# Effect of Plant growth regulators and Micro nutrient on quality of Ber (*Zizyphus mauritiana* Lamk.) cv. Gola.


## ABSTRACT

`The present experiment was carried out on twenty eight year old ber orchard planted under sodic soil condition which is located at the Main Experiment Station Horticulture, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya. The objective of experiment was to assess the effect of PGRs and micro nutrient on quality of ber.The application of different growth regulators affected different characters of ber significantly i.e., Fruit weight, Fruit size, TSS, acidity, ascorbic acid, reducing sugar, non-reducing sugar and Total sugar. The maximum fruit size, length (3.87 and 3.92cm) and breadth (3.38 and 3.41 cm) was recorded under the treatment of **$T_8$**- 0.15 % Promalin+0.5% Borax, which was statistically *at par* with **$T_{10}$**-15 ppm $GA_{4+7}$+0.5 % Borax (3.79 and 3.84cm) and (3.33 and 3.36cm).The maximum fruit weight was recorded (27.69g and 28.89g) under the treatment of **$T_8$**- 0.15 % Promalin + 0.5% Borax, which was statistically *at par* with **$T_{10}$**-15 ppm $GA_{4+7}$ + 0.5 % Borax (26.30g).The maximum TSS (19.42 and 19.49) $^0$Brix was recorded under the treatment of **$T_8$**- 0.15 % Promalin + 0.5 % Borax, which was statistically *at par* with **$T_{10}$**-15 ppm $GA_{4+7}$ + 0.5 % Borax (19.02 and 19.09) $^0$Brix. The minimum Acidity (0.24% and 0.23 %) was recorded under the treatment of **$T_8$**- 0.15 % Promalin + 0.5 % Borax, which was statistically *at par* with **$T_{10}$**- 15 ppm $GA_{4+7}$ + 0.5 % Borax. The maximum Ascorbic acid (85.33 and 86.02) was recorded under the treatment of **$T_8$**- 0.15 % Promalin + 0.5 % Borax which was statistically *at par* with **$T_{10}$**- 15 ppm $GA_{4+7}$ + 0.5 % Borax (84.71 and 84.62). The maximum Reducing sugar (6.23 and 6.25) was recorded under the treatment of **$T_7$**- 0.13 % Promalin + 0.5 % Borax. The maximum non-reducing sugar (7.92 and 7.95) was recorded under the treatment of **$T_7$**- 0.13% Promalin +0.5 % Borax. The maximum Total sugar (14.15 and 14.20) was recorded under the treatment of **$T_7$**- 0.13 % Promalin +0.5 % Borax.



***Keywords:*** *Acidity, Ber, Boron, $GA_{4+7}$, Promalin, Sugars.*


## INTRODUCTION

The Indian Ber (*Zizyphus mauritiana* Lamk.) belong to family Rhamnaceae and genus *Ziziphus* which includes about fifty species, and among those, 18-20 species are native to India (**Pareek,1983**). It is tetraploid in nature with a chromosome number 2n= 4x=48. Origin place of fruit ber is believed to be India to South - Western Asia. Ber is a very famous ancient fruit crop of India and China. It is also called as Chinese date or Chinese fig or plum. It is an important minor fruit of India which is reported to be growing in other countries also such as Iran, Syria, Australia, USA, Russia, Myanmar etc. Ber is cultivated in various part of country particularly in arid and semi-arid regions comprising of 53,000 ha area, producing 5.70 lakh MT of fruits (National Horticulture Board, 2021-22). The major ber growing regions are Punjab, Haryana, Uttar Pradesh, Rajasthan, Maharashtra, Andhra Pradesh, Bihar, and Madhya Pradesh. Ber tree bears its inflorescence in the axils of leaves on current season's growth. The flowering period lasts for about two and a half months from September to November. The fruit setting starts in second week of October and continues up to first fortnight of November.

