Pak.J.Bot., 24(2):197-200, 1992.

INFLUENCE OF GROWTH REGULATORS, COBALT AND SILVER IONS ON FRUIT DROP IN MANGO (*MANGIFERA INDICA* L.).

S.S.M. NAQVI, S.M. ALAM AND SABA MUMTAZ

Plant Physiology Division;
Atomic Energy Agricultural Research Centre,
Tando Jam, Pakistan.

Abstract

Pre-mature fruit drop decreases mango yield The effect of aqueous sprays of 1-naphthaleneacetic acid (NAA), gibberellic acid (GA_3), silver nitrate ($AgNO_3$) or cobalt nitrate [$Co(NO_3)_2$], alone or in combination, on fruit retention in mango (cv. Sindhri) was studied. Spray was done once when fruitlets were of pea-size and then two weeks later when fruitlets increased to marble-size. Compared to control, applications of Co (100 mg/L), Ag (100 mg/L) ions, NAA (20 mg/L) and GA_3 (50 mg/L) enhanced fruit retention by 131, 127, 100 and 50%, respectively. No additive effect was observed when these chemicals were sprayed in combination.

Introduction

Mango is the most extensively grown tropical fruit in the world which is probably consumed fresh in larger quantities than any other fruit species. Besides inconsistent bearing excessive premature fruit drop adversely affects the crop production (Mukherjee, 1953; Singh, 1960; Singh & Ram, 1983; Desai *et al.*, 1985). Fruit drop occurs at all stages of development but is extensive (over 90%) during the first 2-4 weeks after fertilization (Singh, 1960; Jagirdar & Choudhry, 1967; Nunez- Elisea & Davenport, 1983).

It is now well established that ethylene is responsible for the abscission of most plant organs (Reid, 1985) and its biosynthesis can be chemically regulated (Yang & Hoffman, 1984). Van Lelyveld (1978) suggested the involvement of ethylene in the shedding of young mango fruits which has been experimentally supported by Nunez-Elisea & Davenport (1986). Spray application of growth regulators have been shown to enhance mango fruit retention (Jagirdar & Choudhry, 1967; Aravindakshan *et al.*, 1979; Dahshan & Habib, 1981; Singh & Ram , 1983) and recently Naqvi *et al.*, (1990) have demonstrated that besides the growth regulator NAA, aqueous spray applications of Co and Ag also effectively enhanced fruit yield in the elite mango cultivars, Sindhri, Langra and Dasehri. These studies were therefore, conducted to test if GA_3 as well as the combinations of NAA, GA_3, Ag and Co can further enhance the fruit yield by decreasing the pre-mature fruit drop.

Materials and Methods

Mango *(Mangifera indica* L.) trees, grown at the orchard of the Atomic Energy Agricultural Research Centre, Tando Jam were selected on the basis of similarity in age and their flowering/fruiting behaviour.

Aqueous solutions of 20mg/L of 1-naphthaleneacetic acid (NAA), 50mg/L of gibberellic acid (GA_3), 100mg/L of silver nitrate ($AgNO_3$) or 100mg/L of cobalt nitrate [$Co(NO_3)_2$] alone or in combinations of two of them were sprayed to the point of run-off. Control was treated with distilled water and 0.01% Tween-80 was used as wetting agent in all the treatments. Since the largest number of fruits abscise within 2-4 weeks of setting, two sprays were carried out in the morning hours, the first when the fruits had attained pea-size (15-20 days after fertilization) and the second after two weeks when it had attained marble-size (25-30 days after fertilization).

Six uniform panicles from three trees of mango cv. Sindhri were randomly selected and total number of fruits in each panicle was counted at the time of first spray and at maturity when they were harvested. Each tree was considered as a replicate. Since our earlier experiments, carried out for 3 consecutive years, have demonstrated the effectiveness of NAA, Ag and Co ions in enhancing fruit retention in cv. Sindhri and Langra (Naqvi *et al.*, 1990), we conducted these experiments only in 1985. The data pertaining to percent fruit retained were statistically analysed for means separation.

