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# Effect of Different Chemicals on Yield and Quality Parameters in Pomegranate (*Punica granatum* L.) Cv. Phule Bhagwa

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## ABSTRACT

The experiment was conducted during the year 2014-15 at two locations in factorial randomized block design. The first experiment was carried out at village Durgapur for *Ambiabahar* and second experiment was carried out at village Rahuri factory for *Mrigbahar*. There were eight treatments in foliar application of chemicals (F) and six treatments in soil application of chemicals (T). Thus, total forty eight treatment combinations were replicated in two times. In *Ambiabahar* experiment, the maximum number of fruits per plant (81.50) were recorded in $F_4T_3$ which was statistically at par with $F_3T_3$ (81.00). In *Mrigbahar* experiment, the maximum number of fruits per plant (146.00) were recorded in $F_3T_3$ which was statistically at par with $F_4T_3$ (143.25). Significantly maximum yield per plant (22.13 kg) and (49.59 kg) was recorded in $F_3T_3$ in ambia and *Mrigbahar* experiment respectively. In both experiment, significantly maximum average weight of fruit was recorded in $F_3T_6$. The maximum T.S.S. (15.45°Brix) and (16.65°Brix) was recorded in $F_4T_6$ in ambia and *Mrigbahar* experiment, respectively. In *Ambiabahar* experiment, the minimum acidity (0.397%) was recorded in $F_3T_3$ which was statistically at par with $F_3T_2$, $F_3T_4$ and $F_2T_3$ (0.41%), while in *Mrigbahar* experiment significantly minimum acidity (0.346%) was recorded in $F_4T_3$.

**Key words:** *Ambiabahar*, *Mrigbahar*, *Punicag ranatum,* Phule Bhagwa, Yield, Quality

Pomegranate (*Punica granatum* L.) belonging to family punicaceae is associated with the most ancient civilization in the Middle East and is native to Persia and the surrounding area. In India, pomegranate is widely grown commercially in the states of Maharashtra, Gujarat, Rajasthan, Andhra Pradesh, Karnataka and to limited extent in Uttar Pradesh, and Tamil Nadu. The pomegranate plant flower and provide fruit throughout the year in central and southern India. However, it needs to be thrown into rest period so as to enable prolific harvest at a given time. Looking to the pattern of precipitation, flowering can be induced during January-February (*Ambiabahar*), June-July (*Mrigbahar*) and September-October (*Hastabahar*). Water stress induces flowering in a stipulated period which ultimately leads to proper management and thereby receiving good quality yield. However, this water stress is interrupted by untimely rains and sometimes by abnormal weather conditions. This disturbs the rhythm of flowering, fruit development and harvesting in general. This also invites pests and diseases. Thus, with a view to avoid ill effects of weather conditions, chemical induction of flowering was thought to be a reliable practice for effective *Bahar* enhancement (Ramezanian *et al*. 2009). Therefore the present investigation was planned to study the effect of different chemicals in induction of flowering in pomegranate.

## MATERIALS AND METHODS

The present investigation was conducted to study the effect of chemicals on induction of flowering in pomegranate Cv. Phule Bhagwa during 2014-15 on farmer's field at two locations. The first experiment was carried out at village Durgapur for *Ambiabahar* on two year old orchard and second experiment was carried out at village Rahuri factory for *Mrigbahar* on five year old orchard. In both experiments the crop was kept into the rest period so as to enable prolific flowering at a given time. The recommended dose of fertilizer 625:250:250, N:$P_2O_5$:$K_2O$ g/plant is given to plants of all treatments and absolute control. The date of first irrigation for *Ambia* and *Mrigbahar* experiment was 1st of January 2015 and 1st of June 2015, respectively. Flower bud differentiation in pomegranate occurs about one month before flowering. Hence, the treatments were applied one month before the date of first irrigation in both experiments. The date of first irrigation was preceded by withholding of water which is a part of *bahar* regulation in pomegranate. The experiment was conducted in factorial randomized block design. There were eight treatments in foliar application of chemicals and six treatments in soil application of chemicals. Thus, total forty eight treatment combinations were replicated in two times. Treatment details are elaborated in (Table 1). Observations on fruit quality and yield parameters were recorded.

