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Mepiquat Chloride can Enhance Flowering and Yield in Pomegranate (*Punica granatum* L.) cv. Bhagwa

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ABSTRACT: The effect of different concentrations of mepiquat chloride (MC) on flowering, fruiting and yield of pomegranate (*Punica granatum* L.) was studied in the field trial at Department of Horticulture University of Agricultural Sciences, GKVK, Bengaluru, during august 2019 to May 2020. Mepiquat Chloride 5 % AS at the rate of 50 g a.i. ha^{-1}, 62.5 g a.i. ha^{-1} and 125 g a.i. ha^{-1} at 15-20 days prior to initiation of flowering or at the time of initiation of flowering and control were the treatments studied in the present investigation. The application of 125 g a.i. ha^{-1} at 15-20 days prior to initiation of flowering produced maximum number of bisexual flowers (122.03), average number of fruits per plant (116.00), average length of fruits (9.40 cm), average width of fruits (8.40 cm) and fruit yield per plant (30.91 kg plant^{-1}). From the results of the experiment, it can be concluded that Mepiquat Chloride 5 % AS at the rate 125 g a.i. ha^{-1} at 15-20 days prior to initiation of flowering was more effective in improving floral, fruit and yield characters in pomegranate cv. Bhagwa. MC has potential to use as flowering and yield enhancer in pomegranate.

Keywords: Pomegranate, Mepiquate chloride, Bhagwa, Bisexual flowers,

INTRODUCTION

Pomegranate (*Punica granatum* L.) an ancient fruit crop belonging to the family *Punicaceae*. It is rather unusual being one of only two species in its genus *Punica*, which is sole genus in family *Punicaceae* (ITIS, 2006). The region stretching from Iran to Northern India is known to be the origin of this fruit crop (Morton, 1987). On contrary, Mars (2000) suggested that it is native to the smaller area of Iran and was spread by humans during pre-historic times. In India fruits of wild origin are thick peeled and highly acidic in nature compared to cultivated types (Bist *et al*., 1994).

Pomegranate has been naturalized throughout the Mediterranean region since time immemorial. The carbonized pomegranate exocarps from early bronze age (3000 BC) *e.g.,* Jericho and from the late bronze age in Cyprus (Ward, 2003; Boncuk, 2014). Pomegranate played significant role in different religion, including Buddhism, Christianity, Judaisum and Islam (Langely, 2000). Some argued that the pomegranate is the "apple" of biblical garden of Eden (McDonald, 2002).

Pomegranate is known for it's medicinal properties besides as table fruit. It was employed to treat diabetes in Indian system of medicine and to reduce the tapeworm infestation by Romans (Langley, 2000).

The use of plant growth regulator (PGR) is one of the statergies routinely used in fruit production for canopy management, fruiting, avoid fruit drop and hasten maturity. Mepiquat Chloride (MC) or 1, 1 dimethylpiperidinum is a water soluble organic molecule which is absorbed by leaves and translocated throughout the plant (Srivatsava, 2002). MC inhibits Gibberellic acid (GA) bio-synthesis by stopping geranylgeranyl pyrophosphate to copalyl pyrophosphate and also blocks further transformation of copalyl pyrophosphate to ent-kaurene in the gibberellic acid biosynthesis pathway. Ultimately reducing cell enlargement and cell division (Srivatsava, 2002).

Plant growth retardants like CCC can increase flowering and fruit set in Golden Delicious apple Guha (1993) and Mango cv. Dashehari Daulta *et al*. (1981). Paclobutrazol (PBZ) a plant growth regulator antagonistic to GA in action, similar to MC. Reynolds (1988); Reynolds *et al*. (1991) showed that application of PBZ enhances yield component and advanced fruit maturity in grapevine. Aly *et al.* (1999) mentioned that paclobutrazol treatments gave a reduction in regrowth of sucker number and length of fig and trees, however,

paclobutrazol treatments increased TSS percentage and vitamin C in fig and pomegranate fruits. However, Salama and Elsherbeny (2016) reported that PBZ effectively controlled the suckers compared to manual removal in pomegranate. The growth regulator MC is globally used in cotton (*Gossypium hirsutum*) and less information is available about its effect on other crops in general and pomegranate in particular. So, the current study had been undertaken to unveil the effect of MC on yield of pomegranate.

