Indian Journal of Agricultural Sciences **92** (11): 1316–1320, November 2022/Article
https://doi.org/10.56093/ijas.v92i11.121210

Impact of mineral nutrients on powdery mildew and quality attributes in umran ber (*Ziziphus mauritiana*)

HARSIMRAT K BONS[1]* and KULWINDER SINGH[1]

Punjab Agricultural University, Ludhiana, Punjab 141 004, India

Received: 7 February 2022; Accepted: 7 October 2022

ABSTRACT

An experiment was conducted at the Fruit Research Farm of Punjab Agricultural University, Ludhiana, Punjab during 2019–20 to study the impact of mineral nutrients on fruit drop, powdery mildew and quality attributes of ber (*Ziziphus mauritiana* Lam.) cv. Umran. A 15 year's old ber plants were sprayed with nutrients like calcium nitrate @0.25 and 0.50%; potassium sulphate @0.25 and 0.50%; boric acid @0.40 and 0.60% and liquid sulphur @0.25 and 0.50% along with control (water spray) during mid-November, mid-December and mid-January (2019–20). Fruit drop and powdery mildew incidence was recorded periodically from November-March. Ber fruits were analysed for physical and bio-chemical parameters after harvesting. Among all the foliar applications, potassium sulphate @0.50% resulted in minimum fruit drop (65.52%). Maximum fruit length (4.86 cm), fruit diameter (3.06 cm), pulp content (93.96%) and fruit colour values (59.50, -4.0 and 33.46) was also recorded in potassium sulphate applied @0.50%. Maximum TSS (15.63 ^{0}B), TSS/acid ratio (120.23), ascorbic acid content (110.25 mg/100 g), total sugars (12.70%), reducing sugars (5.75%), non-reducing sugars (6.60%) and minimum titrable acidity (0.130%) was recorded with boric acid @0.60% which was statistically at par with potassium sulphate @0.50%. However, minimum incidence of powdery mildew was observed in liquid sulphur (0.50%) followed by potassium sulphate (0.50%). From the present studies, it is concluded that 3 foliar applications of potassium sulphate @0.50% resulted in improved quality attributes, reduction in fruit drop as well as reduced incidence of powdery mildew in ber cv. Umran.

Keywords: Boric acid, Fruit drop, Powdery mildew, Potassium sulphate, Quality attributes

Ber (*Zizyphus mauritiana* Lam.) is an ancient fruit tree indigenous to India and belongs to family Rhamnaceae. In India, it is grown on 52,000 ha with an annual production of 6,39,000 MT (Anonymous 2019). Ber is commercially grown in states of Andhra Pradesh, Gujarat, Haryana, Maharashtra, Madhya Pradesh, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal. In Punjab, it ranks 7th and occupies an area of 1278 ha with an annual production of 22083 MT (Anonymous 2021).

The ber fruit contains carbohydrates (17.0 g/100 g), proteins (0.8 g/100 g), total sugars (5.4–10.4 g/100 g), reducing sugars (1.4–6.2 g/100 g), non-reducing sugars (3.2–8.0 g/100 g), calcium (25.6 mg/100 g), phosphorus (26.8 mg/100 g), Iron (0.76–1.8 g/100 g), ascorbic acid content (65.8–76.0 mg/100 g), and carotene (0.02 mg/100 g) [Pareek and Dhaka (2008), Pareek *et al.* (2009). Generally, fruits are consumed as fresh and can also be processed into various products like candy, juice, dehydrated products, wine, jam jelly etc. Umran cultivar is commercially grown in Punjab. Its yield potential is higher i.e. 150–200 kg fruits per tree. The fruits are harvested during mid-March to mid-April when other fruits are not available in the market. It is highly susceptible to powdery mildew disease in which whitish powder appear on aerial plant parts causing premature drop of flower buds and fruits resulting in heavy yield loss.