Table 1 Treatment details

| Treatment No. | Treatment details |
|---|---|
| | Foliar application of chemicals |
| $F_1$ | Cycocel 1500 ppm one month before start of bahar |
| $F_2$ | Cycocel 1500 ppm + $KNO_3$ 1% one month before start of bahar |
| $F_3$ | Cycocel2000 ppm one month before start of bahar |
| $F_4$ | Cycocel 2000 ppm + $KNO_3$ 2% one month before start of bahar |
| $F_5$ | Nitrobenzene 5 ml/litre one month before start of bahar |
| $F_6$ | Nitrobenzene 5 ml/litre one month before start of bahar + second spray 15 days before start of bahar |
| $F_7$ | Salicylic acid 300 ppm one month before start of bahar |
| $F_8$ | Salicylic acid 300 ppm one month before start of bahar + second spray 15 days before start of bahar |
| | Soil Application of chemicals |
| $T_1$ | Methionine -5 ppm in 5 litre Microbial inoculum (M.I.) |
| $T_2$ | $FeSO_4$ - 500 ppm in 5 litre Microbial inoculum (M.I.) |
| $T_3$ | D-glucose - 50 g/plant in 5 litre Microbial inoculum (M.I.) |
| $T_4$ | Microbial inoculum (M.I.) –mixing of 100 kg cow dung, 2 kg *Trichoderma viride*, 2 kg *Pseudomonas fluorescens*, 3 kg Jaggery, 5 kg Neem cake and water in non-metallic drum a week prior to application. |
| $T_5$ | Paclobutrazol – 4ml/plant in 5 litre of water |
| $T_6$ | Calcium nitrate – 60 g/plant in 5 litre of water and drenching |
| | Absolute control |

## RESULTS AND DISCUSSION

*Number of fruits per plant*

The data of *Ambiabahar* experiment regarding number of fruits per plant influenced by foliar application of chemicals (F) and soil application of chemicals (T) is presented in (Table 2, 3). In *Ambiabahar* experiment, the maximum number of fruits per plant (81.50) were recorded in $F_4T_3$ which was statistically at par with $F_3T_3$ (81.00). Significantly minimum number of fruits per plant (29.25) were recorded in $F_7T_4$. The absolute control recorded (28.75) fruit per plant.

The data of *Mrigbahar* experiment regarding yield per plant influenced by foliar application of chemicals (F) and soil application of chemicals (T) is presented in (Table 4, 5). In *Mrigbahar* experiment, the maximum number of fruits per plant (146.00) were recorded in $F_3T_3$ which was statistically at par with $F_4T_3$ (143.25). Significantly minimum number of fruits per plant (67.00) were recorded in $F_8T_4$. The absolute control recorded 53.50 fruit per plant. Goor and Lieberman (1956) reported that the number of hermaphrodite flowers governs the fruit number. In the present study, the highest number of hermaphrodite flowers was recorded in foliar application of cycocel 2000 ppm and soil application of D-glucose + microbial inoculum. Abo-Aziz *et al*. (1988) reported increased number of fruits per tree in response to cycocel application. Kumar (2014) also recorded highest number of fruits in response to foliar application of cycocel in strawberry. Similar results were reported by Thirugnanavel *et al*. (2007) in acid lime, Nahar *et al*. (2010) in mango and Sarker and Rahim (2013) in mango Cv. Amrapali.

*Yield per plant (kg)*

The data of *Ambiabahar* experiment regarding yield per plants influenced by foliar application of chemicals (F) and soil application of chemicals (T) is presented in (Table 2, 3). In *Ambiabahar* experiment, the maximum yield per plant (22.13 kg) was recorded in $F_3T_3$ which was statistically at par with $F_4T_3$ (21.79 kg). Significantly minimum yield per plant (5.67 kg) was recorded in $F_8T_4$. The absolute control recorded 5.52 kg yield per plant. The data of *Mrigbahar* experiment regarding yield per plant influenced by foliar application of chemicals (F) and soil application of

chemicals (T) is presented in (Table 4, 5). In *Mrigbahar* experiment, significantly maximum yield per plant (49.59 kg) was recorded in $F_3T_3$. It was followed by $F_4T_3$ (46.89 kg). Significantly minimum yield per plant (17.42 kg) was recorded in $F_8T_4$. The absolute control recorded 14.59 kg yield per plant. Abo-Aziz (1988) reported increase in yield by 43% in response to cycocel application (1500 ppm) at the beginning of flowering stage. Lakshmi *et al*. (2014) reported highest yield per tree in response to spraying of $GA_3$ 50 ppm + cycocel 1000 ppm + $KNO_3$. Cycocel acted as anti-gibberellin compound by inhibiting vegetative growth, nucleic acid synthesis and protein metabolism thereby enhancing flower bud initiation. Potassium nitrate sprays helps to set more fruits. Kumar *et al*. (2014) recorded highest fruit yield with use of 500 ppm cycocel in strawberry. Similar results for increase in yield by application of cycocel were reported by Chundawat and Gupta (1974) in phalsa and Patel and Patel (1979) in ber.

