Effect of foliar application of chemicals on flowering of fruit crops

Disha Dadhaniya, BA Adodariya, Pooja Mishra, Hemanshi Purohit, Rutu Solanki, Lakhee Kadegiya, Roshni Barad, Hirpara Kinjal, HN Patel, SM Makwana and SR Jadeja

Abstract
Among the fruit crops of tropical and subtropical region the irregular or erratic flowering, low fruit set as well as fruit retention leading to low yield and fruits of poor quality and short availability period are also the main problems in mango production. Certain chemical sprays found very effective for the reduction of intensity and losses due to these limitations. Foliar application of KNO₃, Ethrel and urea significantly increase the flowering percentage. Applications of KNO₃ induce early flowering and reduced alternate bearing. Ethrel release ethylene gas and turn triggering the mechanism of flowering. In addition, urea spray was reported to be helpful for better retention of flowering in certain crops. It is also observed that delayed flowering in mango fail to fetch attractive price from the market. Delayed flowering also have risk due to early rainfall, which may bring fruit drop and deterioration in quality.

Keywords: tropical, sub-tropical fruits, KNO₃, ethrel, urea, flowering

Introduction
Now days, in India fruit growing is a developing trend among horticulturists, though it is an indigenous practice for human being. It is developed and still developing culture for growers. It is the most important fruit crop of the country. For fetching higher price in the market, production of high quality produce is of most importance. Apart from orchard management, cultural practices and post-harvest treatment, proper time of harvesting play an important role for quality production and planning for commercial marketing. The mango inflorescence is primarily terminal, although axillary and multiple panicles may also arise from axillary buds. It is a much branched panicle bearing many very small (4 mm) greenish white or pinkish flowers. Application of KNO₃ advanced flowering and harvesting date, increased yields and reduce alternate bearing (Sergent et al., 1997 and Sharma et al., 1990a) [19, 21] obtain maximum number of fruits per plant and fruit weight of mango by urea application. Ethrel release ethylene gas when it comes in to contact with the plant tissues in turn triggering the mechanism of flowering and may break dormancy of shoots. An ethylene release chemical help in induction of flowering in ‘off’ year mango (Pandey et al., 1973) [12]. In general, it is observed that delayed flowering in fruit crops mango fail to fetch attractive price from the market. Delayed flowering also have risk due to early rainfall, which may bring fruit drop and deterioration in quality. One of the major problems among mango growers is fruit drop at various stages, till it reaches maturity.

Effect of Chemicals
Effect of KNO₃
Bonard and Linsangan (1979) [1] reported that when mature mango trees of cv. Pico, Pahtan and Carabao were sprayed with KNO₃ at 10, 20, 40, 80 or 160 g/liter, 100 per cent flowering was observed in all cultivars within 7-14 days. Nunez (1985) [11] found that percentage of flowering shoots was the highest with spraying of KNO₃ alone but spraying of KNO₃ combined with decapitation tripled and nearly double the number of panicles/shoot in mango cv. Haden and Manila, respectively. Mass (1989) [8] studied that two per cent foliar spray of KNO₃ in November on mango cv. Keitt and Tomy Atkins resulted in 100 per cent flowering. Sergent and Leal (1989) [10] found that KNO₃ at 3.8 g/liter applied to ten month old shoots of mango trees on 19 November induced flowering after 7 days. Ferrari and Sergent (1996) [7] observed that triple foliar spray of KNO₃ at 12 g/liter on ‘Haden’ mango trees during September, October and November considerably increased percentage of reproductive shoots. Also observed that high KNO₃ dose induced early flowering and harvesting as compared to
control trees. Sergent et al. (1997) observed that high KNO₃ dose induced early flowering and harvesting as compared to control mango trees. Dalal et al. (2005) found early and regular flowering in mango var. Pariya with 1.5 per cent KNO₃ which was significantly superior to rest of all treatment. Maximum number of panicles was also provided by the application of KNO₃. Sudha et al. (2012) studied the effect of foliar application of various nitrogenous chemicals on flowering of mango cv. Alphanso and reported that KNO₃ at 2 per cent obtained maximum number of flowering shoots (68.7 per cent) and number of hermaphrodite flowers (282.5/panicle). Amarcholi et al. (2016) invested to know the influence of chemicals on flowering characteristics of ‘Kesar’ mango and found that foliar application of KNO₃ (one per cent) gave maximum flowering percentage (26.12 per cent). Tin (2016) noted that application of 2 g of paclobutrazol and 3 per cent potassium nitrate is suitable for Sentalone mango flowering production in off-season. Nunez (1985) applied pre flowering sprays of urea and KNO₃ and found increase in number of fruits retained per panicle on mango trees. Muhammad et al. (2007) studied that higher concentration of KNO₃ were found favorable to induce early emergence of panicles and increased percentage of hermaphrodite flowers and fruit set in mango. Babul and Rahim (2013) studied the effect of foliar spray of urea at 4 per cent on mango exhibited better performance in relation to terminal shoot length and KNO₃ at 4 per cent gave superior results with respect to length and width of panicle and number of secondary branches per panicle compared to control.

