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Foliar application of ethephon (ethrel) for quick defoliation in pomegranate (*Punica granatum L.*) var. Bhagwa

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Abstract

Pomegranate (*Punica granatum L.*) is a newly introduced as alternate commercial fruit crop against Nagpur mandarin in Satpura plateau region of M.P. In this situation, there are three flowering seasons, viz., January-February (*Ambia bahar*) June-July (*Mrig bahar*) and September-October (*Hasta bahar*). The choice of flowering/fruitletting is regulated taking into consideration the availability of irrigation water, market demand and pests/disease incidence in a given locality. The crop of only one flowering season is taken in a year. Defoliation in pomegranate is an important practice followed to induce synchronized flowering. In the present study, an attempt has been made to test different concentrations of ethephon for their efficacy towards defoliation. The experiment was conducted during *Ambia* crop (Jan-Feb) 2018 using different levels of ethephon in the orchard of pomegranate at JNKVV, Krishi Vigyan Kendra, Chhindwara (M.P.) India. Six year old pomegranate var. Bhagwa plants of uniform size and growth were selected for the investigation. There were five treatments replicated thrice with two plant unit in RBD. Ethephon at different concentrations (600, 800, 1000 and 1200 ppm) were sprayed on pomegranate plants during stress period. All the treatments caused defoliation significantly over the control (untreated). Application of ethephon resulted in defoliation to a tune of 81.63% to 96.53% after 7 days of spraying. It was observed that spraying of ethephon at 1200 ppm was found to be effective for quick defoliation followed by 1000 ppm and 800 ppm, respectively. Therefore, it is advised to farmers that ethephon either at 1200 ppm or 1000 ppm can be successfully used for quick defoliation in pomegranate.

Keywords: Ethephon, ethrel, quick defoliation, pomegranate, *Punica granatum L.* var. Bhagwa

Introduction

Pomegranate (*Punica granatum L.*), belonging to the family Punicaceae, is one of the favourite table fruits in the world, for its refreshing juice with nutritional and medicinal properties. This fruit crop has wide adaptability and it grows in tropical, sub-tropical and even temperate regions. It has comparatively, wider adaptability, hardy nature, quick steady and high yields, fine table and medicinal properties, better keeping qualities and the plants can be thrown in rest period when irrigation facilities are generally inadequate. The biological testing of various extracts of different parts of pomegranate plant and fruit has revealed hypotensive, antispasmodic and anthelmintic properties. Acid sweet fruits of pomegranate are mainly used for dessert purpose. The juice makes a delicious drink having medicinal property and can be converted into an attractive jelly (Anar rub). Pomegranate wine can be made using whole fruit as well as juice. Pomegranate seeds are dried and sold as Anardana. Rind can be used in tooth powder preparation and in medicine and cosmetic industries (Kadam, 1996). Rind is also a source of a dye which gives yellowish brown to khaki shades and has been used for dyeing wool and silk (Patil and Karale, 1990). Due to these attributes, pomegranate has been now recognized as an important fruit crops.

In India, pomegranate is commercially cultivated in Maharashtra and parts of Karnataka where good quality fruits are produced due to dry and hot climate. The crop is also being cultivated in other states. It is a newly introduced as alternate commercial fruit crop against Nagpur mandarin in Satpura plateau region of M.P. In this situation, there are three distinct flowering seasons, viz., January-February (*Ambia bahar*) June-July (*Mrig bahar*) and September-October (*Hasta bahar*). The choice of flowering/fruitletting is regulated taking into consideration the availability of irrigation water, market demand and pests/disease incidence in a given locality. The crop of only one flowering season is taken in a year. Defoliation in pomegranate is an important practice followed to induce synchronized flowering.

Hence, an attempt has been made to find suitable concentration of ethephon (*ethephol*) for quick defoliation in pomegranate (*Punica granatum L.*) var. Bhagwa.

Materials and Methods

A field investigation was carried out during 2017-18 at pomegranate orchard of JNKVV, Krishi Vigyan Kendra, Chhindwara during *Ambia Bahar* to assess the effectiveness of three concentration of Ethephon for quick defoliation. The five years old pomegranate cv. Bhagwa trees with spacing of 12 x 8 ft. were used as experimental material. The trees were uniform in age and size and were trained to a multi stem training system. The trees were grown under drip irrigation following common cultural practices during the study period. The experiment consisted of 05 treatments with four replications and two plants in each replication laid out in Randomized Complete Block Design.

Ethephon is commonly used to induce thinning of fruitlets or to facilitate the fruit harvesting process (John-Karuppiah and Burns, 2010) [8]. In the presence of ethylene, the cells within the fruit pedicel AZ produce cell wall degrading enzymes, thereby inducing the disintegration of the separation layer in the AZ and ultimately leading to the detachment of the fruit (Leslie *et al.*, 2007) [9]. Ethephon applied to whole citrus trees breaks down in the tissue to release ethylene. A large increase in ethylene evolution from fruiting citrus can be detected 24 hours after application with another peak four days later possibly due to natural ethylene production. The use of ethephon promoted significant defoliation as occurred with other abscission agents (Hartmond *et al.*, 2000b; Burns, 2002; Burns *et al.*, 2003b; Pozo & Burns, 2006; Li *et al.*, 2008) [7, 2, 7, 11]. Indeed, defoliation increased as dose increased. However, as observed in the present study, despite this loss of leaves, the capacity of the trees to intercept light may not be severely affected (Li *et al.*, 2006) [10] because trees may partially compensate defoliation by increasing the capacity for photosynthesis of the leaves that remain in the canopy.

