Journal of Applied Sciences

ISSN 1812-5654

science alert

ANSInet
an open access publisher
http://ansinet.com

Journal Applied Sciences 6 (2): 266-269, 2006
ISSN 1812-5654

Delaying Apricot (cv. Shahroudi) Flower Induction by Growth Regulators Application

E. Ganji Moghadam and A. Mokhtarian
Khorasan Agricultural and Natural Resources Research Centre, Mashad, Iran

Abstract: Control flowering time in apricot trees is very important where spring frost damage is of high risk. Application of plant growth regulators during autumn has been suggested for controlling bloom date. This experiment was conducted during 2000-2001 to examine the effects of application of different concentrations of ethephon and gibberellic acid (0, 50, 100, 200 and 300 mg L^{-1}) at the end of August, September and October) to delay flowering in apricot Shahroudi cultivar. A factorial experiment was laid out in Completely Randomized Block Design with 3 replications. Compared to the control results showed, 100 mg L^{-1} of ethephon applied at the end of October delayed full bloom approximately 3 days (2000) and 7 days (2001). Gibberellic acid applied at 300 mg L^{-1} at the end of August delayed full bloom about 5 days (2000) and at the end of September, l0 days (2001). During both year's gibberellic acid and ethephon applied at the higher concentrations resulted lower percentages of flower opening and fruit set.

Key words: Gibberellic acid, ethephon, bloom delay, fruit set

INTRODUCTION

Iran is one of the most important apricot producers in the world. The apricot production of Iran is about 225000 mt per year. An important portion of this production is obtained from the northeast of Iran. One limiting factor influencing successful apricot growing in Iran is late spring frost. In many years, the apricot production of Iran can be affected by late spring frost. So, the most important aim of Iranian apricot breeding programs is resistance to late spring frost.

Many chemicals have been tested to determine their ability to protect fruit blossoms from freeze damage or delay flower development until freeze damage is less likely.

Sedgley[1] reported a delay in bud break with autumn application of plant growth regulators, especially ethephon, which delayed bloom in several fruit species.

In preliminary studies to determine the effect of ethephon treatment on fruit bud hardiness[2] and fruit abscission[3] treatment in autumn or at high rates in summer delayed anthesis of various stone fruit cultivars the following spring. High concentrations (2000 and 4000 mg L^{-1}) of ethephon delayed bloom but induced leaf yellowing and abscission, terminal dieback and gummosis in cherries and plum[3]. Applying ethephon (250 or 500 mg L^{-1}) two months prior to normal leaf abscission increased sweet cherry bud hardiness in midwinter, delayed bloom 3-5 days and had no deleterious effect on fruit maturity or quality[4,5]. Dennis[6] delayed bloom of several stone fruits with ethephon (250 and 500 mg L^{-1}). Ethephon treatment during early leaf fall greatly accelerated leaf abscission, plum trees treated with 250 mg L^{-1} ethephon were completely defoliation 5-7 days before untreated trees[7]. Application during bud swell did not affect bloom delay, fruit set, or yield[8]. Delaying bloom of apricots with ethephon (150-200 mg L^{-1}) doubled yields following a –4°C freeze at bloom time[9]. Treatment with 100 mg L^{-1} during the period of natural leaf abscission effectively delayed peach flowering and increased winter bud hardiness in New Jersey[10-12]. The effects of gibberellins on flowering have been studied more extensively than those of any other plant growth regulator. Gibberellin treatment during autumn can delay bloom and increase bud hardiness[13,14], but the two effects are not necessarily correlated. Gibberellin delayed apricot blossoming 11-13 days one year but similar treatments were ineffective the following year[15]. Postharvest application of GA (June to August) ranging from 10 to 1000 mg L^{-1} induced several flower and fruit responses in Patterson apricot[16,17]. Late summer and early autumn GA treatments can delay bloom of stone fruits, but often induce detrimental effects such as flower bud abscission and reduced set. This study was initiated to determine the effects of time of ethephon and gibberellic acid application and concentrations on bloom delay of Shahroudi apricot.

MATERIALS AND METHODS

The research was carried out in the Khorasan Agricultural and Natural Resources Research Centre during the years 2000-2001 to examine the effects of

Corresponding Author: E. Ganji Moghadam, Khorasan Agricultural and Natural Resources Research Centre, Mashad, Iran
Tel: +98 511 3400301

application of different concentrations of ethephon and gibberellic acid (0, 50, 100, 200 and 300 mg L^{-1}) at the end of August, September and October on delay the flowering in apricot Shahroudi cultivar. A factorial experiment was laid out in Completely Randomized Block Design with 3 replications where each replication comprised 5 trees. All data were subjected to analysis of variance and Duncan's Multiple Range tests were used to compare the treatment means. Treatments were applied to 15 year-old Shahroudi apricot trees. The various growth regulators were applied with a small hand sprayer, with the leaves covered thoroughly to point of run off. The trees were planted and grown using management practices common to commercial orchards in Iran. The plantation is located on a sandy soil with low humus content. In the soil of the orchard a high pH (7.5) and high calcium content (15-20%) were measured. Spacing of the trees is 3x4 m; 10 cm of the rootstock shanks is left exposed above the soil line. The trees were trained as open vases.

Ethephon and gibberellic acid treatments effects were determined by bloom delay, percent flower opening and fruit set. The number of opened flowers were recorded periodically and expressed as percent of total. Bloom delay was determined by subtracting the time of 70% anthesis of ethephon and gibberellic acid application from that of control and was expressed as the number of bloom delay days.