Plant nutrients have been reported to regulate or manipulate fruit set, yield, fruit quality and fruit drop. The application of potassium sulphate @1.5% at fruit set stage reduces flower drop (75.22%) and increase fruit retention (24.78%) as compared to control (Singh and Bal 2006). Two sprays of boric acid @0.4% during mid-October and mid-November on ber cv. BAU Kul-1 increased total soluble solids, total sugars, reducing sugars and TSS\acid ratio (Majumder 2017). Information on the effect of calcium nitrate, potassium sulphate, boric acid and liquid sulphur on enhancement of quality attributes of ber cv. Umran by reducing fruit drop and incidence of powdery mildew is limited. Therefore, present research work was planned to study the impact of mineral nutrients on fruit drop, incidence of powdery mildew disease and quality attributes of ber cv. Umran.

[1]Punjab Agricultural University, Ludhiana, Punjab.
*Corresponding author email: harsimratpau@pau.edu

MATERIALS AND METHODS

The present study was carried out at Fruit Research Farm**,** Punjab Agricultural University, Ludhiana (30° 53' 41" N and 75° 48' 26" E and 247 metre amsl), Punjab during 2019–20. Mineral nutrients, viz. calcium nitrate, potassium sulphate and liquid sulphur @0.25% and @0.50% each and Boric acid @0.40% and @0.60% were sprayed on 15 years old ber trees cv. Umran planted at 7.5 m × 7.5 m spacing during mid-November, mid-December and mid-January. Experiment was laid out in randomized block design (RBD) with 3 replications per treatment and considering one tree per replication. Data on fruit drop was recorded periodically from November to March. Incidence of powdery mildew disease was recorded from October to February. Ber fruits from sprayed plants were harvested during first week of April and analyzed for quality attributes.

Ten randomly selected fruits from each replication were used to assess quality attributes of ber. Physical parameters like fruit size in terms of length and breadth (cm) were measured with the help of Vernier's caliper and expressed in centimeters. Pulp content was recorded by dividing the pulp weight with total fruit weight multiplied by 100 and expressed in percentage. Pulp/stone ratio was calculated by dividing the weight of pulp with weight of seed. The fruit colour was recorded by using Colour Flex spectrophotometer (Hunter Lab, USA) in terms of L, a and b value. The 'L' value measures lightness. The 'a' value measures redness when positive, greenness when negative and b value measures yellowness when positive and blueness when negative. Among chemical parameters, total soluble solids (TSS) content was determined with the help of Digital refractometer (Atago PAL-1, model 3810, Japan) and expressed in per cent. Acidity was expressed as per cent of citric acid as method given by AOAC (2005). Total sugars and reducing sugars expressed in percentage was estimated by method suggested by AOAC (2005). Ascorbic acid content was expressed in mg/100 g of pulp and was estimated using 2, 6-dichlorophenol indophenol dye by visual titration method (AOAC 2005). Carotenoids of fruit pulp were calculated according to method suggested by Kirk and Allen (1965). Total phenols were expressed as mg/100 g pulp and determined by method given by Hossain and Rahman (2011).

Fruit drop (%) was computed as:

$$\text{Fruit drop (\%)} = \frac{\text{Total number of fruits set–Total number of fruits retained}}{\text{Total number of fruits set}} \times 100$$

The data on the incidence of powdery mildew on ber fruits were reported on the selected 4 twigs per plant from October to January using 0–5 grades (Thind and Kaur 2006).

Percentage Disease Intensity (PDS) was calculated as:

$$\text{PDS} = \frac{\text{Sum of ratings}}{\text{No. of observations}} \times \frac{100}{\text{Maximum grade}}$$

Disease rating scale against powdery mildew of ber cv. Umram.

Grade	Description
0	No Disease
1	1–20% Fruit area covered with powdery mildew
2	21–40% Fruit area covered with powdery mildew
3	41–60% Fruit area covered with powdery mildew
4	61–80% Fruit area covered with powdery mildew
5	81–100% Fruit area covered with powdery mildew

RESULTS AND DISCUSSION

The impact of foliar spray of nutrients on the fruit size, pulp content and pulp stone ratio of Umran cv. of ber is presented in Table 1. In present study, highest fruit diameter (3.06 cm) and fruit length (4.86 cm) and highest pulp content (94.46 %) was observed in potassium sulphate @0.50% and lowest in control treatment. Potassium sulphate treatments resulted in significant increase in fruit size and pulp content over control and other treatments. Similar results were obtained by Yadav *et al.* (2014), Choudhary *et al.* (2020b) and Singh and Bal (2006) in ber. The reason for increase in fruit size and pulp content with foliar application

