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IMPACT OF FOLIAR APPLICATION OF DIFFERENT PLANT GROWTH SUBSTANCES ON FLOWERING AND FRUIT SET OF POMEGRANATE (*PUNICA GRANATUM* L.) CV. MRIDULA UNDER SEMI-ARID SUB-HUMID CLIMATIC CONDITION

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ABSTRACT

A field experiment was conducted to investigate the "Impact of foliar application of different plant growth substances on flowering and fruit set of Pomegranate (*Punica granatum* L.) cv. Mridula" at Fruit Farm, Department of Fruit Science, College of Horticulture, Banda University of Agriculture and Technology, Banda (U.P.) during Mrig Bahar (June-July) 2022-2023. The experiment consisted of seven treatments with three replications laid out in Randomized Block Design. The growth substances applied were GA_3 (50 ppm), NAA (15 ppm), KNO_3 (1%) and their Compositions. The application of NAA (15 ppm) + GA_3 (50 ppm) resulted in a higher number of hermaphrodite flowers plant^{-1} (62.67), higher number of male flowers plant^{-1} (56.67), higher number of total flowers plant^{-1} (119.33), minimum days taken from bud appearance to fruit set (23.00), maximum initial fruit set (85.60%), maximum final fruit set (46.69%), minimum fruit drop (53.31%). While, the minimum days taken from flowering to harvest (150 days) were recorded under NAA (15 ppm). As a result of the research, it can be concluded that NAA (15 ppm) + GA_3 (50 ppm) were the most effective treatments for improving flowering and fruiting attributes in pomegranate cv. Mridula during Mrig Bahar Season.

Key words : Mridula, Plant Growth Substances, Pomegranate, Flowering, Fruit set.

Introduction

The pomegranate (*Punica granatum* L.) is one of the ancient known edible fruits, can grow in a variety of agro-climatic areas, from tropical to sub-tropical (Levin, 2006; Jalikop, 2007). It is a member of the family Punicaceae and genus Punica (Chatterjee and Randhawa, 1952). It is a widely prized fruit recognized for its delicious taste, bright color, and significant beneficial effects on health. In the pomegranate's growth cycle, the flowering and fruit set stages are crucial since they directly impact the fruit's productivity and quality. The pomegranate is a historic fruit that was first grown in Iran (De Candolle, 1967). Since the beginning of time, plant growth substances have been a crucial part of horticulture since they were an efficient way to boost both the quantitative and qualitative aspects of crop growth and development. The complex and coordinated actions of endogenous compounds regulate plant growth and development as well as responses to environmental factors. According to Chowdhary and Desai (1993), plant growth substances reportedly play an important role in pomegranate. It has been observed that different fruit crops respond differently to various plant growth substances, such as GA_3, NAA, and KNO_3, at different concentrations in terms of flowering and fruit set (Bhujbal *et al*., 2013). The spraying of plant growth substances directly onto leaves, known

as foliar application, plays an important role in enabling adequate nutrient uptake and physiological responses. This "Mridula" variety of pomegranate is of great interest among farmers because of its unique characteristics and potential commercial value.

The main objective of this study was to investigate the effect of different plant growth substances on flowering and fruit set in pomegranate cv. Mridula. By assessing the effects of foliar application of plant growth substances on flowering and fruit set, valuable insights can be gained in optimizing pomegranate cultivation practices and improving overall yield. Therefore, the present study was carried out to find out the suitability of plant growth substances on flowering and fruiting of pomegranate cv. Mridula.

Materials and Methods

The field experiment was conducted during the year 2022-23 at Fruit Farm, Department of Fruit Science, College of Horticulture, Banda University of Agriculture and Technology, Banda (U.P.), India. The experiment consisted of seven treatments with three replications laid out in Randomized Block Design. The growth regulators applied were GA_3 (50 ppm), NAA (15 ppm) KNO_3 (1%) their Compositions. Four years old pomegranate trees of cv. Mridula with uniform vigour and size, planted at a spacing of 6 × 6 m^2 were selected. All plants were given uniform cultural practices during the period of investigation. The solutions of plant growth substances were prepared by dissolving them in small quantity of ethanol, NaOH and made up the volume by the addition of distilled water and sprayed with the help of Knapsack sprayer. Spraying was done till the leaves/twigs of the tree got wet and drops of the solution started dripping.