The ripe ber fruit have high nutritive values and conventionally it is considered a "Poor man's fruit". The ber fruit is richer than apple in protein, phosphorus, calcium and Vitamin'C'. and one

hundred gram of edible ber contains moisture (85.9%), protein(0.8g), fat (0.1g), carbohydrates (12.88%), calcium (0.03g), phosphorus (0.03g), iron (0.8g), beta carotene (70 IU), vitamin C (50-100mg/100g pulp) etc. Ripe ber fruits are eaten fresh. Fruits is also dried and used as dessert. It givens an excellent product when candy. Other processed products made are ber butter, ber juice or squash, RTS etc.

Plant bio-regulators and micronutrient such as Promalin, $GA_{4+7}$ and borax play an important role in increase fruits size, fruits set, fruit yield, self-life and quality improvement. Promalin plays an important role for increase the size and shape of the fruit. Promalin containing gibberellins and cytokine promotes both cell division and cell enlargement.

$GA_{4+7}$ plays an important role for induce fruit elongation and to increase the size and quality, fruit set, changing fruit shape and size, increasing weight of fruit,

Boron is for most important in the micro nutrients. Boron also plays important role for nucleic acid and lignin synthesis, pollen tube growth, it is associated with carbohydrate and fat metabolism and translocation and transformation of sugars.

**MATERIALS AND METHODS**

The present study was conducted on twenty eight years old uniform tree of ber cv. Gola, planted at a distance of 8 x 8m in Main Experimental Station of Horticulture, Acharya Narendra Deva University of agriculture & Technology, Narendra Nagar, Kumarganj, Ayodhaya. ($26^0.47^0$N latitude, $82.12^0$E longitude of 113 meters altitude away from mean sea stratum) during 2021-22 and 2022-23. Plants growth regulators and micro-nutrient, viz. promalin (0.13% and 0.15%), $GA_{4+7}$ (10 ppm and 15 ppm) and borax (0.5%). Experiment was laid out in randomized block design (RBD) with three replication per treatment and considering one tree per replication. Data on fruit drop was recorded periodically from October to March. Ber fruits from sprayed plants were harvested month of March 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 term of length and breadth (cm) were measured with help of vernier's calliper and expressed in centimetres. Fruit weight were recorded with help of digital weighing machine and expressed in gram. Among bio-chemical parameters, TSS content was determined with hand refractometer and expressed in per cent (Ranganna, 1986). Acidity was expressed as per cent of citric acid as method given by Kaur, A. and Kalia, M.(2017). Ascorbic acid content was expressed in mg/100g of pulp and was estimated using 2,6-dichlorophenol indophenol dye by visual titration method(AOAC 1975).Total sugar reducing, non-reducing expressed in per cent was estimated by method suggested by AOAC (1975).The experiment data were analyzed following RBD to test the significance of using the Stastistix-10 software. The differences in quantified concentrations were evaluated using F test at $P<0.05$. Statistical analysis was done as described by Gomez and Gomez (1984).

## RESULTS AND DISCUSSION

### Fruit Size (cm)

### Fruit Length (cm)

A perusal of data on fruit length presented in Table (1.) indicated that all treatments have a significant effect in improving the fruit length over control .The maximum fruit length (3.87cm and 3.92 cm) was recorded with **$T_8$**-0.15% Promalin+0.5% Borax, which was significantly superior over the rest of the treatments and at par with **$T_{10}$** -15 ppm $GA_{4+7}$ +0.5% Borax (3.79cm & 3.84cm) followed by **$T_9$**-10 ppm $GA_{4+7}$+ 0.5% Borax (3.64cm and 3.69 cm ), **$T_5$** -15 ppm $GA_{4+7}$ (3.54cm and 3.59cm) and **$T_7$**- 0.13% Promalin+0.5% Borax (3.39cm and 3.43cm), **$T_3$**- 0.15 % Promalin (3.28cm and 3.32cm), **$T_4$**- 10 ppm $GA_{4+7}$ (3.22cm and 3.25cm),**$T_2$**- 0.13 % Promalin (3.13 and 3.17),**$T_6$** -0.5 % Borax(3.10&3.14cm) respectively. While minimum fruit length (3.08cm and 3.11cm) was recorded with control during 2021-22 and 2022-23, respectively.

