Biological Forum – An International Journal **14(4): 83-87(2022)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Influence of Foliar Application of NAA, GA_3 and Zinc Sulphate on Fruiting and Yield Attributes of Ber (*Zizyphus mauritiana* Lamk.)

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(Received 17 July 2022, Accepted 19 September, 2022)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: The present experiment was conducted at the Horticulture Garden, Department of Fruit Science, College of Horticulture, of Chandra Shekhar Azad University of Agriculture and Technology, Kanpur (U.P.) during October 2019-March 2020. Well established healthy and uniform trees of Ber cultivar Banarasi Karaka The experiment comprised 9 treatments consisting of foliar spray of GA_3, NAA, Zinc Sulphate and control These treatments are as Follow- T_0 Control (water spray), T_1 (GA_3 @0 ppm), T_2 (GA_3 @20 ppm), T_3 (NAA @30 ppm), T_4 (NAA @40 ppm), T_5 ($ZnSO_4$ @0.4%), T_6 ($ZnSO_4$ @0.6%), T_7 (GA_3 @10ppm + NAA 30ppm + $ZnSO_4$ .04%), T_8 (GA_3 @20ppm + NAA @40ppm + $ZnSO_4$ @.06%). NAA 40ppm (T_4) at fruit setting stage proved significantly effective in increasing fruit weight, length of fruit, fruit volume and reducing fruit drop. and the yield attributes were however, improved with $ZnSO_4$ 0.6% (T_6) and NAA 40ppm +GA_3 20ppm +$ZnSO_4$ 0.6%(T_8). NAA, GA_3 and micronutrients Zn is very effective but spraying of NAA 40ppm hastened fruiting, yielding attributes.

Keywords: GA_3, NAA, ZINC, BER, Drop and Retention.

INTRODUCTION

The fruit known as "ber," or *Zizyphus mauritiana* Lamk., is a member of the Rhamnaceae family and is grown in a number of Hindu, Muslim, and Sikh temples in India. The jujube tree is connected to Lord Shiva, whose devotion is incomplete without the offering of jujube fruit, especially during Mahashivaratri. Typically, it is an Indo-Chinese area fruit. The world's tropical and subtropical areas are home to the about 40 species that make up the genus Zizyphus. It may be grown anywhere that is warm, up to a height of 1500 metres above mean sea level. Ber is said to be native to the region extending from South Western China and Malaya to India.

Ber fruit is a tasty fruit that contains plenty of minerals, vitamins A, C, and B complex. Iron (0.8g), protein (0.8g), calcium (0.03g), phosphorus (0.03g), carotene (70IU), and vitamin C are all present in one hundred grammes of edible fruit (50-100mg). Ber fruit has a calorific content of 55 calories per 100 grammes of fruit, compared to jack fruit's 38 mg, litchi's 42 mg, apple's 56 mg, and guava's 66. The diverse species of the genus Ziziphus have also produced several alkaloids, flavonoids, sterios tannins, saponin, and fatty acids that have been chemically separated. Due to these traits, Ziziphus species are employed as traditional remedies to cure a variety of illnesses. Ber bark is also used to treat throat issues, ulcers, sores, scabies, and burning sensations in the body. Fruits can be used to cure chronic bronchitis, fever, and enlargement of the lever as well as to cleanse and nourish the blood. Additionally, skin eruption and a dry cough are both treated with ber seeds. However, the leaves of this plant are utilised to treat diabetes mellitus.

Gibberellin is primarily utilised for controlling physiological processes and is economically employed to enhance the quality of fruit in crops including grapes, berries, citrus, cherries, and apples. It has affected the lengthening of rachis cells, the thinning of flowers, and the growth of berries in grapes. Citrus has also taken advantage of the impact of delayed fruit senescence caused by GA_3, and more recent findings have revealed that GA_3 may stimulate apple blooming. According to studies by Bankar and Prasad (1990); Kale *et al.* (1999); Singh *et al.* (2001) and others, GA_3 causes fruit set to increase and fruit drop to decrease in ber.

The excellent economic return and inexpensive cost of ber make it highly popular. Widespread adoption, cultivation, and drought resistance. The area that is dry

and semi-dry is seeing an increase in under-ber cultivation every day. Additionally, to being referred to as the "king of the fruit of the dry region," As ber has been cultivated for more than 4,000 years, it is referred to as "poor man's fruit." months in China and India. The biggest manufacturer of India. Ber with an annual population of 50,000, Ber inhabited a 50 MT are produced in India annually. A major Uttar Pradesh, Bihar, Madhya Pradesh, and Punjab are the states that are expanding Andhra Pradesh, Haryana, Rajasthan, Gujarat, and Maharashtra.