Table 2 Effect of individual factor on yield and quality parameters during *Ambiabahar* experiment

| Treatment | No. of fruits per plant | Yield per plant (kg) | Average weight of fruit (g) | Rind thickness (mm) | T.S.S. (°Brix) | Acidity (%) |
|---|---|---|---|---|---|---|
| $F_1$: Cycocel 1500 ppm | 53.29 | 12.65 | 235.69 | 3.13 | 14.32 | 0.430 |
| $F_2$: Cycocel 1500 ppm + $KNO_3$ 1% | 52.50 | 12.13 | 229.89 | 3.03 | 14.28 | 0.435 |
| $F_3$: Cycocel 2000 ppm | 65.54 | 16.56 | 250.51 | 3.28 | 14.58 | 0.415 |
| $F_4$: Cycocel 2000 ppm + $KNO_3$ 2% | 60.63 | 14.98 | 247.12 | 3.15 | 14.73 | 0.419 |
| $F_5$: Nitrobenzene 5 ml/litre | 44.71 | 9.51 | 211.80 | 3.08 | 14.06 | 0.432 |
| $F_6$: Nitrobenzene 5 ml/litre + second spray after 15 days | 44.63 | 9.32 | 207.13 | 3.03 | 14.00 | 0.434 |
| $F_7$: Salicylic acid 300 ppm | 36.46 | 7.47 | 203.41 | 2.98 | 13.92 | 0.442 |
| $F_8$: Salicylic acid 300 ppm + second spray after 15 days | 36.75 | 7.52 | 203.63 | 2.97 | 13.78 | 0.443 |
| S. E.± | 0.49 | 0.15 | 1.59 | 0.05 | 0.04 | 0.001 |
| C. D. at 5% | 1.38 | 0.41 | 4.46 | 0.14 | 0.12 | 0.003 |
| $T_1$: Methionine - 5 ppm + M.I. | 46.72 | 9.95 | 210.04 | 2.94 | 14.00 | 0.431 |
| $T_2$: $FeSO_4$ - 500 ppm + M.I. | 43.59 | 9.70 | 218.20 | 2.84 | 14.06 | 0.426 |
| $T_3$: D-glucose-50 g/plant + M.I. | 64.59 | 15.64 | 237.87 | 3.11 | 14.46 | 0.419 |
| $T_4$: Microbial inoculum (M.I.) | 40.56 | 8.46 | 206.14 | 2.87 | 13.96 | 0.432 |
| $T_5$: Paclobutrazol – 4 ml/plant | 49.28 | 11.16 | 223.16 | 3.28 | 14.20 | 0.444 |
| $T_6$: Calcium nitrate – 60 g/plant | 51.13 | 12.91 | 247.98 | 3.43 | 14.57 | 0.434 |
| S. E.± | 0.43 | 0.13 | 1.37 | 0.04 | 0.04 | 0.001 |
| C. D. at 5% | 1.20 | 0.35 | 3.86 | 0.12 | 0.11 | 0.003 |

*Average weight of fruit (g)*

The data of *Ambiabahar* experiment regarding average weight of fruit influenced by foliar application of chemicals (F) and soil application of chemicals (T) is presented in (Table 2, 3). In *Ambiabahar* experiment, the maximum average weight of fruit (284.57 g) was recorded in $F_3T_6$ which was statistically at par with $F_4T_6$ (281.07 g). Significantly minimum average weight of fruit (189.08 g) was recorded in $F_8T_4$. The absolute control recorded 191.84 g average weight of fruit.