**Effect of Ethrel**

Dutch (1972) reported early flowering in ‘Carabao’ mango in the Philippines in response to traditional smudging methods which was due to the ethylene gas produced by the smudge fires. This effect was duplicated by weekly or twice monthly foliar spray applications of 125-250 ppm ethephon. Singh and Dhillon (1986) noted reduction in incidence of floral malformation in mango plants treated with NAA 100 ppm, IBA 200 ppm, 2, 4-D 100 ppm, ethrel 200 ppm and cycoceol 3000 ppm treatments applied at flower bud differentiation. The per cent of hermaphrodite flowers in healthy panicles were the highest with ethrel 300 ppm of all other treatments. Shaban (2004) reported that C/N ratio increased with application of ethrel during the period of flower bud differentiation that flowering increased in mango trees. Shyamal et al. (2010) studied the plant growth substances on vegetative growth, flowering and fruit quality of papaya and revealed that TIBA (100 and 150 ppm) and ethrel (200 and 300 ppm) proved to be the best particularly in the number of days taken for sex differentiation and promotion of femaleness, respectively. Chacko et al. (1972) investigated the effect of ethrel on flower induction in ‘off’ year in Langra mango trees. Result of investigation showed that large number of panicles emerged even from dormant buds situated in the Woody branches of the ethrel treated trees, indicating the extreme floriferous condition induced by ethrel treatment. Whereas ethrel could induce flowering in the ‘off’ year Langra trees without any new growth. Karim et al. (2007) studied that ethrel at 1 per cent resulted in greater number of panicles as compared with ethrel at 0.5 per cent and 1.5 per cent of young mango trees.

**Effect of Urea (Nitrogen) on flowering**

Singh (1974) observed in mango cv. Langra, sex-ratio was significantly decreased with the application of urea at two and four per cent. Rajput and Tiwari (1975) did not find any effect of urea and phosphorus at different concentrations on sex-ratio in mango cv. Totapuri, Langra and Dashehari. Shawky et al. (1978) observed increased number of perfect flowers with the application of urea just before flower bud differentiation in Taimur mango trees. Rajput and Singh (1983) reported increased flowering duration by two and four days with three and six per cent urea spray, respectively in mango as compared to control. Ravishankar et al. (1989) revealed that maximum flowering on new vegetative growth was developed subsequently on fruited shoots by combined application of KNO₃ and urea (one per cent) in mango cv. Alphonso. Vijayalakshmi and Srinivasan (1998) reported that application of urea and KNO₃ (each at one per cent) on mango reduce the ratio of male to hermaphrodite flowers by 3.85 and 3.53, respectively over the control (5.05). Yeshiela et al. (2005) reported that 4 per cent KNO₃ + 1 gram of urea treatment on mango cv. ‘Tommy Atkins’ increase flowering percentage (52 per cent) as compared to water spray (37%). Parmar et al. (2014) studied that 1.5 per cent urea solution and 0.6 per cent zinc sulphate were effective for the augmentation of flowering attributes of guava. Rajput and Tiwari (1975) reported that among foliar sprays of 2, 4 and 6% urea. That urea (4%) gave increased panicle length and number of secondary branches per panicle in mango. Rajput and Singh (1989) reported that double application of urea at 4% on ‘Dashehari’ mangoes appreciably increased panicle related characters.

**Conclusion**

Among the fruit crops of tropical and subtropical region the irregular or erratic flowering, low fruit set as well as fruit retention leading to low yield and fruits of poor quality and short availability period are also the main problems in mango production. Foliar application of KNO₃, Ethrel and urea significantly increase the flowering percentage and reduce alternate bearing in the crops where it is a major problem. Ethrel release ethylene gas and turn triggering the mechanism of flowering. In addition, urea spray was reported to help flowering in mango.

**References**


5. Dalal SR, Gorge VS, Jadhao BY, Jogdande ND. Effect of chemical on flowering and fruit yield of mango var.


