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EFFECT OF GIBBERELLIC ACID AND POTASSIUM NITRATE SPRAY ON PANICLE PHYSIOLOGY OF MANGO (*Mangifera indica* L.)

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Abstract

Present studies were carried out to observe the effect of low (25, 50, 75 ppm) and high (200, 250, 300 ppm) concentration of GA_3 and KNO_3 (1, 2 and 3%) on the panicle emergence and malformation of inflorescence. Lower concentration of GA_3 and higher concentration of KNO_3 were found favorable to induce early emergence of panicles and reduced incidence of malformation of inflorescence. An increased percentage of hermaphrodite flowers and fruit set were also observed on these panicles. However, higher doses of GA_3 delayed panicle emergence, increased intensity of malformation, as well as the percentage of male flowers and in turn fruit set percentage decreased in these treatments.

Key words: Mango, malformation, panicle physiology, gibberellic acid, potassium nitrate.

INTRODUCTION

Mango (*Magnifera indica* L.) is the second major fruit of Pakistan. Its annual production is 1.67 million tonnes from an area of 151 thousand hectares (Anonymous, 2005). Our present per hectare yield is less than 11 tonnes as compared to major mango producing countries.

There are serious feelings that low yield is due to mismanagement of the orchards and frequency of diseases particularly the malformation of the inflorescence which is responsible for the maximum loses in productivity. Mango malformation is a complex problem which considered to be controlled through use of growth regulators. GA_3 promoted as well as delayed emergence of flowers with variable doses (Kachur et al., 1972) while KNO_3 promoted early blooming (Astudillo and Bondad, 1978, Sergent and Leal, 1989). Responses of the GA_3 have been reported significantly different at different locations and with different cvs. (Tomer, 1984). Gibberellic acid has been reported to delay flowering in regions with high temperature in 'Kensington Pride" mango (Greer et al., 1988). GA_3 at the concentration of 500,1000, or 1500 ppm delayed flowering in mango when applied to matured shoots (Mammon,1988) and the extent of expression of inflorescence development was positively correlated with GA_3 concentration (Oosthuyse, 1995). Response of GA_3 also varied from year to year (Turnbull et al., 1996).

Potassium nitrate induced off season flowering in mango (Bondad and Lingangan, 1979, Davenport, 1993). Leaf buds released generated stimulus after KNO_3 or NH_4NO_3 treatments, which was responsible for receptive buds to initiate reproductive growth (Tongumpai et al., 1989).

MATERIALS AND METHOD

Studied reported here in, were carried out during 2005-2006 in Experimental Fruit Orchard (Square 9), Institute of Horticultural Sciences, University of Agriculture Faisalabad. Following concentrations of GA_3 and KNO_3 were sprayed in the last week of the January before blooming.

T_1: Control
T_2: GA_3 25 ppm
T_3: GA_3 50 ppm
T_4: GA_3 75 ppm
T_5: GA_3 200 ppm
T_6: GA_3 250 ppm
T_7: GA_3 300 ppm
T_8: KNO_3 1%
T_9: KNO_3 2%
T_{10}: KNO_3 3%

Following data were collected at weekly intervals.

- Time of panicle emergence
- Total number of panicles
- Number of healthy panicles
- Number of malformed panicles

Data from the treated trees were collected at weekly intervals between 3rd weeks of February to 2nd week of the April, period constitute the blooming duration. Healthy and malformed panicles were recorded separately corresponding to the time of emergence of the flushes, which occurred, during April to September, during the preceding year. Treatments were compared using DMR test as described by Steel and Torrie (1980).

RESULTS AND DISCUSSION

Observations indicated that low concentration of GA_3 enhanced early flowering and improved the number of healthy panicles. Higher doses, on the other hand, delayed emergence of healthy panicles and increased the frequency of malformation. The total number of panicles however, was found statistically equivalent in both treatments (Figure 1).

In response to GA_3 application at the lower concentration of 25, 50 and 75 ppm, blooming commenced during third week of February that completed by the end of March in all treatments against first week of March to 15th of April in control plants. The peak bloom and the number of normal and the malformed panicles although varied under each treatment. The total number of the panicles appeared were 99, 129, 110 and those suffered from malformation were 18 (18.18%), 20 (15.50%) and 11(10%) in treatments with 25, 50 and 75 ppm concentrations respectively.

Higher concentrations of 200, 250 and 300 ppm GA_3 delayed blooming in mango significantly. Blooming appeared during third week of March in case of 200 ppm, which further delayed by the higher concentration of 300 ppm to the last week of March. Total blooming panicles in response to 200, 250 and 300 ppm were 101,118 and 108 while malformed panicles out of these were 50 (49.50%), 59 (50%) and 79 (67.59%), respectively.