The data of *Mrigbahar* experiment regarding average weight of fruit influenced by foliar application of chemicals (F) and soil application of chemicals (T) is presented in (Table 4, 5). In *Mrigbahar* experiment, significantly maximum average weight of fruit (357.51 g) was recorded in $F_3T_6$. It was followed by $F_1T_6$ (348.69 g) which was statistically at par with $F_4T_3$ (327.38 g), $F_4T_6$ (340.35 g), $F_3T_3$ (339.62 g). Significantly minimum average weight of fruit (259.91 g) was recorded in treatment $F_8T_4$. The absolute control recorded 272.80 g average weight of fruit. Similar results for increase in average fruit weight by application of cycocel were reported by Hari-Om *et al*. (1975) in apple, Harishkumar and Singh (1984) in grape. Similar results for increase in average fruit weight by application of $KNO_3$ were reported by Debaje *et al*. (2011) in acid lime. Korkmaz *et al*. (2016) reported increased average fruit weight in response to calcium nitrate application. Ramezanian *et al*. (2009) reported calcium as a 2 and 4% calcium chloride spray increased average fruit weight in pomegranate.

*Rind thickness*

The data of *Ambiabahar* experiment regarding rind thickness influenced by foliar application of chemicals (F) and soil application of chemicals (T) is presented in (Table 2, 3). In *Ambiabahar* experiment, numerically the maximum rind thickness (3.70 mm) was recorded in $F_3T_6$. Numerically the minimum rind thickness (2.65 mm) was recorded in $F_2T_2$. The absolute control recorded 2.80 mm rind thickness. The data of *Mrigbahar* experiment regarding rind thickness influenced by foliar application of chemicals (F) and soil application of chemicals (T) is presented in (Table 4, 5). In *Mrigbahar* experiment, numerically the maximum rind thickness (4.20 mm) was recorded in $F_3T_6$. Numerically the minimum rind thickness (3.10 mm) was recorded in treatment $F_5T_4$. The absolute control recorded 3.20 mm rind thickness. Similar results were recorded by Chapman (1982) who revealed that fruit diameter and rind thickness was

increased by applied potassium in mandarins. Morgan *et al.* (2005) also reported the need for maintaining K levels within the optimum range is probably more critical for enhancing external fruit quality. They also reported that peel thickness was directly proportional to K concentration in leaf and peel tissues. Gill *et al*. (2005) reported that foliar potassium treatments significantly increased peel thickness of Kinnow mandarin fruits. In addition, Goepfert *et al.* (1987) working on Valencia orange reported that potassium increased peel thickness. Young Ho *et al*. (2004) in Korea found that application of calcium in Satsuma mandarin caused the thickest peel. These results are also supported by Kim *et al*. (2004) who reported that rind thickness increased as a result of calcium application in Satsuma mandarins. Similar results were recorded by Debaje *et al.* (2011) in acid lime.

Table 3 Effect of two factors on yield and quality parameters during *Ambiabahar* experiment