The growth and development of fruits, vegetables, and grains are thought to require zinc. It is crucial for the production of chlorophyll and is hence helpful for photosynthetic processes. IAA is synthesized with the help of several enzymes that include zinc. A lack of zinc results in "rossetting" in apples and "mottle leaf" in avocados. For foliar spray, $ZnSO_4$ is the salt that is most frequently utilized. Although several scientists throughout the world have conducted extensive study in this area, few results are now accessible in light of the significance of these hormones and nutrients.

The fruit quality of several fruits improved thanks to naphthalene acetic acid (Auxin), which also boosted fruit set and lowered fruit drop. Auxin content in plants is increased to prevent abscission (Gardner 1951). Auxin slows abscission by halting the physiological decomposition of the middle lamella's calcium pectate (Bonner, 1950; Van Overbeek, 1959). NAA (Auxin) prevents fruit dropping by strengthening the pedicle. Following fruit set and encouraging pedicle vascular growth, the fruit pedicle often displays increased visibility. According to Briggs and Leopoid (1958); Addicot and Lynch (1955), fruit drop is prevented by high auxin levels in the abscission zone.

MATERIALS AND METHODS

The present experiment was conducted at the Horticulture Garden, Department of Fruit Science, College of Horticulture, of Chandra Shekhar Azad University of Agriculture and Technology, Kanpur (U.P.) during October 2019-March 2020.

Experiment Design and Treatments. The experiment made use of the Ber Banarasi Karaka cultivar. Well established healthy and uniform trees of berthe trees were about 48 years old and were properly maintained by adopting proper horticultural practices and recommended dose of fertilizers. During the course of investigation, the whole orchard was kept under clean and uniform cultural practices. 9 trees of ber were taken and on each tree three unique branches were selected and used as one unit (for one treatment). Thus 27 unit were selected on 9 trees of ber. The experiment included nine treatments, each comprising of foliar sprays of GA_3, NAA, zinc sulphate, and control. The specifics of the treatment allocation are as Follows:

T_0 Control (water spray), T_1(10 ppm GA_3), T_2(20 ppm GA_3), T_3(30 ppm NAA), T_4(40 ppm NAA), T_5 (0.4% $ZnSO_4$), T_6(0.6% $ZnSO_4$), T_7 (10ppm GA_3 + 30ppm NAA +04% $ZnSO_4$) , T_8 (20ppm GA_3 + 40ppm NAA + 06% $ZnSO_4$). On November 20, 2019, at the fruit setting stage, plant growth regulators and urea were sprayed into the leaves of each treatment to give a homogeneous spray over the whole ber plant treatment.

Parameters of Study

Initial fruit set: The initial fruit set per panicle was recorded after spraying, by counting the total number of fruits set under tagged panicles of each treatment and average number of fruits per penicle were derived.

Fruit drop (%): The fruit drop per cent was calculated by the following equation:

$$\text{Fruit drop (\%)} = \frac{(\text{Total no. of fruit set} - \text{Total no. of fruit at harvest time})}{\text{Total no. of fruit set}} \times 100$$

Fruit Retention (%): The fruit retention per cent was calculated with following formula:

Fruit retention (%) = Number of fruits at harvest/ initial number of fruit set ×100

Fruit Volume (cc): The volume of fruit was recorded by water displacement method with the help of measuring cylinder and expressed in cc.

Fruit Length (cm): The length of fruits was measured from stem end to calyx end in centimetres at harvest with the help of Vernier callipers.

Fruit Width (cm): The width of the fruit also recorded with vernier callipers on horizontal expansion of the fruit at maximum point. The mean value was expressed in centimetres.

Fruit weight (g): The weight of ten randomly selected fruit from each treatment per replication was recorded on electric balance and the mean value was expressed in gram.

Average fruit weight = Total weight of fruits (g)/ Number of fruits

Yield (Kg/tree): The yield per treatment was recorded and expressed as fruit yield\tree in kg.

Statistical Analysis

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:

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

Where,

MSE = Mean sum of square due to error

r = Number of replications

t = Number of treatments

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

RESULTS

The observations of different parameters were recorded like Initial Fruit set, Fruit drop, Fruit Retention, Fruit Volume, Length of fruit, Width of Fruit, Fruit weight and Yield.