The observations were recorded on three randomly selected plants of each treatment. Four branches of about one-meter length were selected on each tree in all directions. The hermaphrodite and male flowers present on these branches were counted separately and expressing in number. Thus, the number of hermaphrodite flowers was counted and marked at the time of flowering. After one month, number of settled fruits were counted at the time of fruit setting for the initial fruit set and final fruit set was calculated by counting the number of fruit set, divided by the number of fruits obtained at harvest and expressed in percentage. The recorded data was analyzed by using MS-Excel. The mean values of data were subjected to statistical analysis of variance as per the procedures outlined given by Panse and Sukhatme (1989) for Randomized Block Design. The Critical difference was calculated at 5 per cent level of significance.

Results and Discussion

Effect on number of hermaphrodite flowers plant^{-1}

The application of different concentrations of plant growth substances significantly affected the number of hermaphrodite flowers plant^{-1}. The significant maximum number of hermaphrodite flowers plant^{-1} (62.67) was recorded with the treatment T_4 [NAA (15 ppm) + GA_3 (50 ppm)] followed by T_7 [NAA (15 ppm) + GA_3 (50 ppm) + KNO_3 (1%)]. However, the minimum number of hermaphrodite flowers per plant 46.00 was observed with T_1[GA_3 (50 ppm)] (Table 1). This might be due to the transport of NAA from ovary to the pedicel of flower (Brahmachari *et al*., 1996) and also due to the fact that GA_3 might had enhanced the endogenous level of auxins in plants (Nitsch and Nitsch, 1961).

Effect on number of male flowers plant^{-1}

The significant maximum number of male flowers per plant (56.67) was recorded with the treatment T_4 [NAA (15 ppm) + GA_3 (50 ppm)] followed by T_7 [NAA (15 ppm) + GA_3 (50 ppm) + KNO_3 (1%)]. However, the minimum number of male flowers per plant 41.00 was recorded with T_3 [KNO_3 (1%)] (Table 1). It is also influenced by environmental factors, such as photoperiod and nutritional status, and these environmental effects may be mediated by gibberellins (Taiz and Zeiger, 2002).

Effect on total number of flowers plant^{-1}

The perusal of the data reveals that the total number of flowers per plant showed statistically significant trends. The maximum number of total flowers per plant 119.33 was achieved with T_4 [NAA (15 ppm) + GA_3 (50 ppm)] followed by T_7 [NAA (15 ppm) + GA_3 (50 ppm) + KNO_3 (1%)]. However, the minimum number of total flowers per plant 88.67 was recorded with T_3 [KNO_3 (1%)] (Table 1). The distribution of flower types and the expression of sex in pomegranates can be affected by the use of plant growth substances (Chaudhari and Desai, 1993).

Effect on days taken from bud appearance to fruit set

The application of different concentrations of plant growth substances significantly affected the days taken from bud appearance to fruit set. The significant minimum days taken from bud appearance to fruit set (23.00) were recorded with the treatment T_4 [NAA (15 ppm) + GA_3 (50 ppm)] and T_7 [NAA (15 ppm) + GA_3 (50 ppm) + KNO_3 (1%)] followed by treatment T_2 [NAA (15 ppm)] that recorded 24.67. While the maximum days taken from bud appearance to fruit set (26.67) was observed with the treatment T_1 [GA_3 (50 ppm)] (Table 1). It might be

Table 1 : Effect of plant growth substances on flowering of Pomegranate cv. Mridula.

Treatments	No. of hermaphrodite flower plant^{-1}	No. of male flower plant^{-1}	No. of total flower plant^{-1}	Days taken from Bud appearance to Fruit Set
GA_3 50 ppm	46.00	50.00	96.00	26.67
NAA 15 ppm	57.00	49.33	106.33	24.67
KNO_3 1%	47.67	41.00	88.67	26.00
NAA 15 ppm + GA_3 50 ppm	62.67	56.67	119.33	23.00
NAA 15 ppm + KNO_3 1 %	54.67	45.00	99.67	25.00
GA_3 50 ppm + KNO_3 1 %	50.67	43.67	94.33	25.00
GA_3 50 ppm + NAA 15 ppm + KNO_3 1 %	59.67	51.33	111.00	23.00
SEm±	0.64	1.19	1.34	0.61
CD@5%	1.97	3.68	4.14	1.87

Table 2 : Effect of plant growth substances on fruiting of Pomegranate cv. Mridula.