### Fruit breadth (cm)

A perusal of data on fruit length presented in Table 1. indicated that all treatments have a significant effect in improving the fruit breadth over control .The maximum fruit breadth (3.38 cm and 3.41 cm ) was recorded with **$T_8$** - 0.15% Promalin+0.5% Borax, which was significantly superior over the rest of the treatments and at par with **$T_{10}$** 15 ppm $GA_{4+7}$ +0.5% Borax( 3.33cm and 3.36cm) and **$T_9$**-10 ppm $GA_{4+7}$+ 0.5% Borax (3.32 cm and 3.35 cm ), followed by **$T_5$** -15 ppm $GA_{4+7}$ (3.30 cm and 3.33cm ),**$T_7$**- 0.13% Promalin+0.5% Borax (3.26 cm and 3.29cm ) **$T_3$**- 15ppm Promalin (3.22 and 3.25 cm ),**$T_4$** -10 ppm $GA_{4+7}$ ( 3.18cm and 3.21cm) and **$T_2$**-0.13 % Promalin(3.10cm and 3.13cm), **$T_6$**- 0.5% Borax (3.00cm and 3.03cm ), respectively. While minimum fruit breadth (2.60cm and 2.63cm) was recorded with control during 2021-22 and 2022-23, respectively.

Fruit size was reported to be a genetic characteristic of the cultivars. The increase in size of fruit (length and width) over control as a result of foliar application of borax , Promalin(6BA) and $GA_{4+7}$ in present investigation might be due to their involvement in cell division, cell elongation, increased volume of intercellular spaces in the mesocarpic cells (Brahmachari *et al.* 1997), Promalin , $GA_{4+7}$ is also reported to promote growth by increasing plasticity of the cell wall followed by the hydrolysis of starch into sugar which reduces the cell water potential, resulting in the entry of water into the cell and causing elongation (Kassem *et al*., 2011).

Increased in fruit size with plant growth regulators and micro-nutrient application has also been reported by Stembridge and Morell (1972) reported that maximum fruit size application of promalin @ 50 ppm. Unarth (1974) foliar application of 25 and 50ppm promalin sprayed in apple, Cibulsky (1977); Looney (1979); Comai *et al.* (1981) in apple, Curracy and Williams (1982); Eccher and Maffi (1986) in apple, Pal (1997) in apple.

### Fruit weight (g) / fruit

A perusal of data on fruit weight presented in Table1. indicated that all treatments have a significant effect in improving the fruit weight over control. The maximum fruit weight (27.69 g and 28.89g) was recorded with **$T_8$** - 0.15% Promalin+0.5%Borax, which was significantly superior over the rest of the treatments and at par with **$T_{10}$** -15 ppm $GA_{4+7}$ +0.5% Borax ( 26.30g in 2021-22), followed by **$T_9$** -10 ppm $GA_{4+7}$+ 0.5% Borax (25.87g,) **$T_5$** -15 ppm $GA_{4+7}$ (23.96 g and 25.16 g ),**$T_7$** - 0.13% Promalin+0.5% Borax ( 23.40g and 24.60g) , **$T_3$**- 15ppm Promalin (23.24g and 24.44g),**$T_4$** -10 ppm $GA_{4+7}$ ( 22.83g and 24.03g), **$T_2$**-0.13 % Promalin (21.97g and 23.17g) respectively. While minimum fruit weight (19.89g and 21.09) was recorded with control during 2021-22 and 2022-23, respectively.