Table 1 Effect of foliar application of nutrients on physical parameters of ber cv. Umran

Treatment	Fruit size		Pulp content (%)	Pulp/stone ratio	Fruit colour		
	Length (cm)	Diameter (cm)			L*	a*	b*
Calcium nitrate @0.25% (T_1)	3.69^{d}	2.30^{c}	93.29^{g}	13.91^{e}	55.10^{de}	-2.1^{b}	29.10^{ef}
Calcium nitrate @0.50% (T_2)	3.70^{d}	2.31^{c}	93.35^{f}	14.05^{e}	56.40^{c}	-2.3^{bc}	28.76^{f}
Potassium sulphate @0.25% (T_3)	4.58^{b}	3.04^{a}	94.02^{b}	15.72^{b}	57.43^{b}	-3.9^{e}	31.64^{b}
Potassium sulphate @0.50% (T_4)	4.86^{a}	3.06^{a}	94.46^{a}	17.07^{a}	59.50^{a}	-4.0^{e}	33.46^{a}
Boric acid @0.40% (T_5)	4.06^{c}	2.57^{b}	93.68^{dc}	14.83^{c}	54.36^{e}	-2.7^{cd}	29.40^{e}
Boric acid @0.60% (T_6)	4.12^{c}	2.58^{b}	93.75^{c}	15.00^{c}	54.73^{de}	-2.9^{d}	30.63^{c}
Liquid Sulphur @0.25% (T_7)	3.58^{de}	2.23^{c}	93.22^{hg}	13.76^{d}	55.33^{d}	-2.4^{bc}	30.13^{d}
Liquid Sulphur @0.50% (T_8)	3.75^{d}	2.27^{c}	93.64^{edc}	14.74^{c}	56.93^{bc}	-2.5^{c}	30.76^{c}
Control -Water spray (T_9)	3.68^{d}	2.29^{c}	93.03^{i}	13.36^{f}	53.16^{f}	-1.5^{a}	28.74^{f}
LSD (P≤0.05)	0.19	0.19	0.18	0.46	0.84	0.37	0.39

Means with the same superscript are not significantly different at P<0.05 according to LSD.

of potassium may be due to their role in accelerating rate of cell division, cell enlargement and more intercellular spaces between them as well as increase of more water, sugars and soluble solids due to mobilization of metabolites towards the fruit development.

The data on fruit colour indicates that maximum 'L', 'a',' b' values were observed with potassium sulphate @0.50% and minimum were recorded in control. Similar findings were reported by Gill *et al.* (2012) who observed that foliar applications of potassium in Patharnakh pear had a positive effect on 'b' value of fruits, which indicated change in fruit colour from greenish to greenish yellow and three sprays of potassium sulphate @2% gave better colouration to the fruits as compared potassium nitrate. Potassium sulphate spray promotes preference of fruit colour by regulating the pigment (Su *et al.* 2022).

The data pertaining to total soluble solids and acidity of Umran cultivar of ber (Table 2) showed that maximum (15.63°B) total soluble solids were recorded with application of boric acid @0.60% which was statistically at par with potassium sulphate @0.50% followed by boric acid @0.40% and potassium sulphate @0.25%. Minimum (14.05°B) total soluble solids were observed in control treatment. These findings are in conformation with the results of Majumder *et al.* (2017) in ber cv. Bau kul-1 and Baranwal *et al.* (2017) in guava. There is an increase in TSS, as polysaccharides and pectin gets converted into soluble compounds and translocation of sugars from leaves to developing fruits through cellular membrane by formation of ionisable sugar borate complex. Lowest (0.130%) titrable acidity was observed in boric acid @0.60% which was at par with potassium sulphate @0.50% and boric acid @0.50% whereas maximum (0.178%) titrable acidity was observed in control. Results are in confirmatory with Yadav *et al.* (2014) and Majumder *et al.* (2017). The reason for decreased titrable acidity due to potassium application might be due to increased TSS of the fruits.