KNO_3 @ 1.0% did not affect the flowering. In this treatment total panicles were 108 out of them 34 (31.48%) were found malformed. With increased doses of 2% and 3%, the blooming started earlier and produced 110 and 108 panicles out of them, 29 (26.36%) and 18 (16.67%) were malformed (Figure 2).

Higher doses of KNO_3 promoted early blooming and minimized incidence of malformation bearing out the findings of (Astudillo and Bondad, 1978) and (Sergent and Leal, 1989).

Panicle length (cm)

Panicles appeared in beginning of the March which continued to grow for more than a month and attained various sizes. The large sized panicles carried more hermaphrodite besides total number of flowers, thus increased the possibilities of more fruit setting. Longer panicle length was observed in response to the treatments with GA_3 at the low concentrations and KNO_3 application at higher concentration. Higher concentrations of GA_3 on the other hand reduced the growth of panicles. Significantly higher growth (38.77 cm) was attained in response to spray with 3% KNO_3 followed by GA_3 @ 75 ppm (37.75 cm). The other treatments of GA_3 at the lower concentrations and KNO_3 @ 2% also promoted growth of the panicles significantly over all other treatments while T_7 (GA_3 300 ppm) significantly reduced the growth and produced the shortest panicles of 22.48 cm length (Table 1).

Floral biology

The data regarding number and percentage of hermaphrodite flowers is presented in the Table 1. The perusal of the table revealed that the number of the hermaphrodite flowers increased significantly as a result of the application of the KNO_3 at various concentrations while GA_3 application reduced their number significantly. KNO_3 @ of 3% increased percentage of hermaphrodite flowers significantly over all other treatments followed by KNO_3 @ 2%. GA_3 application tended to reduce the percentage of the hermaphrodite flowers being significantly minimum as a result of GA_3 at the rate of 300 ppm, the highest concentration.

It has been deduced from the experiment that GA_3 treatments increased percentage of male flowers being significantly highest on the terminals treated with the highest doses of GA_3. It is observed in several studies that GA_3 increases maleness in various plants (Mitchell and Wittmer, 1962). It is evident from the perusal of the Table 1 that GA_3 increased maleness in mangoes. However, it was astonishing that total number of the flowers were least affected from any treatment, although the size of the panicles as well as other characters altered. The range of the total flowers remained within range of 884-1072 in case of T_{10} to T_7, respectively. Similarly, number of male flowers were 587 in case of KNO_3 (3%) and 928 in case of GA_3 @ 300 ppm respectively (Table 1).

Fruit set (%)

Initial fruit set is considered as an indicator of productivity of a fruit tree. Therefore percent fruit set was observed as a result of GA_3 and KNO_3 applications. The treatments behaved significantly different. Significantly highest fruit set was observed as a result of KNO_3 application @ 3% concentration. Control was statistically at par with 2% KNO_3. In all other treatments, negative effect of the treatments appeared particularly as a result of GA_3 applications being maximum reduction in the fruit set as a result of the highest rate of application of GA_3 @ 300 ppm. It may be derived that the reduction in fruit set was due to increased percentage of male flower in GA_3 treated panicles (Mitchell and Wittmer, 1962).

CONCLUSION

Thus treatments clearly indicated that the lower concentrations of GA_3 (25, 50 and 75 ppm) promoted early blooming and reduced the malformation ratio while spray of higher concentrations (200, 250 and 300 ppm) delayed the blooming and increased the ratio of malformed panicles. While in case of KNO_3 1% did not affect the flowering but higher doses of KNO_3 (2 and 3%) promoted early blooming and minimized the incidence of malformation.

REFERENCES

Anonymous. 2005. Agriculture Statistics of Pakistan. Government of Pakistan. Ministry of food, Agriculture and Livestock, Islamabad, Pakistan.

Astudillo, E.O. and N.D. Bondad.1978. Potassium nitrate induced the flowering of 'Carabao' mango shoots at different stages of maturity. Philippine J. Crop Sci., 3:147-152.

Bondad, N.D. and E.L. Ingsangan. 1979. Flowering in mango induced with potassium nitrate. Hort. Sci.14:527-528.

Davenport, T. L.1993. Flower manipulation in mangoes. Int: C.L Chia and D.O. Evans (Eds). Proc. conference on mango in Hawaii.CTAHR Uni.of Hawaii at Manoa.pp.54-60.

Greeer, N., J. Saranah and A. Whiley. 1988. Mangoes in South East Queensland Open Day Programme and Information. Maroochy Horticultural Res.Sta.Sec.C.PP.1-

Kachru, R.B., Singh and E.K. Chacko. 1972. Inhibition of flowering in mango (*Mangifera indica*L) by gibberellic acid. HortScience, 6(2):140-141.

Mammon, S.1998. Effect of the giberellic acid on the flowering of mango cv. Nam–Dokmai No-4. Kasetsart Uni. Bankook, pp.1-14.