Results and Discussion

Spray applications of the growth regulators GA_3 and NAA or Co and Ag ions enhanced the fruit retention (Table 1). Compared with control, GA_3 or NAA increased the fruit retention by 58 and 100 %, while Co or Ag ions increased it to 131 and 127%, respectively. Thus the highest fruit retention (yield increase) was achieved with Co or

Table 1. Effect of aqueous spray applications of NAA, GA_3 or Ag and Co ions on fruit retention in cv. Sindhri.

Spray treatments and rate (mg/L)	Fruits /6 panicles at First spray	Harvest	% Fruits retained	% increase over contorl
Control	257	16	6.2 e	
NAA 20	315	39	12.4 bc	100.0
GA_3 50	345	24	9.8 d	58.1
$AgNO_3$ 100	396	56	14.1 a	127.4
$Co(NO_3)_2$ 100	259	37	14.3 a	130.6
NAA + GA_3	426	52	12.2 bc	96.8
NAA + $AgNO_3$	317	43	13.6 ab	119.4
NAA + $Co(NO_3)_2$	280	38	13.6 ab	119.4
GA_3 + $AgNO_3$	311	41	13.2 b	112.9
GA_3 + $Co(NO_3)_2$	385	52	13.5 ab	117.7
$AgNO_3$ + $Co(NO_3)_2$	350	52	14.9 a	140.3

Means followed by the same letter are not significantly different ($P < 0.05$).

Ag ions while the lowest was obtained with GA_3. Spray combination of any two of the chemicals had no additive effect.

There are reports of the effects of auxin, NAA (Planofix) and 2,4-D, on increasing fruit retention in various mango cultivars. Naphthaleneacetic acid @ 10 mg/L and above and 2,4-D @ 10 mg/L were effective in increasing fruit retention in cv. Hindy Be Sinnara, Khasa, Dasehri, Neelum, Langra and Sindhri (Jagirdar & Choudhry, 1967; Aravindakshan *et al.*, 1979; Dahshan & Habib, 1981; Singh & Ram, 1983; Naqvi *et al.*, 1990). GA_3 when applied @ 50 mg/L increased fruit set and the yield per tree of cv.Taimour (Shawky *et al.*, 1978). However, Rajput & Singh (1983) reported increased fruit retention in cv. Dasehari (3.2%) when they used 30 mg/L GA_3 alongwith 6% urea. Both the chemicals were ineffective separately. Our results with cv. Sindhri further support the above findings with regard to NAA and GA_3. These results alongwith others also show that irrespective of cultivars, NAA and GA_3 are effective in increasing yield in mango to a significant extent.

There are also reports where Ag (Singh & Ram 1983; Naqvi *et al.*, 1990) and Co ion (Naqvi *et al.*, 1990) have been shown to enhance fruit retention in mango. Comparing salts of silver nitrate, acetate and lactate, Beyer (1976) reported that it is the Ag ion which is effective in inhibiting ethylene action in plants and not the nitrate, acetate or lactate. Van Lelyveld (personal communication) also observed increased fruit retention in mango when sprayed with $AgNO_3$. He however, pointed out that the fruits were embryoless and remained small and unmarketable; in the present study, all the fruits remained normal and marketable. This may have been due to the fact that the cultivars grown in the Indo-Pakistan sub-continent are monoembryonic and mostly grafted or it may be due to environmental differences between Tando Jam (Pakistan) and Nelspruit (South Africa). It is also possible that the concentration of $AgNO_3$ and/or the stage of fruit development may not have been optimal in his experiments.