**Table 1.: Effect of foliar feeding of plant growth regulators and micro-nutrient on Fruit size, and Fruit weight of ber fruit**

| Treatment | Parameters | | | | | |
|---|---|---|---|---|---|---|
| | Length (cm) | | Breadth (cm) | | Fruit weight (g)/fruit | |
| | 2021-22 | 2022-23 | 2021-22 | 2022-23 | 2021-22 | 2022-23 |
| $T_1$- Control | $3.08^{f}$ | $3.11^{e}$ | $2.60^{f}$ | $2.63^{f}$ | $19.89^{f}$ | $21.09^{f}$ |
| $T_2$ - 0.13 % Promalin | $3.13^{ef}$ | $3.17^{de}$ | $3.10^{d}$ | $3.13^{de}$ | $21.97^{de}$ | $23.17^{de}$ |
| $T_3$ - 0.15 % Promalin | $3.28^{cd}$ | $3.32^{cd}$ | $3.22^{c}$ | $3.25^{bcd}$ | $23.24^{cd}$ | $24.44^{c}$ |
| $T_4$ - 10 ppm $GA_{4+7}$ | $3.22^{de}$ | $3.25^{de}$ | $3.18^{c}$ | $3.21^{cd}$ | $22.83^{cde}$ | $24.03^{cd}$ |
| $T_5$ - 15 ppm $GA_{4+7}$ | $3.54^{b}$ | $3.59^{b}$ | $3.30^{b}$ | $3.33^{abc}$ | $23.96^{c}$ | $25.16^{c}$ |
| $T_6$ - 0.5 % Borax | $3.10^{f}$ | $3.14^{e}$ | $3.00^{e}$ | $3.03^{e}$ | $21.36^{ef}$ | $22.56^{e}$ |
| $T_7$ - 0.13 % Promalin + 0.5 % Borax | $3.39^{c}$ | $3.43^{c}$ | $3.26^{bc}$ | $3.29^{abc}$ | $23.40^{cd}$ | $24.60^{c}$ |
| $T_8$ - 0.15 % Promalin + 0.5 % Borax | $3.87^{a}$ | $3.92^{a}$ | $3.38^{a}$ | $3.41^{a}$ | $27.69^{a}$ | $28.89^{a}$ |
| $T_9$ - 10 ppm $GA_{4+7}$ + 0.5 % Borax | $3.64^{b}$ | $3.69^{b}$ | $3.32^{ab}$ | $3.35^{abc}$ | $25.87^{b}$ | $27.07^{b}$ |
| $T_{10}$ -15 ppm $GA_{4+7}$+ 0.5 % Borax | $3.79^{a}$ | $3.84^{a}$ | $3.33^{ab}$ | $3.36^{ab}$ | $26.30^{ab}$ | $27.50^{b}$ |
| **LSD (p≤0.05)** | **0.113** | **0.155** | **0.079** | **0.135** | **1.699** | **1.199** |

Increase in fruit weight with the spray of PGRs and micro-nutrient might be due to faster loading and mobilization into fruits (Brahmachari *et al.* 1997) and involvement in hormonal metabolism, increased cell division and expansion of cell. This may also be attributed to greater photosynthetic activity, resulting the increased production and accumulation of carbohydrates and favourable effect on vegetative growth and retention of fruits, which might have increased size and weight.

The present findings regarding the increase in fruit size and fruit weight with application of promalin and $GA_{4+7}$ may be due to cell division and cell elongation. These results in close conformity with results of Looney *et al.* (1992), McArtney (2010), Chen *et al.* (2012)**,** Ito *et al.* (2015), Sekhar (2012) and Al-madhagi *et al.* (2012) in strawberry. Kumar *et al.* (2003) and Yildirim *et al.* (2014) also found significant increase in fruit weight and size with application of promalin and $GA_{4+7}$ in fruit crops.