| Treatment | No. of fruits per plant | Yield per plant (kg) | Average weight of fruit (g) | Rind thickness (mm) | T.S.S. (°Brix) | Acidity (%) |
|---|---|---|---|---|---|---|
| $F_1T_1$ | 54.00 | 11.95 | 221.55 | 2.90 | 14.10 | 0.435 |
| $F_1T_2$ | 47.25 | 10.98 | 232.25 | 3.00 | 14.05 | 0.422 |
| $F_1T_3$ | 68.75 | 17.58 | 256.01 | 3.10 | 14.70 | 0.422 |
| $F_1T_4$ | 43.50 | 9.28 | 213.25 | 2.90 | 13.90 | 0.429 |
| $F_1T_5$ | 51.75 | 11.96 | 231.11 | 3.40 | 14.35 | 0.448 |
| $F_1T_6$ | 54.50 | 14.17 | 259.96 | 3.50 | 14.80 | 0.422 |
| $F_2T_1$ | 50.50 | 11.13 | 220.34 | 3.00 | 14.05 | 0.435 |
| $F_2T_2$ | 43.50 | 9.78 | 224.83 | 2.65 | 14.05 | 0.435 |
| $F_2T_3$ | 74.50 | 17.90 | 240.34 | 3.20 | 14.40 | 0.422 |
| $F_2T_4$ | 44.50 | 9.83 | 220.83 | 3.00 | 14.05 | 0.435 |
| $F_2T_5$ | 50.50 | 11.36 | 224.85 | 3.00 | 14.50 | 0.448 |
| $F_2T_6$ | 51.50 | 12.78 | 248.16 | 3.30 | 14.65 | 0.435 |
| $F_3T_1$ | 63.00 | 14.40 | 228.45 | 3.05 | 14.05 | 0.416 |
| $F_3T_2$ | 61.25 | 14.84 | 242.26 | 3.10 | 14.25 | 0.410 |
| $F_3T_3$ | 81.00 | 22.13 | 273.19 | 3.15 | 15.20 | 0.397 |
| $F_3T_4$ | 55.75 | 12.29 | 220.31 | 3.15 | 14.10 | 0.410 |
| $F_3T_5$ | 63.25 | 16.09 | 254.32 | 3.50 | 14.60 | 0.435 |
| $F_3T_6$ | 69.00 | 19.64 | 284.57 | 3.70 | 15.25 | 0.422 |
| $F_4T_1$ | 54.50 | 12.43 | 228.12 | 3.05 | 14.35 | 0.422 |
| $F_4T_2$ | 54.50 | 13.51 | 247.81 | 2.75 | 14.45 | 0.416 |
| $F_4T_3$ | 81.50 | 21.79 | 267.37 | 3.20 | 14.95 | 0.410 |
| $F_4T_4$ | 48.50 | 10.72 | 221.06 | 3.00 | 14.35 | 0.416 |
| $F_4T_5$ | 61.00 | 15.21 | 249.30 | 3.40 | 14.85 | 0.429 |
| $F_4T_6$ | 63.75 | 17.92 | 281.07 | 3.50 | 15.45 | 0.422 |
| $F_5T_1$ | 39.25 | 8.06 | 205.29 | 3.00 | 14.00 | 0.422 |
| $F_5T_2$ | 42.75 | 9.08 | 212.47 | 2.80 | 14.05 | 0.435 |
| $F_5T_3$ | 58.00 | 12.53 | 216.00 | 3.20 | 14.05 | 0.422 |
| $F_5T_4$ | 34.75 | 6.80 | 195.61 | 2.70 | 13.95 | 0.435 |
| $F_5T_5$ | 47.75 | 10.03 | 210.07 | 3.30 | 14.00 | 0.442 |
| $F_5T_6$ | 45.75 | 10.58 | 231.37 | 3.45 | 14.30 | 0.435 |
| $F_6T_1$ | 44.25 | 8.45 | 190.91 | 2.90 | 14.00 | 0.435 |
| $F_6T_2$ | 34.00 | 6.76 | 198.67 | 2.85 | 13.75 | 0.422 |
| $F_6T_3$ | 55.50 | 12.44 | 224.10 | 3.10 | 14.05 | 0.422 |
| $F_6T_4$ | 38.25 | 7.41 | 193.46 | 2.70 | 14.00 | 0.435 |
| $F_6T_5$ | 46.50 | 9.51 | 204.51 | 3.30 | 13.95 | 0.448 |
| $F_6T_6$ | 49.25 | 11.38 | 231.14 | 3.30 | 14.25 | 0.442 |
| $F_7T_1$ | 32.75 | 6.28 | 191.90 | 2.90 | 13.50 | 0.448 |
| $F_7T_2$ | 33.00 | 6.38 | 193.36 | 2.75 | 13.95 | 0.435 |
| $F_7T_3$ | 48.50 | 10.49 | 216.20 | 2.90 | 14.15 | 0.422 |
| $F_7T_4$ | 29.25 | 5.72 | 195.50 | 2.70 | 13.95 | 0.448 |
| $F_7T_5$ | 37.75 | 7.65 | 202.44 | 3.25 | 14.00 | 0.448 |
| $F_7T_6$ | 37.50 | 8.29 | 221.08 | 3.40 | 13.95 | 0.448 |
| $F_8T_1$ | 35.50 | 6.88 | 193.80 | 2.70 | 13.95 | 0.435 |
| $F_8T_2$ | 32.50 | 6.30 | 193.98 | 2.85 | 13.90 | 0.435 |
| $F_8T_3$ | 49.00 | 10.28 | 209.75 | 3.05 | 14.20 | 0.435 |
| $F_8T_4$ | 30.00 | 5.67 | 189.08 | 2.80 | 13.35 | 0.448 |
| $F_8T_5$ | 35.75 | 7.46 | 208.68 | 3.10 | 13.35 | 0.455 |
| $F_8T_6$ | 37.75 | 8.55 | 226.50 | 3.30 | 13.90 | 0.448 |
| Absolute control | 28.75 | 5.52 | 191.84 | 2.80 | 13.65 | 0.435 |
| S.E. ± | 1.19 | 0.35 | 3.85 | 0.12 | 0.10 | 0.003 |
| C.D. at 5% | 3.35 | 0.99 | 10.81 | NS | 0.29 | 0.007 |

