.10
SE (d)		1.36	0.90	0.23	0.67	0.90	0.49	0.52	0.03	0.29
C.D. at 5%		2.79	1.40	0.46	0.14	1.86	1.02	1.07	0.06	0.61

Fruits volume (cc). The foliar application of plant bio-regulator and urea greatly boosted fruit volume (Table 1). Fruits obtained from plants treated with GA_3 20 ppm + NAA 40 ppm + Urea 2% (15.65 g), followed closely by GA_3 15 ppm + NAA 30 ppm + urea 1.5% (15.55 g), had significantly higher fruit volumes than fruits harvested from untreated (control) plants, which had the lowest fruit volumes (10.61 g). The pulp content of the fruits was much higher under all other treatments than it was under the control. These findings are in conformity with the findings of Gami *et al.* (2019); Devi *et al.* (2019) in ber; Singh *et al.*(2009); Singh and Singh (2015) in aonla.

Fruit pulp weight. The foliar application of plant bio-regulator and urea significantly increased fruit pulp weight (Table 1). Fruits taken from plants treated with GA_3 20 ppm + NAA 40 ppm + Urea 2% (14.38 g), followed closely by GA_3 15 ppm + NAA 30 ppm + urea 1.5% (14.25 g), had much more weight of pulp than fruits harvested from untreated (control) plants, which had fruits with the least amount of pulp (9.89 g). The pulp content of the fruits was much higher under all other treatments than it was under the control. These results are consistent with those from aonla studies by Verma *et al.* (2016); Chandra *et al.* (2015).

Fruits tone weight and pulp: stone ratio. Utilizing plant bio-regulator and urea as compared to the control resulted in a decrease in stone weight and an increase in the pulp: stone ratio (Table 1). Maximum weight of stone and minimum pulp: stone ratio were recorded under control (1.23 g and 8.04%, respectively), whereas fruits produced from plants treated with GA_3 20 ppm + NAA 40 ppm + Urea 2% followed by GA_3 15 ppm + NAA 30 ppm + Urea 1.5% (1.05 g and 13.57%, respectively) showed the lowest weight of stone and highest pulp: stone ratio. The increased accumulation of food substances in the mesocarp's elongated cells and intercellular space may be the cause of the improvement in the pulp to stone ratio. These results have got the support the findings of Singh et al. (2009) in aonla, Painkra *et al.* (2012) in mango and Godara *et al.* (2001); Devi *et al.* (2019); Gami *et al*. (2019) in ber.

CONCLUSION

In this study, a number of parameters changed in response to the application of plant growth regulators, including GA3, NAA, and urea, as well as their combination treatments. The combined treatments of GA3 20 ppm + NAA 40 ppm + urea 2% significantly improved the fruit characters of fruit set (170), fruit drop (84.25%), fruit retention (15.75%), volume (15.65 cc, length (4.45cm), weight (15.4 g), diameter (2.98 cm), pulp weight (14.38 g), and pulp stone ratio (14.10). According to the findings' scenario, the current trial demonstrated that the combined treatment of (GA3 20 ppm + NAA 40 ppm + urea 2%) was more effective. Therefore, it is suggested that researchers, orchardists, farmers, and students spray this treatment on Ber trees in order to boost productivity and raise profits.

FUTURE SCOPE

Plant growth regulator and urea which lowers production costs and increases productivity, were the greatest ways to cultivate ber in a way that was environmentally friendly.

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Conflict of Interest. None.

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