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"Effect of foliar application of micro-nutrients and plant growth regulators on growth and yield attributing traits in ber cv. – Banarasi karaka"

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Abstract

The present study was conducted with objective to know the effect of micronutrients and plant growth regulators on growth, yield of ber Banarasi Karaka cultivar. The investigation was undertaken on the "Effect of foliar application of micro-nutrients and plant growth regulators on growth and yield attributing traits in ber cv. – Banarasi karaka" at horticulture orchard, department of horticulture, Janta College Bakewar, Etawah U.P. well established healthy trees of ber cultivar were selected for the purpose of experimentation. The experiment was investigated in randomized block design known as (RBD) with ten treatments comprising of each three levels of Boron, NAA, IBA respectively. A field experiment was escort to assess the effect of Boron (0.02%), Boron (0.04%), Boron (0.06%), NAA (10ppm), NAA (20ppm) and NAA (30ppm), IBA (10ppm), IBA (20ppm) and IBA (30ppm). The results clearly showed that the foliar application of treatment T_7 (NAA 30ppm) proved most effective followed by T_{10} (IBA 30ppm) in all the treatment enhance the fruiting characteristics like fruit set, fruit retention and the minimum fruit drop contain in treatment T_7, physical characteristics like fruit length, fruit weight, fruit volume, weight of pulp, weight of stone, weight and volume ratio, pulp stone ratio and fruit yield per tree. However, the treatment T_1 (control) showed minimum value in all the treatments.

Keywords: micronutrients, plant growth regulators, foliar application, RBD, fruiting characteristics

Introduction

Ber or Indian jujube (*Zizyphus mauritiana Lamk.*) belongs to family Rhamnaceae, is one of the ancient and common fruit of India and China, being cultivated over 4000 years. It has wide adaptability because of which it is cultivated practically all over India especially in arid and semi-arid regions for its fresh fruits. Therefore, it is also called as 'the apple of arid zone fruits'. The important provinces for ber cultivation in India are Madhya Pradesh, Uttar Pradesh, Andhra Pradesh, Bihar, Assam, Punjab, Haryana, Gujarat and Rajasthan. **Singh and Sharma (2020)** reported that over the years the crop is now widely domesticated and commercial orchards of Ber are now available. With wide commercialization, many physiological problems, i.e. flowers and fruit drop, embryo abortion, poor flowering and fruit setting, abnormal and small size fruits etc. were observed which cause huge loss to the growers. In order to minimize these problems, over the years many experiments and advancement have been done and among them, usage of plant growth regulators is one of the most adopted methods and is utilized to improve flowering, fruiting and yield with improved fruit quality.

Ber is a fruit crop that can be cultivated in a range of soil types, including deep sandy loams with neutral or slightly alkaline reactions, making it a hardy crop. Additionally, soil with pH ranges from 6 to 9.2. In addition to being eaten fresh, the fruits can be candied, dried, and used to make other products like ber butter and squash or juice. It also has healing qualities. Ripe fruit is stimulating, laxative, aphrodisiac, and digestible. It also has a cooling effect. It has higher levels of calcium, phosphorus, protein, and vitamin "C" than an apple Due to widespread commercialization, growers experienced significant losses because of numerous physiological issues with flowers and fruit drop, embryo abortion, poor blooming and fruit setting, a typical and small-sized fruits, etc. Over the years, numerous trials and developments have been made to reduce these issues.

