International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2021; 9(1): 1558-1560

Received: 22-11-2020
Accepted: 30-12-2020

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# Effect of foliar feeding on chemical attributes of Ber (*Ziziphus mauritiana* L.) under Sodic soil

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**DOI:** https://doi.org/10.22271/chemi.2021.v9.i1v.11446

**Abstract**
An experiment was carried out to study the "Effect of foliar feeding on chemical attributes of ber (*Ziziphus mauritiana* L.) Under sodic soil" in the year 2019-20. The experiment was conducted in Randomized Block Design with three replications. The foliar feeding of urea (2.0%), zinc sulphate (0.50%), borax 0.50% and $K_2SO_4$ 0.50% a at peak flowering, peanut size of fruit and second growth phase significantly increased the fruit quality characteristics T.S.S. ($20.86^0$ Brix), Total sugars (9.58%), Reducing sugar (6.68%), Non- reducing sugar (2.90%), Acidity (0.25%), Ascorbic acid (95.66 mg/ 100 g pulp), Fruit yield per plant (33.63 kg/plant) and Fruit yield (9.37 t/ha.) over control. The maximum effect on all parameters, treatment $T_{10}$ was observed best with the feeding of Urea 2.0% + $ZnSO_4$ 0.50% + Borax 0.50% + $K_2SO_4$ 0.50%.
However, the combination of Urea 2.0% + $ZnSO_4$ 0.50% + Borax 0.50% + $K_2SO_4$ 0.50% was found most effective in fruit quality of ber (*Ziziphus mauritiana* L.) under sodic soil.

**Keywords:** Foliar, chemical, attributes, Sodic, *Ziziphus mauritiana* L.

## Introduction
The Indian Ber (*Ziziphus mauritiana* L.), which is also called Chinese date or Chinese fig, belongs to family Rhamnaceae and genus *Ziziphus*. It is tetraploid in nature with a chromosome number 2n=4x=48. Origin of ber is said to be India to south –western Asia. It is a drought hardy and can grow under the most hazardous condition of soil, water and climate and thus it has highly recommended for the arid and desert area of India. The cultivated area of ber increased due to better adoptability and higher return in arid, semiarid and irrigated areas. It is also known as "King of Arid Fruits".
Commercial cultivation usually extends up to 1000 m above sea level. It is known for its ability to withstand adverse conditions, such as salinity, drought and water logging. It has also been mentioned in holy books like Ramayana and Mahabharata. In India, area under ber is 49 million hectare and production consists of 481 million tonne 2017-18. In view of the recent development in production technology of this crop, the cultivation of ber crop is becoming increasing popular in many parts of India such as Rajasthan, Haryana, Uttar Pradesh, Gujarat, Madhya Pradesh, Bihar, Maharashtra, Andhra Pradesh and Tamil Nadu. It is reported to grow in other countries like Iran, Syria, Australia, USA, France and some parts of Italy, Spain, and Africa etc.
Gola is an early variety and popular in Delhi, Haryana, Uttar Pradesh and other adjoining areas. Among the different cultivars of ber, Gola is an extremely drought hardy, early and extensively grown variety. The fruit is ovate to round in shape and the size of fruit is medium. It develops greenish to golden yellow colour at ripening stage. The quality of fruit is excellent but cannot stand long transport. The average weight of fruit varies from 15-20g.
Foliar feeding of nutrients has certain advantages over soil feeding. Foliar feedings are highly effective with rapid pant response and also useful to maintain their optimum concentration in the plant during growth and fruit development. But very scanty information is available on foliage nutritional aspects, which can be valuable in making judicious fertilizer recommendation for profitable production of ber. The foliar feeding of fruit trees has gained much importance in recent years, as fertilizers applied through soil are needed in higher quantities because some amounts leach down and some amounts become unavailable to the plants due to complex soil reaction.

The beneficial effect of foliar feeding of nutrients is based on the fact that the nutrients reach directly to leaves which are the sites of metabolism. Besides this, nutrients are made available to the plants at the time when it is needed. However, response of plants to these nutrients may vary depending upon the soil and agro- climatic conditions. The rate of movement of some nutrients such as nitrogen, phosphorus and potassium absorbed by leaves has been estimated 0.5 cm / min. Not only leaves, buds, petioles and flowers also absorbed nutrients.

Zinc promotes synthesis of indole acetic acid through tryptophan which serves as a precursor for auxin synthesis and directly affected the growth parameters as well as yield parameters. In view of the above fact it become quite clear that foliar feeding of Zn is very important for not only increasing plant vigour, but also for enhance the yield.