MATERIALS AND METHODS

The investigation was carried out during August 2019 to May 2020 in Department of Horticulture, University of Agricultural Sciences Bangalore, Bengaluru, Karnataka in India. Seven-year-old Pomegranate (Bhagva) grown in red sandy loam and spaced at 5m × 5m apart under drip irrigation system were taken for the study. Forty-eight trees which are healthy, nearly uniform in growth, vigour and productivity were provided with eight treatments as mentioned below:

Sr. No.	Treatment	Dose (g a.i./ha)	Application stage
T_1	Mepiquat Chloride 5 % AS	50.0	At 15-20 days before initiation of flowers
T_2	Mepiquat Chloride 5 % AS	62.5	At 15-20 days before initiation of flowers
T_3	Mepiquat Chloride 5 % AS	125.0	At 15-20 days before initiation of flowers
T_4	Mepiquat Chloride 5 % AS	50.0	At initiation of flowers
T_5	Mepiquat Chloride 5 % AS	62.5	At initiation of flowers
T_6	Mepiquat Chloride 5 % AS	125.0	At initiation of flowers
T_7	Mepiquat Chloride 5 % AS	50.0	Two spray: 1st spray at 15-20 days before of initiation of flowers followed by 2nd spray at initiation of flowers
T_8	Control	-	Sprayed with distilled water

Before and during the experiment all the cultural operations were carried out. The observations such as, number of bisexual flowers, fruit set percentage, fruits per tree, fruit length, fruit width and yield were recorded. The number of bisexual flowers were counted from one fourth portion of plant canopy and multiplied it with four to arrive at number of bisexual flowers per tree. The number of fruits per tree at harvest were recorded from each treatment and finally the average number of fruits per tree was calculated. The mature fruits harvested from the tree in each treatment and ten randomly selected fruits were used for recording the average fruit length and width and expressed in cm. The hermaphrodite flowers from each plant were counted upon flowering and later the number of hermaphrodite flowers set fruits were counted from each selected plant and the percentage of fruit set was calculated by using formula

$$\% \text{ Fruit set} = \frac{\text{Mean no. of fruit set per plant}}{\text{Mean no. of hermaphrodite flowers plant}^{-1}} \times 100$$

The statistical analysis was performed on randomized complete block design (RCBD) with three replications for each treatment and each replicate represented two trees. The data were analyzed by repetitive measures analysis of variance using SPSS software and means were compared by Tukey's multiple range test at $p \leq 0.05$.

RESULTS AND DISCUSSION

The effect of mepiquat chloride on flowering and yield were found to be significant, except fruit set percentage. The higher concentration of mepiquat chloride was more effective in producing the bisexual flowers. The mean values showed that single application of mepiquat chloride (125 g a.i ha^{-1}) at 15-20 days before initiation of flowering was found to increase the number of bisexual flowers *i.e.,* 122.03 flowers per tree (Table 1). However, it was found to be minimum (83.53 flowers per tree) in control. The effect of mepiquat chloride can be attributed to the lower levels of endogenous gibberellins, which inhibit the conversion of geranylgeranyl pyrophosphate to entkaurene in the gibberellin synthesis pathway. Reduced gibberellin inhibits cell elongation, reducing annual vegetative growth and promoting reproductive growth, as evidenced by the increased number of hermaphrodite flowers (Jain and Dashora 2007). Hussain *et al.* (2021); Hezagi and Stino (1985) found higher proportion of hermaphrodite flowers with application of cycocel on pomegranate and olive respectively.

The application of MC at initiation of flowering was found to be inferior compared to application at 15-20 days prior to flower initiation. This can be due to MC require some time to act on the precursor of GA and inhibit the production of GA. The percentage of fruit set not affect by any treatment of MC. The trees treated with MC produced higher number of fruits per tree with respect to control. The application of MC at the rate of 125 g a.i ha^{-1} at 15-20 days prior to flower initiation produced higher number of fruits per plant (116.00).

The increased number of bisexual flowers and delayed abscission achieved by retaining the pectin content in the middle lamella (Kachave and Bhosale 2007), effect on sex expression (Chaudhari and Desai 1993), and better pollen tube growth leading to reduced flower drop could all contribute to MC improved fruit retention. Increased amounts of metabolites are required for fruit growth as a result of restricted vegetative growth. Similar findings were made in mango (Daulta *et al.*, 1981) and guava (Saravanan and Kanowjia 2008). The increased number of hermaphrodite flowers resulted in increased fruit set and retention, as well as an increase in the number of

fruits per plant. These findings are similar to those of Desai *et al.* (1982) in 'Kagzi' lime and Guha (1993) in apple.