The data presented in Table 3 showing the impact of foliar application of plant nutrients on total sugars, reducing sugars and non-reducing sugars in cultivar Umran of ber. Maximum (12.70%) total sugars content, reducing sugars (5.75 %) and non-reducing sugars (6.60%) were recorded in boric acid @0.60% which were at par with potassium sulphate @0.50% and minimum were observed in control treatment. Results are in agreement with Yadav *et al.* (2011) and Majumder *et al.* (2017). Boron enhances nitrogen uptake and facilitates photosynthesis which leads to accumulation of carbohydrates thereby increasing sugars content of fruits (Movchan and Soboroikova 1972).

All the treatments increased the ascorbic acid content of ber fruits over control treatment. Maximum (110.25 mg/100 g) ascorbic acid content was reported in boric acid @0.60% which was at par with potassium sulphate @0.50% and boric acid @0.40% whereas minimum (95.80 mg/100 g) ascorbic acid content was recorded in control treatment. Potassium sulphate @0.50% and boric acid @0.40% were non-significant among each other. Results are similar with the findings of Yadav *et al.* (2011) in guava cv. L-49 and Majumder *et al.* (2017) in ber cv. Bau kul-1. Micronutrients like B (boron) influences the physiological processes of enzymes thereby increase in ascorbic acid content. Data on carotenoids indicates that maximum (4.42 mg/100 g) carotenoids were recorded in control whereas minimum (3.05 mg/100 g) carotenoids were recorded in potassium sulphate @0.50%. Potassium sulphate @0.25%, @0.50%, and boric acid @0.60% did not show significant differences

Table 2 Effect of foliar application of nutrients on chemical parameters of ber cv. Umran

Treatment	Total soluble solids (°B)	Titrable acidity (%)	TSS/acid ratio	Total sugars (%)	Reducing sugars (%)	Non-reducing sugars (%)	Ascorbic acid content (mg/100 g)	Carot-enoids (mg/100g)	Total phenolic content (mg/100 g)
Calcium nitrate @0.25% (T_1)	14.93^{c}	0.159^{c}	93.89^{e}	11.05^{d}	4.71^{ef}	6.02^{cd}	102^{d}	3.86^{b}	117.90^{b}
Calcium nitrate @0.50% (T_2)	15.06^{cd}	0.152^{d}	99.07^{d}	12.06^{b}	5.46^{c}	6.27^{b}	104.10^{c}	3.84^{bc}	120.05^{a}
Potassium sulphate @0.25% (T_3)	15.12^{cd}	0.143^{e}	105.73^{c}	11.72^{b}	5.43^{b}	5.97^{b}	108.89^{b}	3.14^{ef}	108.43^{e}
Potassium sulphate @0.50% (T_4)	15.40^{ab}	0.131^{f}	117.55^{ab}	12.43^{a}	5.68^{a}	6.41^{a}	109.23^{ab}	3.05^{f}	112.13^{cd}
Boric acid @0.40% (T_5)	15.28^{bc}	0.132^{f}	115.75^{b}	12.07^{b}	5.53^{b}	6.21^{bc}	109.87^{ab}	3.27^{e}	110.47^{d}
Boric acid @0.60% (T_6)	15.63^{a}	0.130^{f}	120.23^{a}	12.70^{a}	5.75^{a}	6.60^{a}	110.25^{a}	3.20^{ef}	113.53^{c}
Liquid Sulphur @0.25% (T_7)	14.05^{f}	0.169^{b}	83.13^{g}	10.69^{ef}	4.61^{g}	5.77^{ef}	100.47^{e}	3.68^{cd}	107.93^{e}
Liquid Sulphur @0.50% (T_8)	14.36^{e}	0.160^{c}	89.75^{f}	10.97^{de}	4.75^{e}	5.90^{de}	101.40^{de}	3.64^{d}	111.47^{d}
Control-Water spray (T_9)	14.05^{f}	0.178^{a}	78.93^{h}	10.12^{g}	4.15^{h}	5.67^{f}	95.80^{f}	4.42^{a}	103.02^{f}
LSD (P≤0.05)	0.27	4.72	3.45	0.29	0.073	0.23	1.13	0.16	1.93

Means with the same superscript are not significantly different at P<0.05 according to LSD.