Urea plays a vital role in plants. Urea can be applied to plants by soil and foliar feeding. Foliar feeding of urea is more successful than soil feeding. Urea takes part in chlorophyll synthesis, involved in biosynthesis of plant growth and play role in photosynthesis and nitrogen metabolism. It was observed that urea had significantly improved the extension of terminal shoots as compared to the control. The shoots sprayed with urea had early maturity of fruits observations recorded also indicated that fruit set, fruit retention, fruit diameter, fruit weight and yield as well as total soluble solids and acidity content of fruits were increased, whereas, total carbohydrates and ratio of leaves were decreased by the feeding showed good results for most of the characters.

Boron is one of the minor nutrients, and its deficiency results in the inhibition of plant growth. The most important activity of boron is to facilitate the movement and transfer of the products of photosynthesis from the leaves (source) to the active areas (sink) in the plant. This element has a role in regulating cell membrane activity and gene expression (Shaaban, 2010) [8]. It also stimulates the biosynthesis of proteins through its effect in the process of DNA synthesis as well as its role in increasing vitamin C and B. The purpose was improving the growth of trees and the increase in the production of fruits in quantity and quality.

Potassium is an important nutrient for plant meristematic growth and physiological functions, including regulation of water and gas exchange in plants, protein synthesis, enzyme activation, and photosynthesis and carbohydrate translocation in plants. Potassium also plays an important role in crop productivity. It functions as an activator of numerous enzymes like pyruvic, kinase, cytoplasmic enzymes and therefore, causes pervasive effect on metabolic events, it is always involved in the movement of carbohydrate and synthesis in case of potassium deficiency. Potassium is also involved in photosynthesis through its relation with chloroplast, where it is highly concentrates the fat in leaf tissues.

## Material and Method

The present investigation was under taken at Main Experimental Station, Horticulture, A. N. D. U. A. & T., Kumarganj, (Faizabad) Ayodhya U.P. India during 2019-20. Geographically, it is situated in typical saline alkali belt of Indo-gangetic plains of eastern U.P. at 26.47 N latitude, 88.12°E longitudes and at an altitude of 113 meter from mean sea level. The region enjoys sub-humid and subtropical climate receiving a mean annual rainfall of about 1215 mm out of which about 85% is concentrated from mid-June to end of September with an average annual rainfall of 764.01mm and relative humidity of 66.76 per cent.

The experiment was laid out in Randomized Block Design with three replications. One plant was taken as a unit and total number of plants selected is 30 with plant spacing of 6x6 meter. First spray at 20th September and second at 5th November and Third at 20th December. The observations were recorded on T.S.S. ($^0$Brix), Total sugars (%), Reducing sugar (%), Non- reducing sugar (%), Acidity (%), Ascorbic acid (mg/ 100 g pulp), Fruit yield per plant (kg) and Fruit yield (t/ ha.). Statistical analyses of the data obtained in the different sets of experiments were calculated, as suggested by Panse and Sukhatma (1989).

## Result

The statistical analysis of data (Table-1) revealed that the maximum total soluble solids (20.86 $^0$Brix), total sugars (9.58%), reducing sugar (6.68%), non-reducing sugar (2.90%), fruit yield per plant (33.63 kg/plant), fruit yield (9.37 t/ha.) and minimum acidity (0.25%), ascorbic acid (95.66 mg/ 100 g pulp) was observed under treatment $T_{10}$ (receiving Urea 2.0% + $ZnSO_4$ 0.50% + $K_2SO_4$ 0.50% + Borax 0.50%).

Total soluble sugars increased with the increase in concentration of urea and micronutrients which might be due to the availability of more assimilates as a result of nitrogen availability to the fruit trees. Nitrogen is the constituent of various energy sources like amino acids and amino sugars. The increase under treatment T.S.S. content by foliar application of nitrogen have been earlier reported by in ber cv. Banarasi Karaka Animesh and Bikash (2009) [1].

The sugars (total and reducing) were increased by foliar application of urea and zinc sulphate. It might be due to more assimilates as a result of nitrogen availability to the fruit trees. The increase in nitrogen conc. increased the growth in terms of leaf area and shoot length which are directly responsible for the production of carbohydrates. Nitrogen is the constituent of various energy sources like amino acid and amino sugars. Adequate amount of zinc improved the auxin content and it also acted as catalyst in oxidation process. Its presence is of great importance in the sugar metabolism. It is in conformity with the findings of Anju *et al.* (2008) [2] and Animesh and Bikash (2009) [1].