Table 4 Effect of individual factor on yield and quality parameters during *Mrigbahar* experiment

| Treatment | No. of fruits per plant | Yield per plant (kg) | Average weight of fruit (g) | Rind thickness (mm) | T.S.S. (°Brix) | Acidity (%) |
|---|---|---|---|---|---|---|
| $F_1$: Cycocel 1500 ppm | 101.00 | 31.59 | 312.18 | 3.63 | 15.20 | 0.397 |
| $F_2$: Cycocel 1500 ppm + $KNO_3$ 1% | 104.63 | 32.15 | 307.51 | 3.54 | 15.23 | 0.389 |
| $F_3$: Cycocel 2000 ppm | 115.96 | 37.80 | 324.78 | 3.84 | 15.53 | 0.395 |
| $F_4$: Cycocel 2000 ppm + $KNO_3$ 2% | 113.04 | 35.97 | 317.37 | 3.78 | 15.73 | 0.388 |
| $F_5$: Nitrobenzene 5 ml/litre | 83.38 | 23.10 | 276.16 | 3.36 | 14.95 | 0.406 |
| $F_6$: Nitrobenzene 5 ml/litre + second spray after 15 days | 95.79 | 27.23 | 283.76 | 3.49 | 14.86 | 0.408 |
| $F_7$: Salicylic acid 300 ppm | 84.88 | 24.27 | 285.23 | 3.38 | 14.79 | 0.416 |
| $F_8$: Salicylic acid 300 ppm + second spray after 15 days | 82.92 | 22.96 | 276.32 | 3.38 | 14.63 | 0.416 |
| S. E.± | 0.89 | 0.32 | 2.41 | 0.09 | 0.08 | 0.001 |
| C. D. at 5% | 2.51 | 0.90 | 6.78 | 0.24 | 0.23 | 0.004 |
| $T_1$: Methionine - 5 ppm + M.I. | 91.75 | 26.43 | 286.28 | 3.49 | 14.79 | 0.401 |
| $T_2$: $FeSO_4$ - 500 ppm + M.I. | 99.66 | 28.54 | 284.79 | 3.47 | 14.79 | 0.398 |
| $T_3$: D-glucose-50 g/plant + M.I. | 116.06 | 35.77 | 305.06 | 3.61 | 15.27 | 0.377 |
| $T_4$: Microbial inoculum (M.I.) | 81.53 | 23.61 | 287.46 | 3.41 | 14.94 | 0.401 |
| $T_5$: Paclobutrazol – 4 ml/plant | 98.03 | 29.70 | 301.09 | 3.56 | 15.15 | 0.427 |
| $T_6$: Calcium nitrate – 60 g/plant | 99.16 | 32.27 | 322.79 | 3.76 | 15.75 | 0.408 |
| S. E.± | 0.77 | 0.27 | 2.09 | 0.07 | 0.07 | 0.001 |
| C. D. at 5% | 2.17 | 0.77 | 5.87 | 0.21 | 0.20 | 0.003 |

Table 3 Effect of two factors on yield and quality parameters during *Mrigbahar* experiment