Nunez-Elisea & Davenport (1986), using fruitlets from mango cultivars Keitt and Tommy Atkins, have reported that ethylene produced by pericarp was involved in the abscission of mango fruitlets. Since maximum abscission of fruitlets occurs during the first 2-4 weeks after fertilization (Singh, 1960; Jagirdar & Choudhry, 1967; Nunez-Elisea & Davenport, 1986), which also coincides with the maximum ethylene production, it seems that spraying of NAA, GA_3, Ag or Co ions at the stage of maximum ethylene production regulated its level and thus enhanced fruit retention.

Acknowledgment

We are thankful to Mr. K.H. Tahir for the statistical analysis of the data, Mr. M. Farooq for technical assistance and Mr. Mohammad Aslam for Computer work. Thanks are also due to Dr. W.A. Farooqi of NIAB, Faisalabad for his help.

References

Aravindakshan, K., C. Ramachandran, and I.S. Pynadath. 1979. Effect of planofix on fruit set in mango (var. Neelum). *Agric. Res. J. Kerala*. 17: 105-107.

Beyer, E.M. Jr. 1976. Silver ion: A potent antiethylene agent in cucumber and tomato. *HortScience*. 11: 195-196.

Dahshan, D.I., and S.S. Habib. 1981. Effect of 2,4-D sprays on fruit drop of 'Hindy Be Sinnara" mango. *Research Bulletin* No. 1515. pp 12. Ain Shams University, Cairo, Egypt.

Desai, A.G., V.P. Limaye, and R.T Gunjate. 1985. Studies on fruit set and fruit drop in Alphanso, Goamankur, and Kesar varieties of mango (*Mangifera indica* L.). *Maharashtra Jour. Hort.*, 2: 37-42.

Jagirdar, S.A.P and M.R. Choudhry. 1967 Fruit drop control in mango by hormonal spray. *W. Pak. J. Agric. Res.*, 5: 33-42.

Mukherjee, S.K. 1953. The mango -its botany, cultivation, uses and future improvement, especially as observed in India. *Economic Bot.*,. 7· 130-162

Naqvi, S.S.M., S.M. Alam, and S. Mumtaz. 1990. Effect of cobalt and silver ions and naphthaleneacetic acid on fruit retention in mango (*Mangifera indica*. L.) *Aust. J. Exptl. Agric.*, 30: 433-435.

Nunez-Elisea, R., and T.L. Davenport. 1983. Abscission and ethylene production in mango (*Mangifera indica* L.) fruit cv. Tommy Atkins. *Proc. State Hort. Soc.*, 96: 185-188. @REFRENCE = Nunez-Elisea R., and T.L. Davenport. 1986. Abscission of mango fruitlets as influenced by enhanced ethylene biosynthesis. *Plant Physiol.*, 82: 991-994.

Rajput, C.B.S., and N.J. Singh. 1983. Effect of urea and GA_3 sprays on the growth, flowering and fruiting characters of mango. *Prog. Hort.*, 15: 174-177.

Reid, M.S. 1985. Ethylene and abscission. *HortScience*, 20: 45-50.

Shawky, I., Z. Zidan, A. El-Tomi, and D.I. Dahshan. 1978. Effect of GA_3 sprays on time of blooming and flowering malformations in Taimour mango. *Egypt J. Hort* . 5: 123-132.

Singh, R.S. and S. Ram. 1983. Studies on the use of plant growth substances for fruit retention in mango cv. Dasheharı. *Ind. J. Hort.*, 40: 188-194.

Singh, U.R. 1960. Studies in the fruit drop of mango (*Mangifera indica* L.). II Nature and extent of fruit drop. *Hort. Adv.*, 4: 142-154.

Van Lelyveld, L.J. 1978. Peroxidase activity and isozymes in abscised and normal mango (*Mangifera indica* L.) fruits. Zeit. Pflanzenphysiol., 89: 453-456.

Yang, S.F. and N.E. Hoffman. 1984. Ethylene biosynthesis and its regulation in higher plants. *Ann Rev. Plant Physiol.*, 35· 155-189.

(Received for Publication 4 November 1991)