Mitchell, W.D. and S.H. Wittmer. 1962. Chemical regulation of flower sex expression and vegetative growth in *Cucumis stativa*. Science, 136:880-881.

Oosthuyse, S.A. 1995.Effect of aqueous application of GA3 on the flowering of mango trees: why in certain instance is flowering prevented, and in others flowering is only delayed? Year book South Afr. Mango Grower's Assoc., 15:21-25.

Sergent, E. and F. Leal.1989. Flowering induction in mango (*Manginifera indica*.L) with KNO_3. Revista de La Agronimica, Universidad central de Venezuela, 15(1-2):17-32.

Steel, R.G.D. and J.H. Torrie. 1980. Multiple comparison, principal and procedure of statistics. Mc I. Zene Hill Branch Co. Int . New York. 173-191.

Tomer, E. 1984. Inhibition in mango by gibberellic acid. Scientia. Horticulturae.24:299-303.

Tongumpai, P., N. Hongsbhanich and C.H. Voon. 1989.'Cultar" for flowering regulation of mango in Thailand. Acta Horticulturae, 239:375-378.

Turnbull, G.C.N., K.I. Anderson and F.C. Winston. 1996. Influence of gibberellin treatment on the flowering and fruiting patterns in mango. Aust. J. Expt. Agri., 36:603-611.

Table 1: Effect of GA_3 and KNO_3 on the reproductive characteristics of mango cv. Langra

Treatments	Panicle length (cm)	Hermaphrodite Flowers (number)	Male Flowers (number)	Hermaphrodite Flowers (%)	Fruit set (%)
Control	25.90de	228.2bc	718.2de	25.16bc	11.800b
GA_3 25 ppm	28.04cde	215.4cd	721.0de	23.13c	9.0562c
GA_3 50 ppm	30.92cd	201.2cd	742.0cd	21.49cd	9.006c
GA_3 75 ppm	37.75ab	192.8cde	784.0bc	19.80cde	7.806d
GA_3 200 ppm	27.27de	164.6de	837.0b	16.38de	6.108e
GA_3 50 ppm	25.25de	141.2ef	739.0cd	13.80ef	5.428f
GA_3 300 ppm	22.48e	99.00f	928.0a	9.98f	4.740g
KNO_3 1%	29.17cd	243.4bc	694.0de	25.62bc	8.948c
KNO_3 2%	33.21bc	279.2ab	587.0e	30.50ab	12.130b
KNO_3 3%	38.77a	297.8a	587.0f	34.39a	14.060a

Means are followed by the same letters are not significantly different ($P \leq 0.05$) by DMR test.

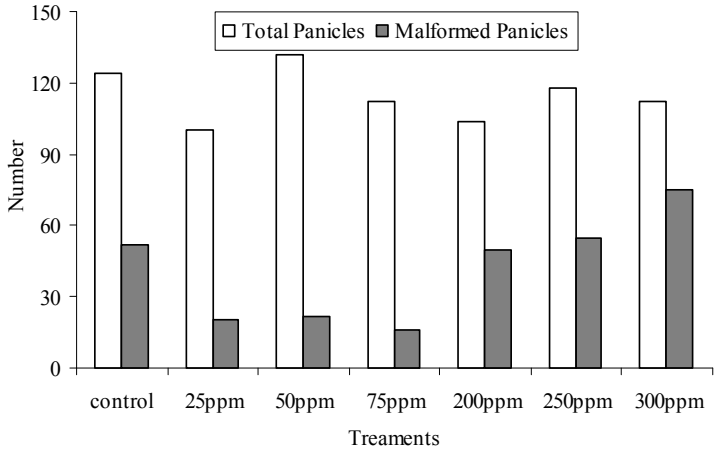

Figure1: Effect of GA_3 on panicle emergence and malformation in mango

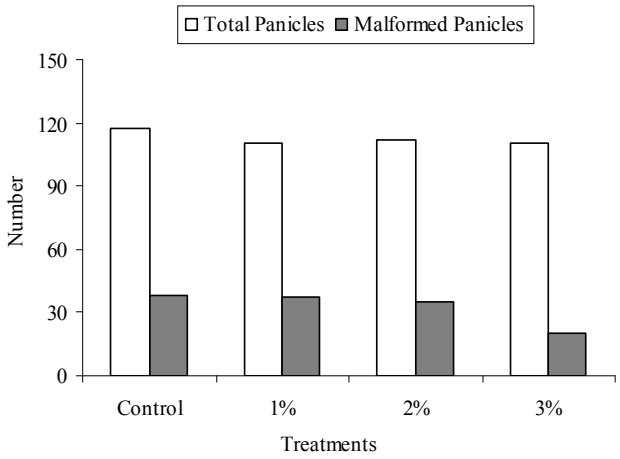

Figure2: Effect of KNO_3 on panicle emergence and malformation in mango