Initial fruit set: That treatments T_6 (0.6% $ZnSO_4$), and T_8 (20ppm GA_3 + 40ppm NAA + 06% $ZnSO_4$) resulted maximum 160 fruit set followed by T_4 (40 ppm NAA) recorded 159.

Fruit set: The tree under control T_2 (20 ppm GA_3) showed minimum fruit set (155).

Fruit drop: Treatment T 4 (40 ppm NAA) resulted in minimum fruit drop of 84.35 per cent followed by T_3 (30 ppm NAA) treatment spray giving 86.95per cent fruit drop. Maximum fruit drop was observed in control T_0 Control (water spray) having a value of 92.97 per cent. Application of $ZnSO_4$ 0.4% showing 88.40% fruit drop remaining at par with GA_3 10 ppm (88.35%).

Fruit Retention: That treatment T_4 (40 ppm NAA) resulted in maximum fruit retention (12.10), The trees under control recorded minimum fruit retention in T_0 Control (water spray) recorded 5.95).

Fruit Volume: Measured under T_0 Control (water spray) treatment, it was closely followed by T_7 (10ppm GA_3 + 30ppm NAA + 04% $ZnSO_4$), T_8 (20ppm GA_3 + 40ppm NAA + 06% $ZnSO_4$) and T_5 (0.4% $ZnSO_4$) sprays registering 12.95, 13.25 and 13.41 cc fruit volume respectively. However, these treatments did not show significant differences when compared among themselves.

Length of fruit: The treatment of T_4 (40 ppm NAA) produced significantly maximum4.85 cm length of fruit closely followed by treatment of T_6 (0.6% $ZnSO_4$) (0.6 % $ZnSO_4$) recorded 4.71 cm fruit length. The plants under control achieved significantly minimum 3.35 cm length of fruit. Treatments T_1 (10 ppm GA_3), T_2 (20 ppm GA_3), T_3 (30 ppm NAA), T_5 (0.4% $ZnSO_4$), and T_8 (20ppm GA_3 + 40ppm NAA + $ZnSO_4$) exhibiting 4.45, 4.65, 4.70, 4.41, and 4.68.

Width of Fruit: Were treated under the treatment of T_8 (40 ppm NAA) recorded 2.710 closely followed by treatment of T_3 (30 ppm NAA) indicated 2.91 fruit width. The significantly poorest 2.15 cm width was revealed under the plants which were untreated (control) closely followed by T_7 (10ppm GA_3 + 30ppm NAA + 04% $ZnSO_4$) treatment registering 2.650 cm width.

Fruit weight: Treatment of T_4 (40 ppm NAA) recorded significantly maximum 16.48 g fruit weight followed by treatment of T_3 (30 ppm NAA) noted 15.85 g fruit weight. Treatment of control (T_o) expressed lightest 12.08 g fruit weight. Treatments T_1 (10 ppm GA_3), T_2 (20 ppm GA_3), T_5 (0.4% $ZnSO_4$), T_6 (0.6% $ZnSO_4$), T_7 (10ppm GA_3 + 30ppm NAA +04% $ZnSO_4$) and T_8 (20ppm GA_3 + 40ppm NAA + $ZnSO_4$) exhibiting 14.75, 14.40, 15.05, 13.94, 14.35 and 13.55 g. Varying concentrations of different growth regulators.

Yield: The highest 29.25 kg tree-1 yield was observed as a result of T_4 (40 ppm NAA) treatment application followed by T_3 (30 ppm NAA) and T_2 (20 ppm GA_3) which registered fruit yield of 28.95 and 28.50. The lowest 21.20 kg tree-1 yield was observed in control T_0 Control (water spray) followed by T_7 (10ppm GA_3 + 30ppm NAA + 04% $ZnSO_4$) and T_8 (20ppm GA_3 + 40ppm NAA + $ZnSO_4$) registered 26.90 and 26.35 kg tree fruit yield respectively.