Treatment	Days taken from flowering to harvest	Initial fruit Set %	Final fruit Set %	Fruit Drop %
GA_3 50 ppm	152.67	69.56	43.75	56.25
NAA 15 ppm	150.00	79.49	44.11	55.89
KNO_3 1 %	150.00	72.69	31.78	68.22
NAA 15 ppm + GA_3 50 ppm	155.67	85.60	46.69	53.31
NAA 15 ppm + KNO_3 1 %	154.33	77.33	42.63	57.37
GA_3 50 ppm + KNO_3 1 %	152.67	68.34	43.43	56.57
GA_3 50 ppm + NAA 15 ppm + KNO_3 1 %	150.33	81.52	45.33	54.67
SEm±	0.90	0.78	1.93	1.93
CD@5%	2.76	2.39	5.94	5.94

due to the increased synthesis of cytokinin and auxin in the root tissue by their enhanced activity with the application of GA_3 and their simultaneous transport to the auxiliary buds would have resulted in a better sink for the mobilization of photo-assimilates at a faster rate. The results are in accordance with the findings of Thirugnanavel *et al*. (2007) in acid lime, Almaguer *et al*. (1992) in orange, Mohsen Kazemi (2014) in tomato and Somwanshi and Patil (2017) in sweet orange.

Effect on days taken from flowering to harvest

The significantly minimum number of days taken from flowering to harvest (150) was recorded with the treatment T_2 [NAA (15 ppm)]. While the maximum days taken from flowering to harvest (155 days) was observed with the treatment T_4 [NAA (15 ppm) + GA_3 (50 ppm)] (Table 2). This may be due to the fact that plants sprayed with GA_3 are more physiologically active to build up sufficient food stores for flower development. Thirugnanavel *et al*. (2007) also reported that GA_3 application in acid lime showed better performance in increasing the number of days from flowering to harvest. These results are in accordance with the findings of Kadam *et al*. (2005) in Chikoo and Debbarma and Hazarika (2016) in Acid lime.

Effect on initial fruit set (%)

The significantly maximum initial fruit set (85.60%) was recorded with the treatment T_4 [NAA (15 ppm) + GA_3 (50 ppm)] followed by T_7 [NAA (15 ppm) + GA_3 (50 ppm) + KNO_3 (1%)]. However, the minimum number of initial fruit set percentage (68.34%) was noticed with the treatment T_6 [GA_3 (50 ppm) + KNO_3 (1%)] (Table 2). The application of GA_3 which is thought to serve as a mediating process for faster translocation and metabolization of stored metabolites and photosynthates from source to sink and also play a significant role in increasing the auxin synthesis in ovaries, may be the cause of the higher fruit set with the application of plant growth substances (Jagtap *et al*., 2013). In accordance to our findings of Ghosh *et al.* (2009) also reported that when NAA was administered at 25 ppm to pomegranate cv. Ruby, the greatest fruit set of 44.3% was seen.

Effect on final fruit set (%)

It is clear from the data presented in Table 2 that the

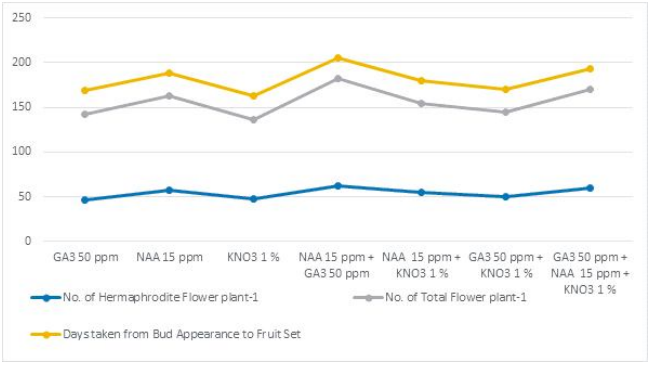

Fig. 1 : Effect of plant growth substances on flowering of Pomegranate cv. Mridula.

