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## Effect of foliar application of chemicals on flowering of fruit crops

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### 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  $\text{KNO}_3$ , Ethrel and urea significantly increase the flowering percentage. Applications of  $\text{KNO}_3$  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,  $\text{KNO}_3$ , 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  $\text{KNO}_3$  advanced flowering and harvesting date, increased yields and reduce alternate bearing (Sergent *et al.*, 1997 and Sharma *et al.*, 1990a) <sup>[19, 21]</sup> 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) <sup>[12]</sup>.

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 $\text{KNO}_3$

Bonard and Linsangan (1979) <sup>[3]</sup> reported that when mature mango trees of cv. Pico, Pahtan and Carabao were sprayed with  $\text{KNO}_3$  at 10, 20, 40, 80 or 160 g/liter, 100 per cent flowering was observed in all cultivars within 7-14 days. Nunez (1985) <sup>[11]</sup> found that percentage of flowering shoots was the highest with spraying of  $\text{KNO}_3$  alone but spraying of  $\text{KNO}_3$  combined with decapitation tripled and nearly double the number of panicles/shoot in mango cv. Haden and Manila, respectively. Mass (1989) <sup>[9]</sup> studied that two per cent foliar spray of  $\text{KNO}_3$  in November on mango cv. Keitt and Tomy Atkins resulted in 100 per cent flowering. Sergent and Leal (1989) <sup>[18]</sup> found that  $\text{KNO}_3$  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) <sup>[7]</sup> observed that triple foliar spray of  $\text{KNO}_3$  at 12 g/liter on 'Haden' mango trees during September, October and November considerably increased percentage of reproductive shoots. Also observed that high  $\text{KNO}_3$  dose induced early flowering and harvesting as compared to

control trees. Sergent *et al.* (1997) <sup>[19]</sup> observed that high KNO<sub>3</sub> dose induced early flowering and harvesting as compared to control mango trees. Dalal *et al.* (2005) <sup>[5]</sup> found early and regular flowering in mango var. Pariya with 1.5 per cent KNO<sub>3</sub> which was significantly superior to rest of all treatment. Maximum number of panicles was also provided by the application of KNO<sub>3</sub>. Sudha *et al.* (2012) <sup>[26]</sup> studied the effect of foliar application of various nitrogenous chemicals on flowering of mango cv. Alphonso and reported that KNO<sub>3</sub> 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) <sup>[1]</sup> invested to know the influence of chemicals on flowering characteristics of 'Kesar' mango and found that foliar application of KNO<sub>3</sub> (one per cent) gave maximum flowering percentage (26.12 per cent). Tin (2016) <sup>[27]</sup> 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) <sup>[11]</sup> applied pre flowering sprays of urea and KNO<sub>3</sub> and found increase in number of fruits retained per panicle on mango trees. Muhammad *et al.* (2007) <sup>[10]</sup> studied that higher concentration of KNO<sub>3</sub> were found favorable to induce early emergence of panicles and increased percentage of hermaphrodite flowers and fruit set in mango. Babul and Rahim (2013) <sup>[2]</sup> studied the effect of foliar spray of urea at 4 per cent on mango exhibited better performance in relation to terminal shoot length and KNO<sub>3</sub> 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

Dutcher (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) <sup>[25]</sup> 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 cycocel 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) <sup>[20]</sup> 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) <sup>[23]</sup> 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) <sup>[4]</sup> 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) <sup>[8]</sup> 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) <sup>[24]</sup> 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) <sup>[16]</sup> 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) <sup>[22]</sup> observed increased number of perfect flowers with the application of urea just before flower bud differentiation in Taimur mango trees. Rajput and Singh (1983) <sup>[14]</sup> 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) <sup>[17]</sup> revealed that maximum flowering on new vegetative growth was developed subsequently on fruited shoots by combined application of KNO<sub>3</sub> and urea (one per cent) in mango cv. Alphonso. Vijayalakshmi and Srinivasan (1998) <sup>[28]</sup> reported that application of urea and KNO<sub>3</sub> (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). Yeshitela *et al.* (2005) <sup>[29]</sup> reported that 4 per cent KNO<sub>3</sub> + 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) <sup>[13]</sup> 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) <sup>[16]</sup> 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) <sup>[15]</sup> 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 KNO<sub>3</sub>, 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

1. Amarcholi JJ, Singh V, Sharma KM, Patel RJ, Chaudhari GV, Momin SK. Influence of various chemicals on flowering and fruiting characteristics of 'Kesar' Mango. Research Journal of Agricultural Science. 2016; 7(1):53-54.
2. Babul CS, Rahim MA. Yield and quality of mango (*Mangifera indica* L.) as influenced by foliar application of potassium nitrate and urea. Bangladesh Journal Agriculture Research. 2013; 38(1):145-154.
3. Bonard ND, Linsangan E. Flowering in mango induced with potassium nitrate. Horticulture Science. 1979; 14:527-528.
4. Chacko EK, Kohli RR, Randhava GS. Studies on effect of 2-chloroethane phosphonic acid (ethrel) on mango. Flower induction in off year in Langra trees. Indian Journal of Horticulture. 1972; 29:1-4.
5. Dalal SR, Gorge VS, Jadhao BY, Jogdande ND. Effect of chemical on flowering and fruit yield of mango var.