**TSS ($Brix^0$)**

A perusal of data depicted in Chart 1 that all treatments have a significant in improving the TSS. The maximum TSS (19.42& 19.49) was recorded under the treatment of **$T_8$**- 0.15 % Promalin+0.5 % Borax, which was statistically *at par* with **$T_{10}$**- 15 ppm $GA_{4+7}$ + 0.5 % Borax(19.02 and19.09) and **$T_9$**-10ppm $GA_{4+7}$ + 0.5 % Borax(18.76 and 18.83), followed by **$T_7$**- 0.13 % Promalin+0.5% Borax (18.41 and 18.48), **$T_6$**- Borax 0.5% (18.03 and 18.10), **$T_5$**- 15ppm $GA_{4+7}$ (17.58 and 17.65), **$T_3$**- 0.15 % Promalin (17.20 and 17.27), **$T_4$**- 10 ppm $GA_{4+7}$(16.56 and 16.63) and **$T_2$**- 0.13 % Promalin (15.83 and 15.90), while minimum TSS (14.80 and 14.87) was recorded with control during 2021-22 and 2022-23, respectively.

Increased TSS due to metabolic modification of starch and pectin, hydrolysis of complex polysaccharides, metabolite synthesis, and fast sugar translocation from leaves to developing fruits, foliar application of PGRs and micronutrients enhances total soluble solids (TSS) content in fruits. Total soluble solids (TSS) are also increased by promalin and boron, with a maximum TSS of 0.5% Borax and 0.15% Promalin applied topically. These results are also in close conformity with those of Jindal *et al.* (2004) in apple, Pandey and Kumar (2022) and Pal *et al.*(2022) in ber cv. Gola, Montalti *et al.* (1984) in apple, Canli *et al.* (2009) in pear, Wismer *et al.* (1995) in apples, Cheolku *et al.* (2000) in pear, and Sharma (2001) in apple cv. Starking Delicious.

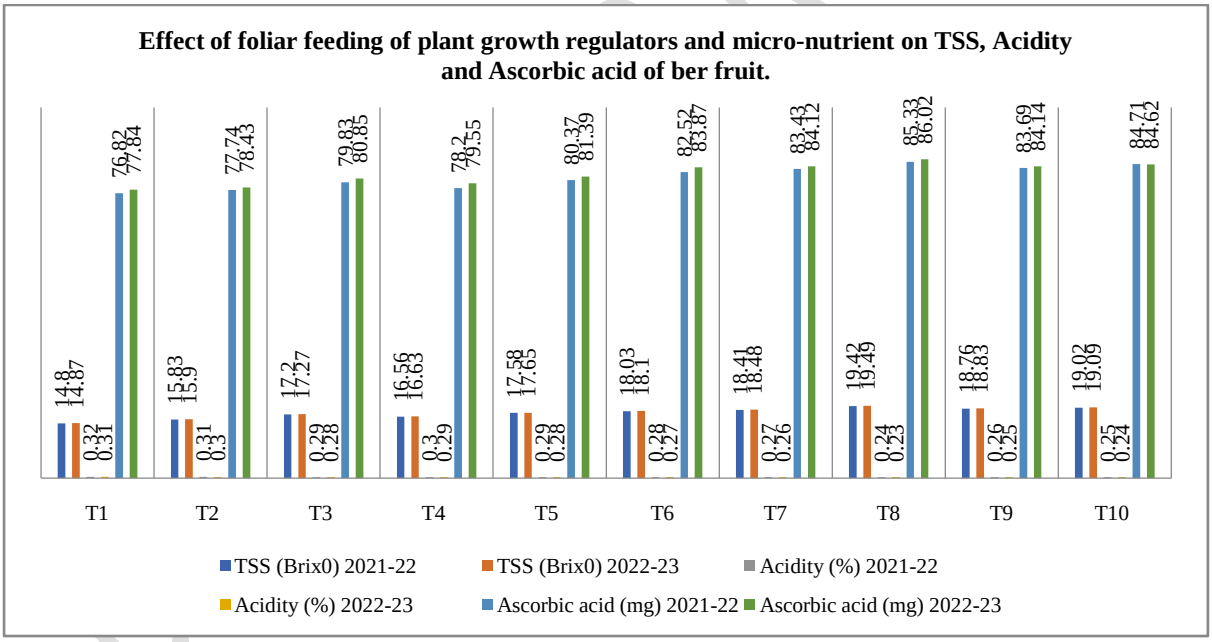


**Chart 1: Effect of foliar feeding of plant growth regulators and micro-nutrient on TSS, Acidity and Ascorbic acid of ber fruit.**