Table 3 Effect of foliar application of nutrients on fruit drop (%) of ber cv. Umran

Treatment	Fruit drop (%)					Mean
	Nov	Dec	Jan	Feb	Mar	
Calcium nitrate @0.25%	61.70^{b}	67.38^{bc}	70.09^{b}	71.90^{e}	73.17^{d}	68.85
Calcium nitrate @0.50%	60.68^{bc}	66.51^{bcd}	69.95^{bc}	70.94^{f}	72.89^{d}	68.20
Potassium sulphate @0.25%	59.23^{d}	65.00^{cd}	68.85^{c}	69.73^{g}	72.03^{e}	66.76
Potassium sulphate @0.50%	57.15^{e}	64.05^{d}	67.11^{d}	68.11^{h}	70.19^{f}	65.52
Boric acid @0.40%	59.93^{cd}	66.78^{bc}	70.17^{b}	72.31^{d}	73.23^{d}	68.49
Boric acid @0.60%	59.66^{cd}	66.03^{bcd}	70.19^{b}	71.98^{de}	73.03^{d}	68.18
Liquid Sulphur @0.25%	62.11^{b}	68.08^{b}	70.82^{b}	73.58^{b}	75.14^{b}	70.05
Liquid Sulphur @0.50%	61.80^{b}	68.00^{b}	70.76^{b}	72.91^{c}	74.18^{c}	69.53
Control-Water spray	65.41^{a}	72.78^{a}	75.81^{a}	77.06^{a}	79.55^{a}	74.13
Mean	60.86	67.18	70.42	72.05	73.72	
LSD (P≤0.05)	1.46	2.55	1.22	0.40	0.57	

Means with the same superscript are not significantly different at P<0.05 according to LSD.

among each other. Results are similar with the findings of Kassam *et al.* (2011) who reported highest carotenoids content in control as compared to plant nutrients. Maximum (120.05 mg/100 g) total phenolic content was recorded in calcium nitrate @0.50% followed by calcium nitrate @0.25% (117.90 mg/100 g) whereas minimum (103.02 mg/100 g) was reported in control. These results were harmony with the findings of Zeraatgar *et al.* (2018) who reported increased in total phenolic content of jujube fruit with application of 1% calcium nitrate over control. The reason for higher total phenolic content with the foliar application of calcium nitrate may be due to fact that calcium compounds strengthen cell walls, maintains as well as control selective exchange of gas and ion. These compounds also increase the activity of cell wall enzymes, reduce oxygen and finally prevent oxidation of phenols.

In the month of November, minimum (57.15%) fruit drop was recorded in 0.50% potassium sulphate followed by potassium sulphate @0.25% (59.23%) and maximum (65.41%) fruit drop was recorded in control. Calcium nitrate and Liquid sulphur treatments showed non-significant differences (Table 3).

In December, lowest (64.05%) fruit drop was reported in 0.50% potassium sulphate which was at par with calcium nitrate @0.50%, potassium nitrate @0.25% and boric acid @0.60%) and maximum (72.78%) fruit drop was recorded in control. During January, lowest (67.11%) fruit drop was noticed in potassium sulphate @0.50% and maximum (75.81%) fruit drop was observed in control treatment. All other treatments were non-significant among each other. In February, minimum (68.11%) fruit drop was observed with application of potassium sulphate @0.50% and maximum (77.06%) fruit drop was observed in control treatment. All the treatments were found to be significantly better than control. During March, minimum (70.19%) fruit drop was noticed in 0.50% potassium sulphate followed by potassium sulphate @0.25% (72.03%) and maximum (79.55%) fruit drop was noticed in control. Calcium nitrate and boric acid treatments showed non-significant differences among each other. Results are in agreement with Singh and Bal (2006),