Growth regulators and micro-nutrient plays an important role in many physiological phenomena like vegetative propagation, induction of seed lessness, increase fruit set, prevention of pre-harvest fruit drop, regulation of flowering, fruit size, thinning of flower and fruits, quality of fruit as well as yield in many fruit crops. NAA is a synthetic auxin plant hormone that is routinely used greatly increase cellulose fibre formation in plant. Fruit drop is controlled by spraying of NAA at different concentration in different fruit crops. NAA also inhibits fruit drop by strengthening the pedicle. Application of NAA reduces excess number of fruits on the branch thus promoting the growth of evenly spaced fruits on branch and directly plays a major role in increasing the overall fruit quality. **Krishna Pratap Singh *et al.*, (2021)** were found maximum fruit set by the spray of NAA 30 ppm and can be used in increasing the quality in the ber fruit. Fruit trees are considered high value crops and even small modifications in production efficiency, product quality or enhanced appeal have the potential to significantly increase the product value **Sesbian *et al.*, (2019).**

The beneficial effect of foliar application of PGRs and nutrients is based on the fact that the nutrients reach directly to leaves, buds, petioles and flowers etc which are the sites of metabolism. Micronutrients like boron also has a positive effect on ber fruit set, yield, fruit quality and storage-life **Samant *et al.*, (2008).** Keeping these facts in view, a field experimental in foliar application of micro-nutrients and plant growth regulators on growth and yield attributing traits in 'Gola' ber cv – Banarasi karaka.

Materials and Methods

The current research work was carried out at the horticulture orchard of department of horticulture, Janta College, Bakewar, Etawah (U.P.), during the research year a field experiment was escort to assess the "**Effect of foliar application of micro-nutrients and plant growth regulators on growth and yield attributing traits in ber cv. – Banarasi karaka".** The experiment was laid out the experimental design employed was randomized block design and each treatment comprised of a single plant and was replicated

three times, the statistical analysis of the data was calculated as suggested by **Panse and Sukhatme (1985).** The application of boron, NAA and IBA enhance fruiting characteristics like fruit set, fruit retention, fruit drop, physical characteristics like fruit length, fruit weight, fruit volume, weight of pulp, weight of stone, weight and volume ratio, pulp stone ratio and fruit yield per tree.

Results and Discussion

Boron (B) is an essential micronutrient for plants, and it plays a crucial role in the growth and development of ber (*Ziziphus mauritiana*). Boron is essential for the development and maintenance of cell walls, fruit set and development and sugar transport in ber plants. PGRs (Plant Growth Regulators) are involved in a variety of physiological processes, including vegetative propagation, induction of seedlessnes, increased fruit set, prevention of pre-harvest fruit drop, blooming regulation, fruit size inhibition, flower and fruit thinning. In the present investigation the applying foliar application on plant growth regulators and micronutrients proved significantly effective in raising the percentage of fruiting characteristics like fruit set, fruit retention, fruit drop, physical characteristics like fruit length, fruit weight, fruit volume, weight of pulp, weight of stone, weight and volume ratio, pulp stone ratio and fruit yield per tree.

During the experiment in ber, the application of various treatments proved significantly effective in improving the fruit set, it also clearly indicates in ber that the effect of Boron, NAA and IBA on the fruiting character in *Zizyphus mauritiana Lamk*. That the greatest fruit set (36.57%) was observed in NAA (30ppm) followed by fruit set (34.17%) was found in IBA (30ppm). Yet, the control showed comparatively least fruit set (24.23%) is measured during the investigation of ber fruit. The highest value of fruit retention (27.83%) was noticed in NAA (30ppm), followed by fruit retention (26.25%) have observed in IBA (30ppm). While, the smallest value conducted during the investigation of fruit retention (18.00%) shown in the control plants. In ber fruit retention varies with varieties to varieties. There is a significant relationship between fruit retention and fruit set **Adhikary *et al.*, (2019).** The outcomes are in similar with the findings of **Indrani Majumder *et al.*, (2017)** in ber, **Sharma *et al.*, (2011)** in ber. The uttermost value of the fruit drop (61.25%) in all the treatment which is taken in the research work of ber fruit was shown lower in NAA (30ppm), followed by fruit drop (64.50%) was observed in IBA (30ppm). Hence, over the control showed highest value of fruit drop (84.37%). These results are partially consistent with findings by **Raj Bala Choudhary *et al.*, (2020)** in ber crop.