## Acidity (%)

A perusal of data Chart 1 revealed that all treatments have a significant in improving the Acidity per cent. The minimum Acidity per cent (0.24 and 0.23) was recorded under the treatment of **$T_8$**- 0.15% Promalin+0.5% Borax, which was statistically *at par* with **$T_{10}$**- 15 ppm $GA_{4+7}$ +0.5 % Borax (0.25 and 0.24) , followed by **$T_9$**-10 ppm $GA_{4+7}$ +0.5% Borax (0.26 and 0.25), **$T_7$**-0.13 % Promalin+

0.5% Borax (0.27 and 0.26), **$T_6$**- Borax 0.5% (0.28 and 0.27),**$T_5$**- 15 ppm $GA_{4+7}$(0.29 and 0.28), **$T_3$**- 0.15 % Promalin (0.29 and 0.28), **$T_4$**- 10 ppm $GA_{4+7}$(0.30 and 0.29)**, $T_2$**- 0.13% Promalin, while maximum Acidity (0.32 and 0.31) was recorded with control during 2021-22 and 2022-23, respectively.

The decrease in the acidity might be due to higher accumulation of sugars in fruits, better translocation of sugars into fruit tissues and conversion of organic acids into sugars by foliar application of PGRs and micro-nutrient. The reduction in the acidity under boric acid treatment might be owing to increased TSS of the fruits. These results also elucidate the finding of Jindal *et al.* (2004) in apple cv. Starking Delicious, Canli *et al.* (2009) in "Deveci" pear, Pandey and Kumar (2022), Pal *et al.* (2022) in ber cv. Gola, Khalid *et al.* (2012) in Kinnow.

## Ascorbic acid (mg)

A perusal of data Chart 1 revealed that all treatments have a significant in improving the Acidity per cent .The maximum Ascorbic acid (85.33 and 86.02) was recorded under the treatment of **$T_8$**-0.15 % Promalin+0.5% Borax which was statistically *at par* with **$T_{10}$**-15 ppm $GA_{4+7}$ + 0.5 % Borax(84.71 and 84.62)followed by **$T_9$**-10 ppm $GA_{4+7}$ + 0.5 % Borax(83.69 and 84.14), **$T_7$**-0.13% Promalin + 0.5 % Borax (83.43 and 84.12), **$T_6$** -Borax 0.5% (82.52 and 83.87), **$T_5$**- 15ppm $GA_{4+7}$(80.37 and 81.39), **$T_3$**-0.15% Promalin (79.83 and 80.85), **$T_4$**- 10 ppm $GA_{4+7}$ (78.20 and 79.55) and **$T_2$**-0.13 % Promalin (77.74 and 78.43), while minimum ascorbic acid (76.82 and 77.84) was recorded with control during 2021-22 and 2022-23, respectively.

The increase in ascorbic acid content might be speculated due to increased activity of enzyme responsible for the synthesis of the ascorbic acid precursor i.e., glucose-6-phosphate or inhibition of its conversion into dehydro ascorbic acid by enzyme ascorbic acid oxidase or both and also the reduction in the rate of respiration by these chemicals (Brahmachari and Rani 2001). Similar result have been reported by Pal *et al.*,(2022) and Pandey and Kumar (2022) in ber cv. Gola, Khalid *et al.*, (2012) in Kinnow and Cheolku *et al.* (2000) in pear.