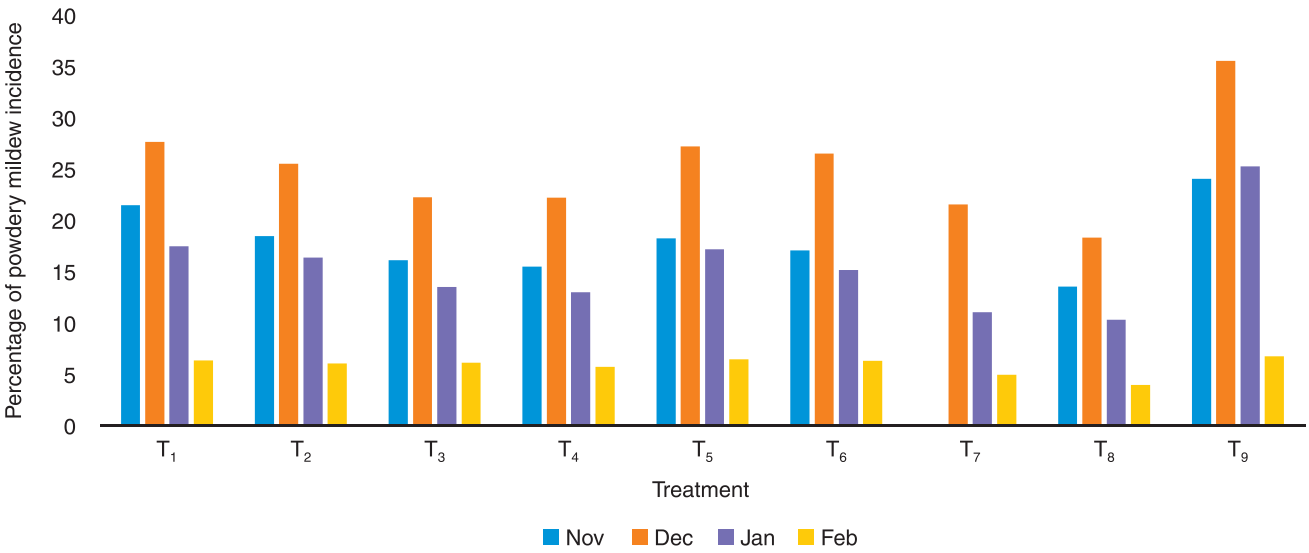

Fig 1 Effect of foliar application of nutrients on incidence of powdery mildew of ber cv. Umran (November-February). Treatment details are given in Table 1.

Fig 2 Effect of liquid sulphur @0.50%, a; Potassium sulphate @0.50%, b; and Water spray (control), c; on powdery mildew disease.

Yadav *et al.* (2014) and Choudhary *et al.* (2020 a) in ber and Kumar *et al.* (2017) in guava. The reason for decreased fruit drop may be due to increase in fruit retention percentage with foliar application of potassium.

The data regarding the impact of foliar spray of mineral nutrients on powdery mildew incidence of Umran cultivar of ber is presented in Fig 1 and 2. Minimum (11.49%) mean disease severity was recorded in liquid sulphur @0.50% followed by liquid sulphur @0.25% (11.83%) and potassium sulphate @0.50% (14.06%) whereas the maximum (22.68%) mean disease severity was recorded in control treatment. In the monthly interval maximum (25.15%) mean disease severity was recorded during December and the minimum (5.75%) mean disease severity was recorded during February. Similar results were reported by Choudhary *et al.* (2020) who observed disease intensity of powdery mildew (14.4%) with application of wettable sulphur in ber as compared to control (35.8%). Thind and Kaur (2006) found that disease severity of powdery mildew in ber varied from 12.16–28.33% with 0.25% sulphex whereas in control it varied from 27.00–36.05% during the month of December in 1995–2002.

From the present studies, it is concluded that 3 foliar applications of potassium sulphate @0.50% during mid-November, mid-December and mid-January resulted in improved quality attributes along with reduction in fruit drop and incidence of powdery mildew in ber cv. Umran.

REFERENCES

Anonymous. 2019. National Horticulture Board www.nhb.gov

Anonymous. 2021. *Package of Practices for Cultivation of Fruits,* pp. 1. Punjab Agricultural University, Ludhiana, India.