| Treatment | No. of fruits per plant | Yield per plant (kg) | Average weight of fruit (g) | Rind thickness (mm) | T.S.S. (°Brix) | Acidity (%) |
|---|---|---|---|---|---|---|
| $F_1T_1$ | 98.00 | 28.82 | 294.08 | 3.70 | 14.80 | 0.410 |
| $F_1T_2$ | 104.75 | 29.94 | 285.85 | 3.60 | 14.70 | 0.397 |
| $F_1T_3$ | 113.50 | 36.10 | 318.02 | 3.80 | 15.40 | 0.371 |
| $F_1T_4$ | 84.00 | 26.11 | 310.87 | 3.60 | 15.20 | 0.384 |
| $F_1T_5$ | 97.00 | 30.61 | 315.60 | 3.50 | 15.05 | 0.422 |
| $F_1T_6$ | 108.75 | 37.93 | 348.69 | 3.60 | 16.05 | 0.397 |
| $F_2T_1$ | 100.75 | 29.78 | 295.58 | 3.60 | 14.80 | 0.371 |
| $F_2T_2$ | 111.50 | 31.96 | 286.74 | 3.50 | 14.90 | 0.384 |
| $F_2T_3$ | 122.25 | 37.98 | 310.64 | 3.70 | 15.65 | 0.358 |
| $F_2T_4$ | 92.25 | 28.16 | 305.21 | 3.45 | 14.95 | 0.397 |
| $F_2T_5$ | 101.00 | 32.14 | 318.25 | 3.40 | 15.20 | 0.422 |
| $F_2T_6$ | 100.00 | 32.86 | 328.65 | 3.60 | 15.85 | 0.404 |
| $F_3T_1$ | 106.75 | 32.80 | 308.02 | 3.80 | 15.30 | 0.391 |
| $F_3T_2$ | 118.75 | 36.80 | 309.97 | 3.80 | 15.05 | 0.384 |
| $F_3T_3$ | 146.00 | 49.59 | 339.62 | 3.90 | 15.75 | 0.365 |
| $F_3T_4$ | 92.25 | 28.38 | 307.62 | 3.55 | 15.40 | 0.397 |
| $F_3T_5$ | 116.50 | 37.97 | 325.95 | 3.80 | 15.45 | 0.422 |
| $F_3T_6$ | 115.50 | 41.29 | 357.51 | 4.20 | 16.25 | 0.410 |
| $F_4T_1$ | 103.25 | 31.61 | 306.16 | 3.65 | 15.40 | 0.397 |
| $F_4T_2$ | 112.25 | 33.48 | 298.24 | 3.65 | 15.40 | 0.391 |
| $F_4T_3$ | 143.25 | 46.89 | 327.38 | 3.80 | 15.75 | 0.346 |
| $F_4T_4$ | 89.50 | 27.98 | 312.60 | 3.60 | 15.50 | 0.384 |
| $F_4T_5$ | 114.00 | 36.42 | 319.49 | 3.90 | 15.70 | 0.416 |
| $F_4T_6$ | 116.00 | 39.46 | 340.35 | 4.05 | 16.65 | 0.397 |
| $F_5T_1$ | 74.75 | 19.76 | 264.40 | 3.30 | 14.85 | 0.410 |
| $F_5T_2$ | 82.50 | 22.00 | 266.76 | 3.35 | 14.55 | 0.397 |
| $F_5T_3$ | 97.50 | 28.03 | 287.39 | 3.40 | 14.95 | 0.384 |
| $F_5T_4$ | 72.00 | 19.26 | 267.58 | 3.10 | 14.60 | 0.397 |
| $F_5T_5$ | 84.75 | 23.48 | 276.95 | 3.40 | 15.20 | 0.435 |
| $F_5T_6$ | 88.75 | 26.10 | 293.92 | 3.60 | 15.55 | 0.410 |
| $F_6T_1$ | 91.75 | 25.14 | 273.96 | 3.35 | 14.65 | 0.410 |