## Reducing sugar (%)

A perusal of data Chart 2 revealed that all treatments have a significant in improving the Acidity percent. The maximum reducing sugar (6.23 and 6.25) was recorded under the treatment of **$T_7$** -0.13 % Promalin + 0.5 % Borax followed by **$T_{10}$**- 15 ppm $GA_{4+7}$ + 0.5 % Borax (5.96 and 5.98), **$T_9$**-10 ppm $GA_{4+7}$ +0.5 % Borax(5.84 and 5.87), **$T_8$**- 0.15 % Promalin+0.5 % Borax (5.73 and 5.75), **$T_6$** - Borax 0.5% (5.59 and 5.62), **$T_5$**- 15 ppm $GA_{4+7}$(5.43 and 5.45),**$T_3$**- 0.15 % Promalin(5.30 and 5.32), **$T_4$**- 10 ppm $GA_{4+7}$(5.07 and 5.14) and **$T_2$**-0.13 % Promalin (4.82 and 4.84), while minimum reducing sugar (4.47 and 4.49) was recorded with control during 2021-22 and 2022-23, respectively.

Foliar spray of PGRs and micro-nutrients is helpful to increase the reducing sugar level, which could be due to accumulation of more carbohydrates to the fruit which results the better accessibility

of nutrition for developing fruits and increases the reducing sugar level of fruits in present investigation. The result in conformity with those of Pandey and Kumar (2022) and Pal *et al.*(2022) in ber cv. Gola, Jindal *et al.* (2004) in apple, Canli *et al.* (2009) in pear and Khalid *et al.*, (2012) in Kinnow and Cheolku *et al.* (2000) in pear.

## Non-reducing sugar (%)

A perusal of data Chart 2 revealed that all treatments have a significant in improving the Acidity per cent.The maximum Non-reducing sugar (7.92 and 7.95) was recorded under the treatment of **$T_7$**- 0.13 % Promalin +0.5 % Borax followed by **$T_{10}$**- 15 ppm $GA_{4+7}$ + 0.5 % Borax (7.87 and 7.90), **$T_9$**- 10 ppm $GA_{4+7}$ + 0.5 % Borax (7.72 and 7.74), **$T_8$**- 0.15 % Promalin + 0.5 % Borax (7.56 and 7.59), **$T_6$** - Borax 0.5% (7.39 and 7.41), **$T_5$**- 15ppm $GA_{4+7}$ (7.17 and 7.20), **$T_3$**- 0.15 % Promalin (6.99 and 7.02), **$T_4$**-10 ppm $GA_{4+7}$ (9.69 and 6.72) and **$T_2$**- 0.13 % Promalin (6.37 and 6.40), while minimum non-reducing sugar (5.89 and 5.92) was recorded with control during 2021-22 and 2022-23, respectively