DISCUSSION

The maximum 160 Initial fruit set was registered with influence of treatment T_6 and T_8, $ZnSO_4$ 0.6% and GA_3 20 ppm + NAA 40 ppm $ZnSO_4$.06% showing 160 initial fruit set. The range of initial fruit set in ber varied from 155 to 160, fruit drop ranged from (84.35-92.97). The fruit length, width of fruit, fruit volume and specific gravity ranged from 3.35-4.85 cm, 2.15-2.94 cm, 10.51-14.400, cc and 1.021-1.097 g cc-1, respectively. Application of NAA 40pmm (T_4) was superior and caused an increase in fruiting attributes like fruit length (4.85 cm) width of fruit (2.94 cm), fruit volume (14.40 cc) and specific gravity (1.097 g), When compared with control (T_0). The Initial fruit set most enhanced by spray of both $ZnSO_4$ 0.6% and GA_3 20ppm + NAA 40ppm + $ZnSO_4$ 0.6% (T_6 and T_8). These results were in close proximity with the findings **o**f Banker and Prasad (1990); Pandey (1999); Ying-Yue *et al*. (2010); Pandey *et al*. (2011). Exogenous application of GA_3 inhibits the production of ethylene and higher endogenous levels of gibberellins probably counteract the effects of endogenous ABA (Abscisic acid) which has been ascribed to cause drop in fruits. Minimum (84.35%) fruit drop was observed with the spray of NAA 40ppm (T_4). It was shown by Ebeed *et al*. (2001); Pandey (2011); Kumar *et al*. (2015).

Fruit volume in ber was affected by the application of growth regulators *viz*., NAA, GA_3, and $ZnSo_4$ over control, but the concentrations did not vary significantly when compared among their respective treatments. The application of NAA, 40ppm (T_4) showed 14.40 cc volume caused significant variation in fruit volume of ber and second maximum aggressive treatments NAA 30ppm (T_3) presented 14.23 cc fruit volume in this concept. GA_3, regulates the semi-permeability of cell wall by which more water is mobilized into fruits that ultimately helps in maximum fruit volume. The findings agree with the reports of Masalkar and Wavhal (1991); Pandey (1999); Gupta and Brahmachari (2004); Bhowmick and Banik (2011).

The possible reason for enhancement in fruit size with NAA, GA_3 and $ZnSO_4$ might be due to higher synthesis of metabolites and enhanced mobilization of food and minerals from other part of the plant toward the developing fruits as it is a well-established fact that the fruit acts as extremely active metabolic sink. The enhancement of fruit size with NAA, GA_3 and $ZnSO_4$ might be due to their involvement in hormonal metabolism, increased cell division, elongation and expansion of cell. These results are in accordance with Pandey (1999); Kale *et al*. (2000).

Increase in fruit weight may be attributed to the strengthening of middle lamella and consequently cell wall, which later may have increased the free passage of solutes to the fruits. This might have led to more length and diameter of fruit and also larger weight of individual fruit. There was a positive and significant

correlation among the length of fruit with weight of fruit and diameter of fruit with weight of fruit. It was also shown by Banker and Prasad (1990); Pandey (1999); Kale *et al* (2000); Wangbin *et al.* (2008); Arora and Singh (2014); Rokaya *et al.* (2016).

The maximum pulp content was noted under lowest concentrations of all the growth regulators and micronutrients followed by medium and highest concentrations. The pulp content during study was accessed maximum under NAA 40ppm (14.04 g) followed by NAA 30ppm (13.85 g) and GA_3, 20ppm (13.69 g) being significantly superior over control. This increase may be ascribed to enhance synthesis of metabolites, increased absorption of water and mobilization of sugars and minerals in the expanded cells and intercellular space of mesocarp. These enhancements of above physiological activities are accelerated possibly due to growth promoter as well as nutrients also. Improvement in pulp content with the use of GA_3, NAA and $ZnSO_4$ has been observed by Pandey (2011); Painkara *et al.* (2012); Singh *et al*. (2012).

The yield per tree is the ultimate object of almost all the experiments. The total yield of fresh fruits was increased with the spray of NAA, GA_3, and $ZnSo_4$, at all the concentrations. The maximum increase in yield per plant is obviously due to the Increase in volume and weight of fruit with the application of NAA 40ppm, the maximum fruit yield per tree was recorded under NAA 40ppm (29.25 kg) succeeded by NAA 30ppm (28.95 kg) but minimum was under control (21.20 kg). All the growth regulators gave higher yield with every increase in concentration. In spite of growth regulator, micronutrients act positive role to hasten yield attributes which ultimately promotes yield of fruit. These results are in accordance with findings of Pandey *et al*. (2011); Singh *et al*. (2012); Omar *et al*. (2015).