| | | | | | | |
|---|---|---|---|---|---|---|
| $F_6T_2$ | 100.00 | 27.73 | 277.23 | 3.40 | 14.75 | 0.410 |
| $F_6T_3$ | 107.00 | 31.30 | 292.48 | 3.50 | 14.90 | 0.384 |
| $F_6T_4$ | 83.25 | 21.93 | 263.58 | 3.35 | 14.70 | 0.410 |
| $F_6T_5$ | 100.00 | 28.31 | 282.98 | 3.60 | 14.95 | 0.422 |
| $F_6T_6$ | 92.75 | 28.98 | 312.35 | 3.75 | 15.20 | 0.410 |
| $F_7T_1$ | 77.75 | 21.60 | 277.83 | 3.40 | 14.50 | 0.397 |
| $F_7T_2$ | 84.50 | 24.00 | 284.04 | 3.20 | 14.55 | 0.410 |
| $F_7T_3$ | 102.50 | 29.81 | 290.73 | 3.50 | 14.90 | 0.410 |
| $F_7T_4$ | 72.00 | 19.61 | 272.36 | 3.25 | 14.60 | 0.422 |
| $F_7T_5$ | 82.00 | 23.38 | 285.62 | 3.35 | 14.90 | 0.442 |
| $F_7T_6$ | 90.50 | 27.22 | 300.81 | 3.60 | 15.30 | 0.416 |
| $F_8T_1$ | 81.00 | 21.90 | 270.26 | 3.10 | 14.05 | 0.422 |
| $F_8T_2$ | 83.00 | 22.39 | 269.54 | 3.25 | 14.40 | 0.410 |
| $F_8T_3$ | 96.50 | 26.46 | 274.24 | 3.30 | 14.85 | 0.397 |
| $F_8T_4$ | 67.00 | 17.42 | 259.91 | 3.40 | 14.60 | 0.416 |
| $F_8T_5$ | 89.00 | 25.26 | 283.93 | 3.55 | 14.75 | 0.435 |
| $F_8T_6$ | 81.00 | 24.31 | 300.07 | 3.70 | 15.15 | 0.418 |
| Absolute control | 53.50 | 14.59 | 272.80 | 3.20 | 14.20 | 0.410 |
| S.E. ± | 2.21 | 0.78 | 5.85 | 0.21 | 0.20 | 0.003 |
| C.D. at 5% | 6.20 | 2.20 | 16.43 | NS | 0.55 | 0.009 |

*T.S.S. (°Brix)*

The data of *Ambiabahar* experiment regarding T.S.S. influenced by foliar application of chemicals (F) and soil application of chemicals (T) is presented in (Table 2, 3). In *Ambiabahar* experiment, the maximum T.S.S. (15.45) was recorded in $F_4T_6$ which was statistically at par with $F_3T_3$ (15.20) and $F_3T_6$ (15.25). Significantly minimum T.S.S. (13.35) was recorded in $F_8T_5$ and $F_8T_4$. The data of *Mrigbahar* experiment regarding T.S.S. influenced by foliar application of chemicals (F) and soil application of chemicals (T) is presented in (Table 4, 5). In *Mrigbahar* experiment, the maximum T.S.S. (16.65) was recorded in $F_4T_6$ which was statistically at par with $F_3T_6$ (16.25). Significantly minimum T.S.S. (14.05) was recorded in treatment $F_8T_1$. Similar results were reported in apple by Hari-Om *et al*. (1975) by application of cycocel. These results are also in accordance with Lakshmi *et al*. (2014) who reported highest T.S.S. in response to cycocel 1000 ppm and $KNO_3$ 1% in acid lime. Cycocel and potassium nitrate sprays increased T.S.S. due to increase in the mobilization of carbohydrates from source to sink. Similar results of increased T.S.S. was obtained by Nath and Barauh in Assam lemon and Partiban in acid lime. Raese and Drake (2000) also recorded that application of calcium increased T.S.S. in apple. Ramezanian *et al*. (2009) also revealed that calcium increased soluble solids content in pomegranate. Similar results were obtained by Korkmaz *et al*. (2016) who reported that calcium nitrate increased the amount of T.S.S.

*Acidity (%)*

The data of *Ambiabahar* experiment regarding acidity influenced by foliar application of chemicals (F) and soil application of chemicals (T) is presented in (Table 2, 3). In *Ambiabahar* experiment, the minimum acidity (0.397) was recorded in $F_3T_3$ which was statistically at par with $F_3T_2$, $F_3T_4$ and $F_2T_3$ (0.41). Significantly maximum acidity (0.455) was recorded in $F_8T_5$. The data of *Mrigbahar* experiment regarding acidity influenced by foliar application of chemicals (F) and soil application of chemicals (T) is presented in (Table 4, 5).

In *Mrigbahar* experiment, significantly minimum acidity (0.346) was recorded in $F_4T_3$. Significantly maximum acidity (0.435) was recorded in treatment $F_5T_5$ and $F_8T_5$. In the interaction effects of *Ambiabahar* experiment the minimum acidity was recorded in $F_3T_3$ statistically at par with $F_3T_2$, $F_3T_4$ and $F_2T_3$. In *Mrigbahar* experiment, significantly minimum acidity (0.346) was recorded in $F_4T_3$. Sugars are indirectly proportional to acidity (Shrestha 1988). Similar results were reported by Sarker and Rahim (2013) in mango.

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