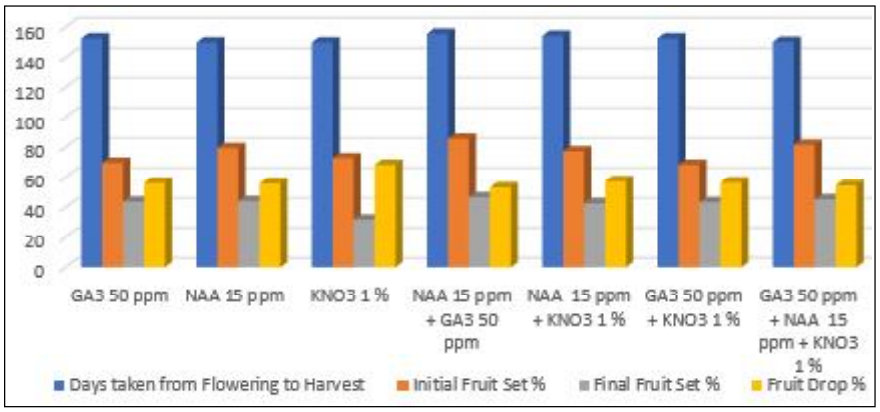

Fig. 2 : Effect of plant growth substances on fruiting of Pomegranate cv. Mridula.

maximum final fruit set (46.69 %) was recorded with the treatment T_4 [NAA (15 ppm) + GA_3 (50 ppm)] which was statistically *at par* with the treatment T_7 [NAA (15 ppm) + GA_3 (50 ppm) + KNO_3 (1%)] and was followed by the T_2 [NAA (15 ppm)] that recorded final fruit set percentage of 45.33 % and 44.11%, respectively. Besides the minimum final fruit set (31.78%) was obtained with the treatment T_3 [KNO_3 (1%)]. Pollen germination and pollen tube development may have been impacted by the greater fruit set brought by the use of GA_3. Gibberellins have been utilized in pomegranate production to boost fruit setting (Agusti and Almela, 1991). In accordance to our findings Saleem *et al*. (2008), GA_3 had a substantial impact on the final fruit set both singly and in combination, which led to the greatest fruit set in the sweet orange cv. Dark Red.

Effect on fruit drop (%)

The data (Table 2) with respect to the percentage of fruit drop obtained that there was significant effect of foliar application of plant growth substances on fruit drop of pomegranate. The maximum fruit drop (68.22 %) was noticed with the treatment T_3 [KNO_3 (1%)]. The minimum fruit drop (53.31 %) was recorded with the treatment T_4 NAA (15 ppm) + GA_3 (50 ppm). In pomegranates, NAA play a favourable effect in preventing fruit drop, which may be explained by the fact that they support the physiological and biological process that prevents abscission (Tomaszewska and Tomaszewska, 1970). Similar to the findings of the present study, Subramanian and Palaniappan (1981) also noted that auxin and growth hormones like GA greatly improved apple fruit setting and increased the number of blooms per plant. By preventing the establishment of the abscission layer, the NAA treatment reduces fruit drop (Frolove, 1967).

Conclusion

Foliar spray of plant growth substances on flowering and fruiting of Pomegranate cv. Mridula showed that NAA @ 15 ppm in combination with GA_3 @ 50 ppm in the Mrig bahar led to production of higher number of hermaphrodite flowers (62.67), male flower (56.67), total flower (119.33), days taken from bud appearance to fruit set (23 days), days taken from flowering to harvest (155 Days), initial fruit set (85.60 %), final fruit set (46.69 %) and minimum fruit drop (53.31 %). In the Mrig bahar, NAA (15 ppm) + GA_3 (50 ppm) proved that superior on almost every count (number of hermaphrodite flowers, number of male flowers, number of total flowers, days taken from bud appearance to fruit set, days taken from flowering to harvest, initial fruit set (%), final fruit set (%) and minimum fruit drop (%). Thus, based on the above finding it can be concluded that combination of NAA (15 ppm) + GA_3 (50 ppm) can be recommended as foliar application to farmers and researchers for better flowering and fruiting of pomegranate cv. Mridula during Mrig Bahar Season.

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