Table -1: "Effect of foliar application of micro-nutrients and plant growth regulators on fruiting characteristics of fruits in ber (*Zizyphus mauritiana Lamk*.) cv. Banarasi Karaka.

Sr. no.	Notation	Treatment	Fruit set (%)	Fruit retention (%)	Fruit drop (%)
1.	**T_1**	**Control**	**24.23**	**18.00**	**84.37**
2.	T_2	Boron (0.02 %)	27.05	19.90	80.17
3.	T_3	Boron (0.04 %)	28.11	20.54	77.66
4.	T_4	Boron (0.06 %)	33.25	24.17	66.24
5.	T_5	NAA (10ppm)	29.21	21.50	72.95
6.	T_6	NAA (20ppm)	31.75	23.07	68.35
7.	**T_7**	**NAA (30ppm)**	**36.57**	**27.83**	**61.25**
8.	T_8	IBA (10ppm)	29.05	20.95	74.35
9.	T_9	IBA (20ppm)	30.20	22.75	71.10
10.	T_{10}	IBA (30ppm)	34.17	26.25	64.50

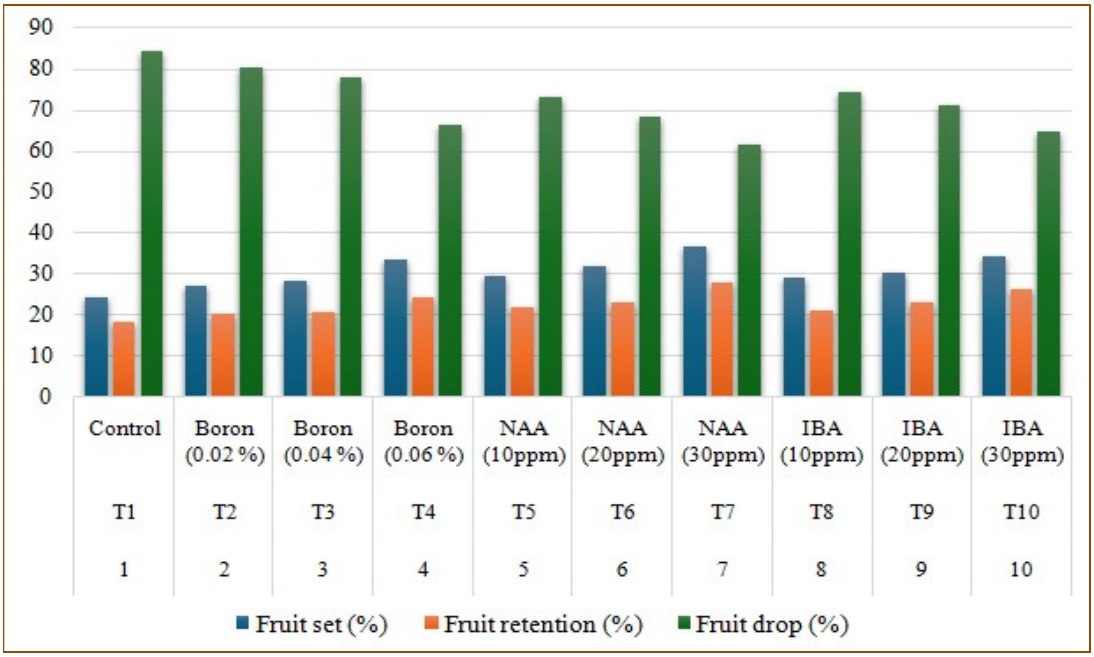

Figure -1: "Effect of foliar application of micro-nutrients and plant growth regulators on fruiting characteristics of fruits in ber (*Zizyphus mauritiana Lamk*.) cv. Banarasi Karaka.