Table 1: Mean performance of Foliar Application of NAA, GA_3 and Zinc Sulphate on Fruiting and Yield Attributes of Ber.

Sr. No.	Treatments	Initial Fruit Set	Fruit Drop (%)	Fruit Retention (%)	Fruit Volume (cc)	Fruit Length (cm)	Fruit Width (cm)	Fruit Weight (g)	Weight of Fruit Pulp (g)	Yield kg/trees
1.	T_0 Control (water spray)	156	92.970	5.950	10.510	3.350	2.150	12.08	10.200	21.200
2.	T_1(10ppm GA_3)	158	88.350	10.330	13.450	4.450	2.760	14.75	13.050	27.150
3.	T_2(20 ppm GA_3)	155	87.150	11.650	14.080	4.650	2.880	14.40	13.690	28.500
4.	T_3(30ppm NAA)	157	86.950	11.970	14.230	4.700	2.910	15.85	13.850	28.950
5.	T_4(40 ppm NAA)	159	84.350	12.100	14.400	4.850	2.940	16.48	14.040	29.250
6.	T_5(0.4% $ZnSO_4$)	156	88.400	10.120	13.410	4.410	2.740	15.05	13.050	27.200
7.	T_6(0.6% $ZnSO_4$)	160	87.150	11.850	13.790	4.710	2.820	13.94	13.400	27.900
8.	T_7(10ppm GA_3 + 30ppm NAA + 04% $ZnSO_4$)	157	87.750	10.450	12.950	4.480	2.650	14.35	12.610	26.350
9.	T_8(20ppm GA_3 + 40ppm NAA +06% $ZnSO_4$)	160	87.050	11.750	13.250	4.680	2.710	13.55	12.890	26.900
	SEm (±) **C.D. at 5% level**	**1.8256** **2.5815**	**1.6340** **3.4646**	**0.2988** **0.6348**	**0.2793** **0.8368**	**0.0876** **0.2597**	**0.0365** **0.1154**	**0.2807** **0.721**	**0.2309** **0.6926**	**0.4139** **1.2412**

CONCLUSION

From the present investigation it can be concluded that NAA 40ppm (T_4) at fruit setting stage proved significantly effective in increasing fruit weight, length of fruit, fruit volume and reducing fruit drop. and the yield attributes were however, improved with $ZnSO_4$ 0.6%(T_6) and NAA 40ppm + GA_3 20ppm + $ZnSO_4$ 0.6%(T_8). These results obtained in present investigation in my own research and this is unique and very useful for research workers, orchard owner and farmer of central U.P. So, I would like to suggest the concerning people that spraying of growth regulators i.e. NAA, GA_3 and micronutrients Zn is very effective but spraying of NAA 40ppm hastened fruiting, yielding attributes.

FUTURE SCOPE

Ber was best grown in an ecologically friendly manner with the use of plant growth regulator and Zinc Sulphate, which also reduces production costs and maintains productivity.

Acknowledgement. Regards and thanks are extended to Dr. S.M. Tripathi, (Major Advisor) in the department of Fruit science, Respected committee members and my dearest friends for the wise direction, encouragement, and helpful criticism throughout the research and manuscript-writing process.

Conflict of Interest. None.

REFERENCES

Arora, R. and Singh, S. (2014). Effect of growth regulators on quality of ber (*Zizyphus mauritiana* Lamk) cv. Umran. *Journal of Agricultural Science Digest, 34*(2): 102-106.

Addicot, F. T. and Lynch, R. S. (1955). Physiology of abscission. *Ann. Rev. Plant Physiol*., *6*: 211-238.

Bhowmick, N. and Banik, B. C. (2011). Influence of pre-harvest application of growth regulators and micronutrients on mango cv. Himsagar. *Indian J. Hort*., *68*(1): 103-107.

Banker, G. J. and Prasad, R. M. (1990). Effect of gibberellic acid and NAA on fruit set and quality of fruit in ber cv. Gola. *Prog. Hort*., *22*(1-4): 60-62.

Briggs, R. H. and Leopoid, A. C. (1958). *Amer. C. Botany, 45*: 547-551.

Bonner, J. (1950). Plant Biochemistry. *Academic Press*, New York.

Ebeed, S., El-Gazzar, A. and Bedier, R. (2001). Effect of foliar application of some micronutrients and growth regulators on fruit drop, yield, fruit quality and leaf mineral content of mango cv. Mesk. *Annals of Agricultural Science Moshtohor, 39*: 1279-1296.