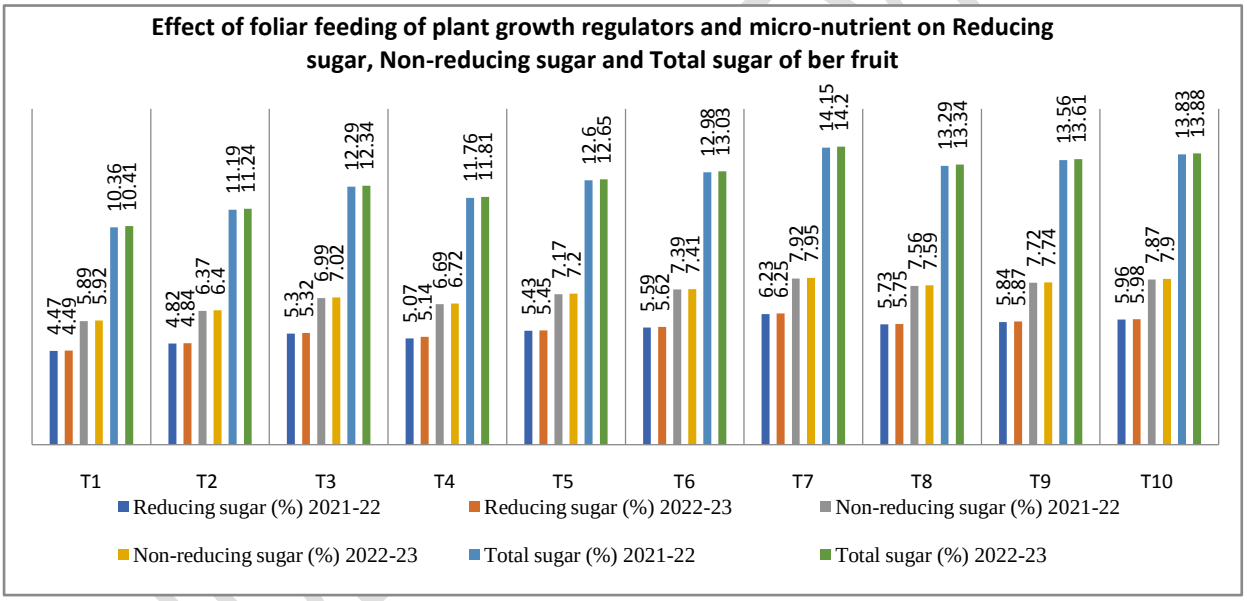


**Chart 2: Effect of foliar feeding of plant growth regulators and micro-nutrient on Reducing sugar, Non-reducing sugar and Total sugar of ber fruit.**

The possible reason for increase in non-reducing sugar content of fruits due to hydrolysis of polysaccharides to simpler form i.e. mono and disaccharides and better transportation of nutrients to plant from leaves to their place of utilization. These results corroborate the earlier records of Pandey and Kumar (2022) and Pal *et al.*(2022) in ber cv. Gola, Khalid *et al.*, (2012) in Kinnow, Jindal *et al.* (2004) in apple and Cheolku *et al.* (2000) in pear.

## Total sugar (%)

A perusal of data Chart 2 revealed that all treatments have a significant in improving the Acidity per cent. The maximum Total sugar (14.15 and 14.20) was recorded under the treatment of **$T_7$**- 0.13

% Promalin+0.5 % Borax followed by **$T_{10}$**- 15 ppm $GA_{4+7}$ + 0.5 % Borax (13.83 and 13.88), **$T_9$**-10 ppm $GA_{4+7}$ + 0.5 % Borax (13.56 and 13.61), **$T_8$**-0.15 % Promalin + 0.5 % Borax (13.29 and 13.34),**$T_6$** -Borax 0.5% (12.98 and 13.03), **$T_5$**- 15 ppm $GA_{4+7}$ (12.60 and 12.65), **$T_3$**- 0.15 % Promalin (12.29 and 12.34), **$T_4$**- 10 ppm $GA_{4+7}$ (11.76 and 11.81) and **$T_2$**- 0.13% Promalin (11.19 and 11.24), while minimum Total sugar (10.36 and 10.41) was recorded with control during 2021-22 and 2022-23, respectively.

The possible reason for increase in total sugar content may be due to hydrolysis of starch yielding mono and disaccharide, which owned a simplest form of sugar and boron, promalin and $GA_{4+7}$ probably augmented the conversion of starch. Gauch and Dugger (1953) reported that the improvement in total sugar content may be due to more translocation of sugars from leaves to developing fruits. Our results are also in line with the finding of Pandey and Kumar (2022) and Pal *et al.*,(2022) in ber cv. Gola, Chaudhary *et al.*(2018) in aonla, Cheolku *et al.* (2000) in pear, Wismer *et al.* (1995) in apples and Sharma (2001) in apple cv. Starking Delicious.

## CONCLUSION

It may be concluded that the application of different growth regulators resulted that improve the characters of ber *i.e.* Fruit weight, fruit size, TSS, acidity, ascorbic acid, reducing sugar, non-reducing sugar and total sugar. The sugar and ascorbic acid, parameters were significantly affected by the application of 0.15% Promalin+0.5% Borax ($T_8$) and $T_{10}$- 15 ppm GA4+7 + 0.5 % Borax. Based on cost benefit ratio it may be concluded that $T_{10}$- 15 ppm GA4+7 + 0.5 % Borax could be recommended to farmers for commercially increasing yield and quality of ber. Normally people don't prefer Gola variety ber over Apple ber due to it's small size but with the application of 15 ppm GA4+7 + 0.5 % Borax we can increase fruit size in a very economical way resultant consumer's preference will also increase.



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