AOAC. 2005. *Official Methods of Analysis*, 18th edn. Association of Official Analytical Chemists, Washington DC.

Baranwal D, Tomar S, Singh J P and Maurya J K. 2017. Effect of foliar application of zinc and boron on fruit growth, yield and quality of winter season guava (*Psidium guajava* L.). *International Journal of Current Microbiology and Applied Sciences* **6**(9): 1525–29.

Choudhary M, Ghasolia R P, Bajaya T and Shivran M .2020 (a). Efficacy of natural products and fungicides against powdery mildew of ber. *International journal of chemical studies* **8**(2): 913–15.

Choudhary R B, Bairwa L N, Garhwal O P and Negi P. 2020(b). Effect of plant growth regulators and nutrients on yield attributing characters and yield of ber (*Zizyphus mauritiana* Lamk.) cv. Gola. *International Journal of Pharmacognosy and Phytochemical Research* **9**(4): 1968–72.

Gill P P S, Ganaie M Y, Dhillon W S and Singh N P. 2012. Effect of foliar application of potassium on fruit size and quality of Patharnakh pear. *Indian Journal of Horticulture* **69**(4): 512–16.

Hossain M A and Rahman S M M. 2011. Total phenolics, flavonoids and antioxidant activity of tropical fruit pineapple. *Food Research International* **44**: 672–76.

Kassem H A, Al-Obeed R S, Ahmed M A and Omar A K H. 2011. Productivity, fruit quality and profitability of jujube trees improvement by pre harvest application of agro-chemicals. *Middle-East Journal of Scientific Research* **9**(5): 628–37.

Kumar G N K, Vani V S, Rao A V D D, Subbaramamma and Sujatha R V. 2017. Effect of foliar sprays of urea, potassium sulphate and zinc sulphate on quality of guava *cv.* Taiwan pink. *International journal of chemical studies* **5**(5): 680–82.

Majumder I, Sau S, Ghosh B, Kundu S, Roy D and Sarkar S. 2017. Response of growth regulators and micronutrients on yield and physico-chemical quality of Ber (*Zizyphus mauritiana* Lamk.) cv. BAU Kul-1. *Journal of Applied and Natural Science* **9**(4): 2404–09.

Pareek S and R S Dhaka. 2008. Association analysis for quality attributes in ber. *Indian Journal of Horticulture* **3**: 77–80.

Pareek S, Kitinoja L, Kaushik R A and Paliwal R. 2009. Postharvest physiology and storage of ber. *Journal of Food Composition and Analysis* **5**(5): 1–10.

Singh C and Bal J S. 2006. Effect of nutrients and growth regulators on fruit drop, size and yield of ber (*Zizyphus mauritiana* Lamk.). *International Journal of Agricultural Sciences* **2**: 358–60.

Su X, Bai C, Wang X, Liu H Zhu Y, Wei L, Cui Z and Yao L. 2022. Potassium sulphate spray promotes fruit colour preference via regulation of pigment profile in Litchi pericarp *Frontiers in Plant Science* **13**: 925609. doi: 10.3389/fpls.2022.925609

Thind S K and Kaur N. 2006. Management of ber powdery mildew with fungicides. *Indian Journal of Horticulture* **63**(3): 267–69.

Yadav H C, Yadav A L, Yadav D K and Yadav P K. 2011. Effect of foliar application of micronutrients and GA_3 on fruit yield and quality of rainy season guava (*Psidium guajava* L.) cv. L-49. *Plant Archives* **11**(2): 147–49.

Yadav D, Singh S P and Singh S. 2014. Effect of foliar application of potassium compounds on yield and quality of Ber (*Zizyphus mauritiana* L.) cv. Banarasi Karaka. *International journal of natural and social sciences* **2**(2): 89.

Zeraatgar H, Davarynejad G H, Moradinezhad F and Abedi B. 2018. Effect of salicylic acid and calcium nitrate spraying on qualitative properties and storability of fresh jujube fruit (*Ziziphus jujube* Mill.). *Notulae Botanicae Horti Agrobotanici Cluj-Napoca* **46**(1): 138–47.