Gupta, R. K. and Brahmachari, V. S. (2004). Effect of foliar application of urea, potassium nitrate and NAA on fruit retention, yield and quality of mango cv. Bombai. *Orissa Journal of Horticulture, 32*: 7-9.

Kumar, J., Kumar, R., Rai, R. and Mishra, D. S. (2015). Effect of nutrients and plant growth regulators on physico-chemical parameters and yield of guava (*Psidium guajava* L.) cv. Pant Prabhat. *The Bioscan, 10*(2): 495-498.

Kale, V. S., Dod, V. N., Adpawar, R. M. and Bharad, S. G. (2000). Effect of plant growth regulators on fruit characters and quality of ber (*Zizyphus mauritiana* L.). *Crop Research, 20*: 327-333.

Kale, V. S., Kale, P. B. and Adpawar, R. W. (1999). Effect of plant growth regulators on fruit yield and quality of ber cv. Umran (*Zizyphus mauritiana* Lamk.). *Annals of Pl. Physiol*., *13*(1): 69-72.

Masalkar, S. D. and Wavhal, K. N. (1991). Effect of various growth regulators on physico-chemical properties of ber cv. Umran. *Maharastra J. Hort., 5*(2): 37-40.

Omar, A. E., Al-Obeed, R. S., Al-Saif, A. M. and Soliman, S. (2015). The impact of foliar application of urea, zinc and Canada humex on yield and fruit properties of jujube cv. Puyin under Saudi Arabia conditions. *The Journal of Agri. and Natural Resources Sci., 2*(3): 524-529.

Painkara, P., Singh, R. K. and Prabhakar, H. K. (2012). Effect of growth regulators on fruit drop and physico-chemical composition of mango cv. Langra. *Flora and Fauna(Jhansi), 18*(2): 213-216.

Pandey, A., Tripathi, V.K.; Pandey, M., Mishra, A.N. and Kumar, D. (2011). Influence of NAA, GA_3 and zinc sulphate on fruit drop, growth, yield and quality of ber cv. Banarasi Karaka. Proceedings of the International Symposium on Minor Fruits and Medicinal Plants for Health and Ecological Security (ISMF & MP), West Bengal, India, 19-22 December, 2011, pp. 184-187.

Pandey, V. (1999). Effect of NAA and GA_3 spray on fruit retention, growth, yield and quality of ber (*Zizyphus mauritiana* Lamk.) cv. Banarasi Karaka. *Orissa Journal of Horticulture, 27*: 69-73.

Rokaya, P. R., Baral, D. R., Gautam, D. M., Shrestha, A.K. and Paudyal, K. P. (2016). Effect of pre-harvest application of gibberellic acid on fruit quality and shelf life of mandarin. *American J. of Plant Sci., 7*(7): 1098-1105.

Singh, P. C., Gangwar, S. R., and Singh, V. K. (2012). Effect of micro-nutrients spray on fruit drop, fruit quality and yield of aonla cv. Banarasi. *Hort. flora Research Spectrum, 1*(1): 73-76.

Singh, K., Randhawa, J. S. and Singh, K. (2001). Effect of growth regulators and fungicides on fruit drop, yield and quality of fruit in ber cv. Umran. *J. Res*. PAU, *38*(3-4): 181-185.

Van Overbeek, J.(1959). Auxins. *Bot. Rev*., *25*: 269-350.

Wangbin, I., Wang, Y., Yue-hua, Z.; Liu, J. and Xulin (2008). Effect of molybednum foliar sprays on fruiting, yield and fruit quality of Jujube. *Proceedings of 1st International Jujube Symposium*, pp. 55-56. Agricultural University of Hebei, Baoding, China.

Ying-yue, L., Jiu-ru, X. and Qing-hua, M. (2010). Trial on fruit setting promotion of different cultivars of *Zizyphus mauritiana* in greenhouse. *Northern Horticulture*, *1*: 628-665.

How to cite this article: Sumit Kumar Tripathi, Vishal Gangwar, Deepak Kumar, Ravi Pratap, Om Pal, Nitin Kumar Chouhan and S.M. Tripathi (2022). Influence of Foliar Application of NAA, GA_3 and Zinc Sulphate on Fruiting and Yield Attributes of Ber (*Zizyphus mauritiana* Lamk.). *Biological Forum – An International Journal*, *14*(4): 83-87.