Prior to application of the treatments, the plants were selected on the basis of their productive potential, such that all plants subjected to chemical thinning presented significant amounts of leaves. The ethephon with four different concentration viz. 600, 800, 1000, and 1200 ppm, and Control plants were fed no spray which were applied in end of December 2016. The plants were sprayed over the full extent of the canopy (internal and external) with approximately five liters of solution. This volume was determined via a blank test in which water was applied. The ethephon with soluble concentrate containing 40% 2-Chloroethyl-phosphonic acid

was used for foliar application. All plants were given uniform cultural practices during the period of investigation. The solutions of plant growth regulators were prepared by dissolving them in small quantity of ethanol and made up the volume by the addition of distilled water and sprayed with the help of Knapsack sprayer.

The plant growth regulators were sprayed on the plants till the leaves / twigs were wet and droplets of solutions started trickling down. The observations of leaf drop were recorded on randomly selected plants of each treatment. Observations were recorded after 3, 5 and 7 days after spray simultaneously for each replication. The data recorded was analyzed using the statistical procedure as described by ICARGOA.

Defoliation (m^{-1} length of shoot)

The observations on defoliation were recorded at 3, 5 and 7 days interval after application of ethephon treatments and expressed as percentage of drop. 5 shoots of 2.5 diameters per plant of each side were tagged with Aluminium zinc tags, coding of treatments done at the time of tagging in each tag. The observations on newly emergence leaves were recorded of the treated plants before experimentation.

Results

Ethephon used as aqueous solution triggered defoliation in pomegranate at all concentrations employed; the higher the concentration, higher was its effect on the extent of defoliation. Data presented in the Table 1 clearly indicated that the treatment with 1200 ppm of ethephon was effective in defoliation of flush in pomegranate seven days after spray. It also resulted in almost 96.53% leaf fall after 7 days of foliar application followed by ethephon with 1000 ppm concentration was 91.16% and 800 ppm effected about 85.74% defoliation. Whereas control was 1.63% defoliation only after 7 days from the treatment.

Conclusions

Ethephon at different concentrations (600, 800, 1000 and 1200 ppm) were sprayed on pomegranate plants during stress period. All the treatments resulted in significant defoliation over the control (untreated). Application of ethephon caused defoliation to a tune of 81.63% to 96.53% after 7 days of spraying. It was found that spraying of ethephon at 1200 ppm was found to be effective for quick defoliation followed by 1000 ppm and 800 ppm, respectively. Therefore, it is advised to farmers that ethephon either at 1200 ppm or 1000 ppm can be successfully used for quick defoliation in pomegranate.

Table 1: Effect of different concentrations of ethephon on leaf drop (defoliation) in pomegranate (*Punica granatum L.*) var. Bhagwa

Treatments (Ethephon)	No of leaves (defoliation % m^{-1} shoot length)			
	Initial	3 days after spray	5 days after spray	7 days after spray
T ₁ -600 ppm	648.02	328.21 (50.65)	482.33 (74.43)	528.96 (81.63)
T ₂ -800 ppm	587.21	315.04 (53.67)	467.13 (79.57)	503.32 (85.74)
T ₃ -1000 ppm	473.31	279.22 (59.03)	398.17 (84.18)	431.21 (91.16)
T ₄ -1200 ppm	593.11	379.1 (63.92)	541.14 (91.25)	572.42 (96.53%)
T ₅ -Control	632.03	3.21 (0.50)	7.02 (1.11)	10.51 (1.63)
CD at (0.05)	-	2.28	0.94	1.04



Effect of ethephon on treated plants after 7 days of spraying with 1200 ppm



Emergence of new leaves on treated plants

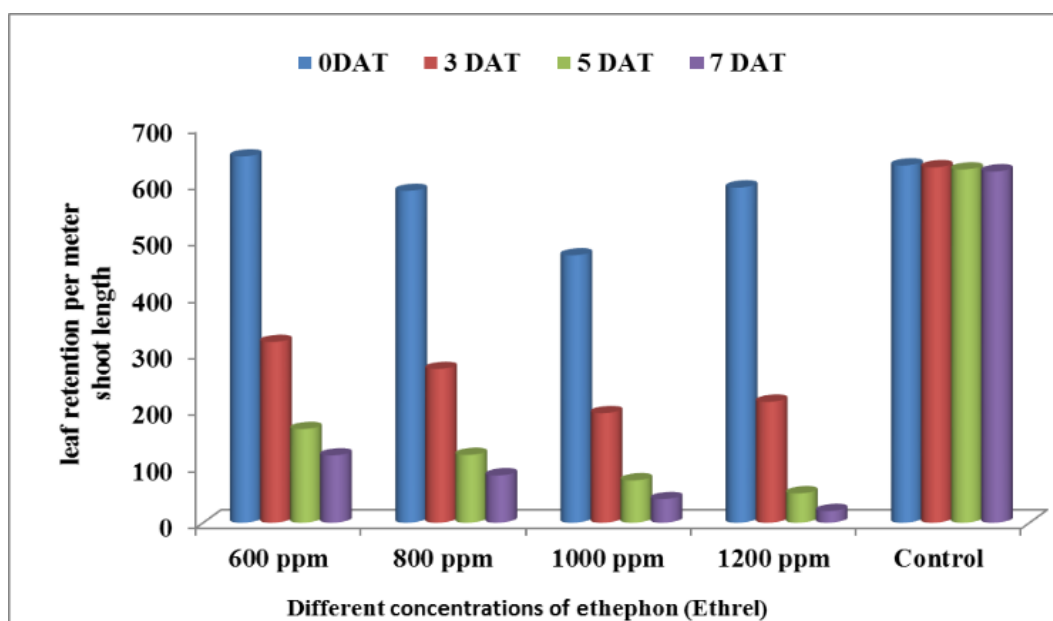


Fig 1: Effect different concentrations of ethephon (*ethrel*) on leaf retention (m^{-1} shoot length)

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