MC has marked impact on physical characteristics of fruit. The trees treated with MC at the rate of 125 g a.i ha^{-1} at 15-20 days prior to flower initiation produced larger fruits 9.40 cm fruit length and 8.40 cm fruit width. The increase in fruit dimensions contributed to higher yield $plant^{-1}$ (30.91 kg $plant^{-1}$) and ha^{-1} (12.36 tonnes ha^{-1}). The larger fruit size obtained by MC was due to increased conduction of photosynthates to developing fruits as a result of MC suppression the vegetative growth by blocking gibberellin synthesis. The similar results were reported by Arun *et al.* (2016) in olive cv. 'Pendulino'. The increase in fruit yield is due to increase in fruit length and width, which was mostly caused by increased levels of endogenous auxins, which promote cell elongation. These findings are similar to those reported by Kurian and Iyer (1992) in the mango cv. 'Alphonso' and Pandey *et al.* (2001) in the guava.

Table 1: Effect of Mepiquat Chloride 5 % AS on flowering, fruiting and yield of Pomegranate during 2019.

Treatment	Number of bisexual flowers/m^2	Number of bisexual flowers/tree	Fruit set (%)	Fruits/m2 (number)	Fruits/tree (number)	Fruit length (cm)	Fruit width (cm)	Fruit yield/tree (kg)	Fruit yield (t/ha)
T1 - 50 g a.i. ha^{-1} MC at 15-20 days before initiation of flowering	29.50	103.25	94.27	27.81	97.33	8.40	7.77	24.07	9.63
T2 - 62.5 g a.i. ha^{-1} MC at 15-20 days before Initiation of flowering	34.30	120.05	94.28	32.33	113.17	9.17	8.27	29.88	11.95
T3 - 125 g a.i ha^{-1} MC at 15-20 days before Initiation of flowering	34.87	122.03	95.11	33.14	116.00	9.40	8.40	30.91	12.36
T4 - 50 g a.i. ha^{-1} MC at initiation of flowering	24.03	84.12	97.89	23.52	82.33	7.93	6.90	19.84	7.94
T5 - 62.5 g a.i. ha^{-1}MC at initiation of flowering	25.50	89.25	96.78	24.67	86.33	8.23	7.10	20.90	8.36
T6 - 125 g a.i. ha^{-1} MC at initiation of flowering	28.00	98.00	89.82	25.14	88.00	8.17	7.30	21.47	8.59
T7 - 50 g a.i. ha^{-1}1st spraying at 15-20 days before initiation of flowering followed by 2nd spray at initiation of flowers	31.17	109.08	98.71	30.76	107.67	8.53	7.90	27.17	10.87
T8 – Control	23.87	83.53	93.04	22.19	77.67	7.83	6.90	18.75	7.50
Sem	0.38	1.34	-	0.29	2.04	0.08	0.07	0.52	0.21
CD@5%	1.16	4.07	NS	0.87	6.19	0.24	0.21	1.59	0.63

CONCLUSION

Foliar spray of MC 125 g a.i ha^{-1} at 15-20 days prior to flower initiation led to increase in bisexual flowers (122.03), number of fruits per tree (116.00), fruit length (9.40 cm), width (8.40 cm) and yield ha^{-1} (12.36 tonnes ha^{-1}). Therefore, a foliar spray of MC 125 g a.i ha^{-1} at 15-20 days prior to flower initiation can be recommended for fetching higher yield and better-quality fruits of pomegranate under Indian condition.

FUTURE SCOPE

The present investigation has been carried out on various concentrations of MC. Further studies can be carried out to evaluate suitable combination of different plant growth regulator to enhance the flowering and yield in pomegranate.

REFFERENCES

Aly, M. A., Bacha, M. A. and Farahat, F. E. (1999). Effect of some growth bioregulators on controlling of suckers, fruit characteristics and yield of fig and pomegranate trees. *Journal of King of Saud University*., *11*(2), 157-169.

Arun, K., Sharma, N. and Singh, G. (2016). Effect of paclobutrazol and cycocel on growth, flowering and physiological characteristics of olive cv. Pendulino. *Plant Archives*, *16*, 110–114.

Bist, H. S., Srivastava, R. and Sharma, G. (1994). Variation in some promising selections of wild pomegranate (*Punica granatum* L.). *Horticulture Journal*, *7*, 67-70.