The ongoing investigation the application of various treatments proved significantly effective an improving the fruit length, it also clearly indicates in Chinese date (ber) fruit that the effect of Boron, NAA and IBA on the physical characteristics in ber fruit. The data revealed that all the treatments had significant effects on fruit length (cm) over control plants. The largest value of fruit length was (5.47cm) found in NAA (30ppm), followed by (5.05cm) concluded in IBA (30ppm). While the fruit length of control (4.07cm) shown the lowest value. These results are corroborated by the findings of **Arora and Singh (2014)** found a significant increase in fruit size traits, i.e. fruit length, breadth, weight and volume were recorded with the application of NAA 30 ppm.

The maximum fruit weight was reported with the foliar application (16.85gm) was recorded in NAA (30ppm), followed by fruit weight (16.25gm) was significantly observed in NAA (30ppm). Thus, the minimal value over the control was (13.52gm) is measured during the investigation of ber fruit. The results are further supported by the findings of **Pankaj Kumar *et al.*, (2022).** The value of fruit volume (cc) showed that all the treatments increased except the control plants. The supreme value of fruit volume was (18.20) have noticed in NAA (30ppm), followed by fruit volume (17.22) was studied in treatment IBA (30ppm). However, the control (11.12) showed minimum value of specific gravity of fruit. These findings supported previously by **Sheel Priya *et al.*, (2023)** in ber. The largest value of weight of pulp was (14.10gm) found in NAA (30ppm), followed by (13.58gm) concluded in IBA (30ppm). While the control (11.12gm) shown the lowest value of weight of pulp.

The greatest weight of stone (2.75gm) was observed in NAA (30ppm) followed by weigh of stone (2.67gm) was found in IBA (30ppm). Yet, the control showed comparatively least weight of stone (2.40gm) is measured during the investigation of ber fruit. The maximum weight and volume ratio was reported with the foliar application (1.08) was recorded in NAA (30ppm), followed by weight and volume ratio (1.06) was significantly observed in NAA (30ppm). Thus, the minimal value of weight and volume ratio over the control was (0.98) is measured during the investigation of ber fruit.

The combination of different treatment of micronutrients and plant growth regulators are significantly affected by pulp stone ratio, the maximum pulp stone ratio (5.12) was noticed in treatment NAA (30ppm), followed by pulp stone ratio (5.08) was found in treatment IBA. However, the control showed minimum value of pulp stone ratio (4.63). These results are in similar with the findings of **Yadav *et al.*, (2014) in ber.** The fruit yield (Kg/tree) showed that all the treatments increased the fruit yield except the control. The supreme value of fruit yield was (42.50 Kg/tree) have noticed in application of NAA (30ppm), followed by fruit yield (40.17 Kg/tree) was observed in IBA (30ppm). Hence, over control showed minimal value of fruit yield (28.10 Kg/tree) respectively. These results are in similar with the findings of **Gill K.S. and Bal J.S. (2013), Bhosale and Singh (2017)** in ber.

Table -2: "Effect of foliar application of micro-nutrients and plant growth regulators on fruiting characteristics of fruits in ber (*Zizyphus mauritiana Lamk*.) cv. Banarasi Karaka.

Sr. No.	Notation	Treatment	Fruit length (cm)	Fruit weight (gm)	Fruit volume (cc)	Weight of pulp (gm)	Weight of stone (gm)	Wt. & vol. ratio	Pulp stone ratio	Fruit yield (Kg/tree)
1.	**T_1**	**Control**	**4.07**	**13.52**	**13.80**	**11.12**	**2.40**	**0.98**	**4.63**	**28.10**
2.	T_2	Boron (0.02 %)	4.13	13.75	13.87	11.32	2.43	0.99	4.65	30.17
3.	T_3	Boron (0.04 %)	4.20	14.12	14.15	11.66	2.46	1.00	4.73	31.80
4.	T_4	Boron (0.06 %)	4.91	15.84	16.63	13.23	2.61	1.05	5.06	38.75
5.	T_5	NAA (10ppm)	4.46	14.52	14.90	12.02	2.50	1.02	4.80	35.75
6.	T_6	NAA (20ppm)	4.85	15.25	15.86	12.65	2.60	1.04	4.86	37.50
7.	**T_7**	**NAA (30ppm)**	**5.47**	**16.85**	**18.20**	**14.10**	**2.75**	**1.08**	**5.12**	**42.50**
8.	T_8	IBA (10ppm)	4.38	14.37	14.60	11.90	2.47	1.01	4.81	33.25
9.	T_9	IBA (20ppm)	4.57	14.75	15.35	12.21	2.54	1.04	4.80	36.17
10.	T_{10}	IBA (30ppm)	5.05	16.25	17.22	13.58	2.67	1.06	5.08	40.17