Decrease in acidity with foliar application of $ZnSO_4$ might be due to increase in translocation of carbohydrate and increase metabolic conversion from acidity to sugars. The minimum acidity (0.25%) was recorded under $T_{10}$ but statically significant over control. It is conformity with the findings of Yadav *et al.* (2001) [9], Birendra *et al.* (2005) [3], Animesh and Bikas (2009) [1].

In ascorbic acid the nitrogen increased the efficiency of metabolic process of trees and stimulates the functioning of a number of enzymes in the physiological process which probably cause an increase in ascorbic acid. Zinc application also increased the ascorbic acid which seems to be due to increased growth and availability of more metabolites for ascorbic acid synthesis. It is in conformity with the findings of Kundu *et al.* (2007) [6], Anju *et al.* (2008) [2] and Aminesh and Bikash (2009) [1].

Average fruit yield per plant (kg) significantly increased under treatment $T_{10}$ (33.63 kg) as compared to control (22.65 kg). Similar results obtained by Yadav and Rathore (2004) [10] and Deepa *et al.* (2008) [4]. Yield per hectare (ton) significantly increased under treatment $T_{10}$ (9.37 t) as compare to control (6.19 t). Similar results obtained by Kumar and Shukla (2010) [5].

It is concluded, on the basis of the effect of foliar feeding on chemical attributes of ber (*Ziziphus mauritiana* L.) under

sodic soil the spray of Urea 2.0% + $ZnSO_4$ 0.50% + Borax 0.50% + $K_2SO_4$ 0.50% first spray at 20th September and second at 5th November and Third at 20th December proved significantly effective in increasing of fruit quality of ber. This treatment help to achieve the better quality and yield of ber of Eastern Uttar Pradesh Growers.

**Table 1:** Effect of foliar feeding on chemical attributes of ber (*Ziziphus mauritiana* L.) under sodic soil

| Treatments | T.S.S. ($^0$Brix) | Total sugars (%) | Reducing sugar (%) | Non-reducing sugar (%) | Acidity (%) | Ascorbic acid (mg/ 100 g pulp) | Fruit yield per plant (kg) | Fruit yield (t/ ha.) |
|---|---|---|---|---|---|---|---|---|
| $T_1$. Control | 15.95 | 7.55 | 5.53 | 2.02 | 0.26 | 96.43 | 22.65 | 6.19 |
| $T_2$. Urea 2.0% | 16.39 | 7.94 | 5.75 | 2.19 | 0.26 | 96.36 | 23.70 | 6.48 |
| $T_3$. $ZnSO_4$ 0.50% | 16.65 | 8.20 | 5.95 | 2.25 | 0.25 | 96.31 | 24.20 | 6.65 |
| $T_4$. $K_2SO_4$ 0.50% | 16.88 | 8.61 | 6.21 | 2.40 | 0.25 | 96.25 | 25.35 | 7.05 |
| $T_5$. Borax 0.50% | 17.35 | 8.91 | 6.30 | 2.61 | 0.25 | 96.05 | 26.40 | 7.25 |
| $T_6$. Urea 2.0% + $ZnSO_4$ 0.50% | 17.75 | 9.12 | 6.42 | 2.70 | 0.25 | 95.80 | 27.10 | 7.50 |
| $T_7$. Urea 2.0% + $K_2SO_4$ 0.50% | 18.35 | 9.27 | 6.50 | 2.77 | 0.25 | 95.77 | 28.15 | 7.85 |
| $T_8$. Urea 2.0% + Borax 0.50% | 18.77 | 9.39 | 6.57 | 2.82 | 0.25 | 95.71 | 29.40 | 8.30 |
| $T_9$. Urea 2.0% + $ZnSO_4$ 0.50% + $K_2SO_4$ 0.50% | 19.45 | 9.47 | 6.62 | 2.85 | 0.25 | 95.67 | 31.35 | 8.79 |
| $T_{10}$. Urea 2.0% + $ZnSO_4$ 0.50% + $K_2SO_4$ 0.50% + Borax 0.50% | 20.86 | 9.58 | 6.68 | 2.90 | 0.25 | 95.66 | 33.63 | 9.37 |
| S.Em.± | 0.26 | 0.05 | 0.031 | 0.048 | 0.001 | 0.032 | 0.901 | 0.147 |
| C.D. at 5% | 0.77 | 0.14 | 0.291 | 0.142 | 0.005 | 0.088 | 2.678 | 0.436 |

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