Boncuk, M. (2014). Word Origin, Nar, Pomegranate.

Chaudhari, S. M. and Desai, U. T. (1993). Effects of plant growth regulators on flower sex in pomegranate (*Punica granatum* L.). *Indian Journal of Agricultural Sciences*, *63*, 34–35.

Daulta, B. S., Singh, H. K. and Chohan, K. S. (1981). Effect of zinc and CCC sprays on flowering, fruiting and physicochemical composition on fruit in mango (*Mangifera indica* L.) cv. Dashehari. *Haryana Journal of Horticultural Sciences*, *10*, 161–165.

Desai, U. T. Choudhari, K. G. Ran, S. D. and Patil, Y. S. (1982). Alteration of flowering period in Kagzi lime with plant growth substances. *Journal of Maharashtra Agricultural University*, *7*, 161–162.

Guha, D. (1993). Regulation of tree growth and yield in Golden Delicious apple with Cycocel and Ethrel. *South Indian Journal of Horticulture*, *41*, 333–340.

Hezagi, E. S. and Stino, G. R. (1985). Chemical regulation of sex expression in certain olive cultivars. *Acta Agrobotany*, *35*, 185–190.

Hussain, F., Murthy, B. N. S., Reddy, M. L. N., Satisha, J., Upreti, K. K., Laxman, R. H. and Srinivasulu, B. (2021). Induction of flowering and improvement of fruit yield and quality in pomegranate (*Punica granatum*) cv. Bhagwa by various plant growth regulators. *Environment Conservation Journal*, *22*(1), 49-58.

ITIS (2006). Integrated Taxonomic Information System.

Jain, M. C. and Dashora, L. K. (2007). Growth, flowering, fruiting and yield of guava (*Psidium guajava* L.) cv. Sardar as influenced by various plant growth regulators. *International Journal of Agriculture Sciences*, *3*, 4–7.

Kachave, D. B. and Bhosale, A. M. (2007). Effect of plant growth regulators and micronutrients on fruiting and yield parameters of Kagzi lime (*Citrus aurantifolia* Swingle) fruits. *Asian Journal of Horticulture*, *2*, 75–79.

Kurian, R. M. and Iyer, C. P. A. (1992). Stem anatomical characters in relation to the vigour in mango. *Scientia Horticulturae*, *50*, 245–253.

Langley, P. (2000). Why Pomegranate? *British Medical Journal*, *321*, 1153-1154.

Mars, M. (2000). Pomegranate plant material: Genetic resources and breeding, a review. *Options Méditerranéennes*, *A 42*, 55-62.

McDonald, J. A. (2002). Botanical determination of the Middle Eastern tree of life. *Econ. Bot.*, *56*, 113-129.

Morton, J. F. (1987). Fruits of warm climates (University of Miami, Coral Gables, Florida, 1987).

Pandey, D. K., Goswamy, C. L. and Kumar, R. (2001). Effect of plant growth regulators on photosynthesis under water logging. *Indian Journal of Plant Physiology*, *6*, 90–94.

Reynolds, A. G. (1988). Effectiveness of NAA and paclobutrazol for control of regrowth of trunk suckers on 'Okanagan Riesling' grapevines. *Journal of American Society for Horticultural Sci*ence, *113*, 484-488.

Reynolds, A. G., Cottrell, A. C., Wardle, D. A. and Gaune, A. P. (1991). NAA and paclobutrazol control grapevine suckers: Vine performance and fruit tissue residues. *Hort Science*, *26*(10), 1286-1287.

Salama, A. S., and Elsherbeny, R. A. (2016). Influence of Growth Regulator Treatments on suckers Growth Control, Yield and Fruit Quality of Pomegranate Trees cv. Manfalouty and Their Economics Affect. *IOSR Journal of Agriculture and Veterinary Science*, *9*(1), 73-82.

Saravanan, S. and Kanowjia, A. (2008). Effect of gibberellic acid on fruit set and physico-chemical properties of guava (*Psidium guajava* L.). *Allahabad Farmer*, *64*, 72–76.

Srivastava, L. M. (2002). Plant growth and development: Hormones and environment. San Diego: Academic Press, San Diego.

Ward, C. (2003). Pomegranate in eastern Mediterranean context during the Late Bronze Age. *World Archaeology*, *34*, 529-541.

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