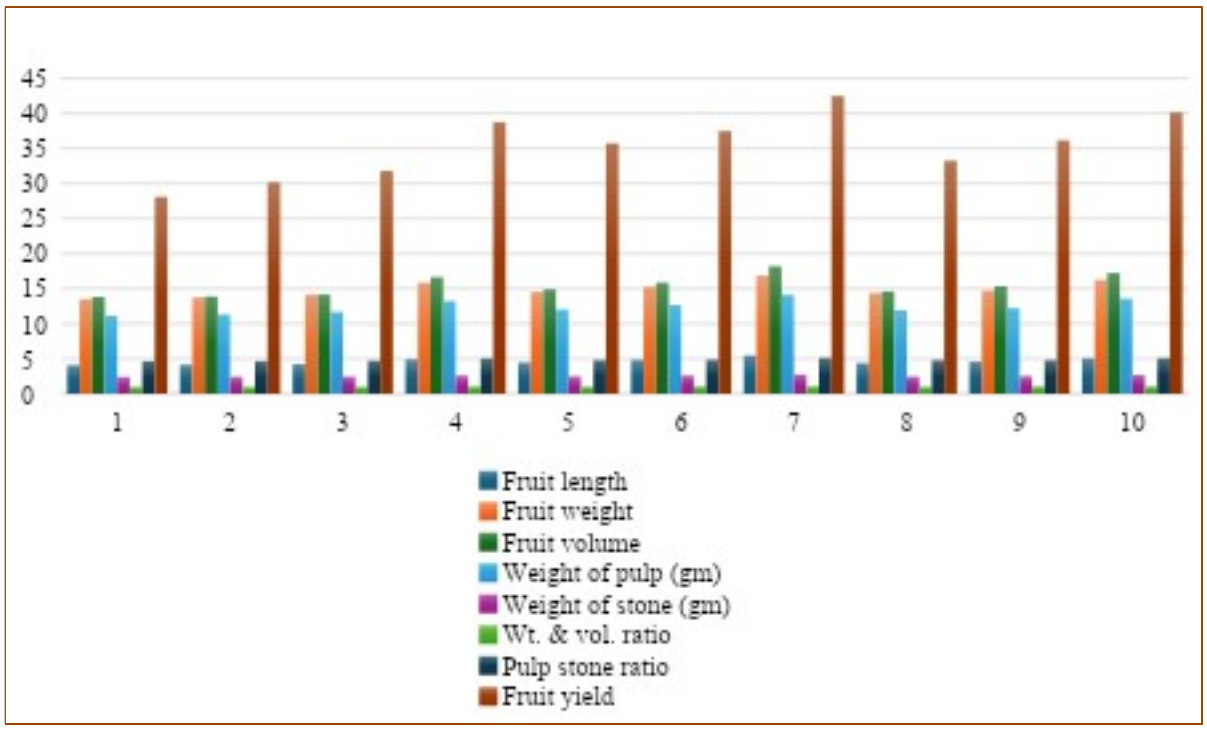

Figure -2: "Effect of foliar application of micro-nutrients and plant growth regulators on fruiting characteristics of fruits in ber (*Zizyphus mauritiana Lamk*.) cv. Banarasi Karaka.

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