- Pairya. International Journal of Agriculture Science. 2005; 1(1):24-25.
6. Dutcher RD. Induction of early flowering in 'Carabao' mango in the Philippines by smudging and ethophon application. Horticulture Science. 1972; 7:343.
  7. Ferrari FD, Sargent AE. Promotion of flowering and fruit set in mango (*Mangifera indica* L.) cv. Haden with potassium nitrate. Revta Faculadad Agronomia. 1996; 22:1-8.
  8. Karim MF, Shokry EM, Sabagh ASE. Effect of ethrel on flower induction in young trees of three commercial mango cultivars. Journal of Agriculture and Environment Science. 2007; 6:132-163.
  9. Mass EF. In Nicaragua: Potassium nitrate foliar spray induces bloom in mango orchard. Better Cropped International Journal. 1989; 5(1):4-5.
  10. Muhammad A, Tahir FM, Anwar R, Pervez MA, Rehman S. Effect of gibberellic acid and potassium nitrate spray on panicle physiology of mango (*Mangifera indica* L.). International Symposium on Prospect of Horticulture Industry in Pakistan, 2007, 126-130.
  11. Nunez ER. Flowering and fruit set of monoembryonic and polyembryonic mango as influenced by potassium nitrate sprays and shoots decapitation. Proc. Fla. State Horticulture Soc. 1985; 98:179-183.
  12. Pandey RM, Singh RN, Singh GC. Usefulness of ethrel in regulating a flower bearing in mango. *Science and Culture*, 1973; 39(3):148-150.
  13. Parmar JM, Karetha KM, Rathod PJ. Effect of urea and zinc on growth and flowering attributes of guava (*Psidium Guajava* L.) cv. Bhavanagar red. *Advance Research Journal of Crop Improvement*. 2014; 5(2):140-143.
  14. Rajput CBS, Singh JN. Effect of urea and GA<sub>3</sub> sprays on the growth, flowering and fruiting characteristics of mango. *Progressive Horticulture*. 1983; 15(3):174-177.
  15. Rajput CBS, Singh JN. Effect of urea and GA<sub>3</sub> sprays on the growth, flowering and fruiting characteristics of mango. *Acta Horticulture*. 1989; 231:301-305.
  16. Rajput CBS, Tiwari JP. Effect of foliar spray of urea on flowering and fruiting characters of three cultivars of mango. *Bangladesh Horticulture*. 1975; 3:1-5.
  17. Ravishankar H, Nalawadi UG, Hulamani NC. Effect of spraying chemicals and nutrients on growth and flowering in 'off' year mango trees. *Journal of Maharashtra Agriculture University*. 1989; 14:319-322.
  18. Sargent E, Leal F. Flowering induction in mango (*Mangiferaeindicae* L.) with KNO<sub>3</sub>. *Revista de la Faculadad de Agronomia*. 1989; 15:17-32.
  19. Sargent E, Ferrari D, Leal F. Effect of potassium nitrate and peclobutrazol on flowering induction and yield of mango (*Mangifera indica* L.) cv. Haden. *Acta Horticulture*. 1997; 455:180-187.
  20. Shaban AEA. Effect of ethrel spraying on inducing flowering in the "off" year of mango trees. *Annals of Agriculture Science*. 2004; 49:687-698.
  21. Sharma TR, Nair PKR, Neema MK. Influence of foliar sprays of urea, KNO<sub>3</sub> and NAA on physical composition of mango cv. Langra. *Punjab Horticulture Journal*. 1990; 30(1-4):47-52.
  22. Shawky I, Zindan Z, Tomi AE, Dahsan D. Effect of urea sprays on time of blooming, flowering, malformation and productivity of Taimur mango tree. *Egyptian Journal of Horticulture*. 1978; 5(2):133-142.
  23. Shyamal MM, Bordoloi B, Pakkiyanathan K. Influence of plant growth substances on vegetative growth, flowering, fruiting and fruit quality of papaya. *Indian Journal of Horticulture*. 2010; 67(2):173-176.
  24. Singh RR. Effect of foliar spray of nitrogen and phosphorus on flowering and fruiting of mango (*Mangifera indica* L.) cultivar Langra. *Haryana Journal Horticulture Science*. 1974; 3:147-54.
  25. Singh Z, Dhillon BS. Effect of plant regulators on floral malformation, flowering productivity and fruit quality of mango (*Mangifera indica* L.). *Acta Horticulture*. 1986; 175:315-320.
  26. Sudha R, Balamohan TN, Soorianthasundaram K. Effect of foliar spray of nitrogenous chemicals on flowering, fruit set and yield in mango (*Mangifera indica* L.) cv. Alphonso. *Journal of Horticulture Science*. 2012; 7(2):190-193.
  27. Tin MP. Effect of paclobutrazol and potassium nitrate on off-season fruit production of *Mangifera indica* L. cv. Seintalone. *Dagon University Research Journal*. 2016; 7(1):131-140.
  28. Vijayalakshmi D, Srinivasan PS. Induction of flowering in 'off' year mango cv. Alphonso as influenced by chemicals and growth regulators. *Annals of Plant Physio*, 1998; 12:93-97.
  29. Yeshitela T, Robbertse PJ, Stassen PJC. Potassium nitrate and urea sprays affect flowering and yields of 'Tommy Atkins' (*Mangifera indica* L.) mango in Ethiopia. *South African Journal of Plant and Soil*. 2005; 22(1):28-32.