RESULTS AND DISCUSSION

Compared to the control results showed, ethephon at low concentrations successfully delayed bloom and 100 mg L^{-1} of ethephon applied at the end of October delayed full bloom approximately 3 to 7 days in both years (Fig. 1). Although ethephon at 300 mg L^{-1} delayed bloom 8 to 10 days, treatment resulted in the production of abnormal flowers and lower fruit set (Fig. 2). Increase in ethephon concentrations resulted in an increase in percent abnormal flowers and gummosis (Table 1).

Gibberellic acid applied at 300 mg L^{-1} at the end of September delayed full bloom about 5 to 10 days (Fig. 2). During both years' gibberellic acid applied at the higher concentrations resulted lower percentages of flower opening and fruit set (Table 2).

Flowering period of trees treated with ethephon and gibberellic acid at 100 and 300 mg L^{-1}, respectively were loner than control. We found significantly differences in other characteristics such as fruit size and soluble solids content between treatments (Data was not shown).

Fall ethephon and gibberellic acid applications delayed bloom in the 2 years studied. Depending upon concentration and time of application, full bloom of

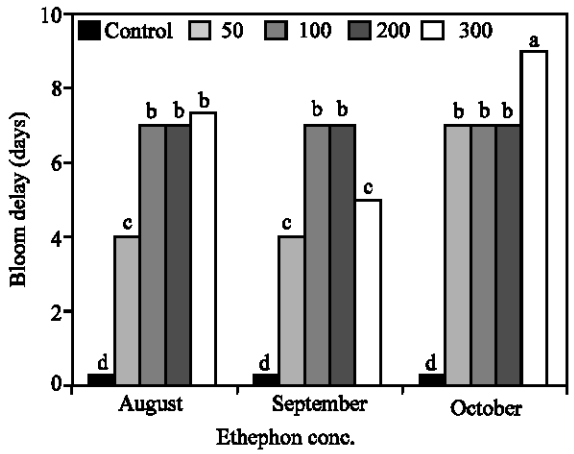

Fig. 1: Effects of ethephon application on bloom delay of apricot cv. Shahroudi in 2002

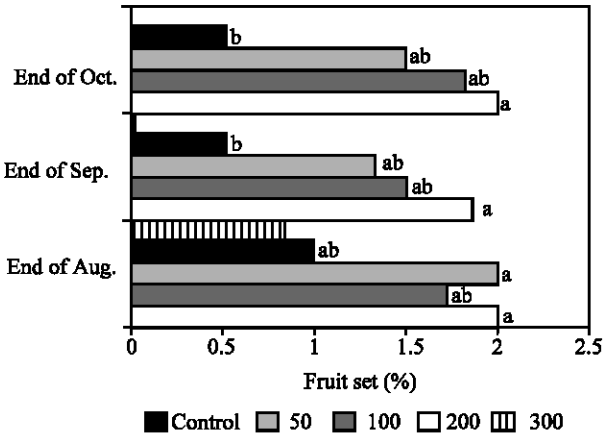

Fig. 2: Effects of ethephon application on fruit set percentage of apricot cv. Shahruodi in 2002

Shahroudi was 3 to 7 and 5 to 10 days later than the control in ethephon and gibberellic acid application respectively. This results are similar to that reported for several stone fruit species (cherries, peach, plum and apricot) to which ethephon was applied at 100 to 500 ppm[6]. Present findings have been confirmed by

Table 1: Effect of ethephon application on shoot gummosis apricot trees (cv. Shahroudi)

Application time Conc. mg L^{-1}	End of Aug	End of Sept.	End of Oct.
Control	0C	0C	0C
50*	0C	0.67BC	0.67BC
100	1ABC	1.67AB	1.33ABC
200	1.3ABC	2AB	1ABC
300	1.67AB	2.33A	2.33A

†Means with similar capital letter in each column and row are not significantly different at 1% level *mg L^{-1}

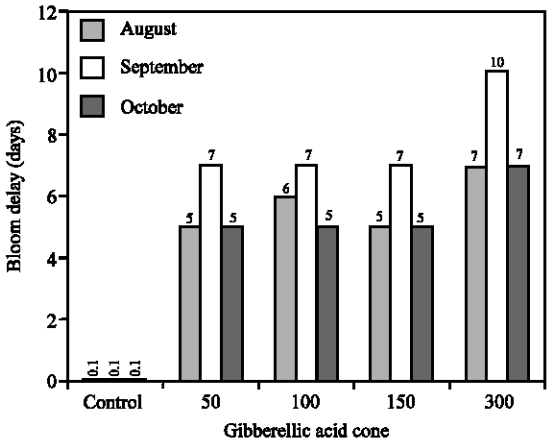

Fig. 3: Effect of gibberellic acid application on bloom delay

Table 2: Effect of gibberellic acid application on fruit set percentage apricot (cv. Shahroudi)

Application time Conc. mg L^{-1}	End of Aug	End of Sept.	End of Oct.
Control	1.5AB	1.17AB	3.5A
50*	1.16AB	1.16AB	2.66AB
100	0.67AB	0.84AB	2.5AB
200	0.3B	0.16AB	1.66AB
300	0.1B	0.17AB	0.4A

†Means with similar capital letter in each column and row are not significantly different at 1% level * mg L^{-1}

other authors who consider fall ethephon and gibberellic acid application to have an effect on time of flowering[15,18-20].

Flowering period of trees treated with ethephon and gibberellic acid at 100 and 300 mg L^{-1}, respectively were loner than control and a high percentage of those flowers that opened late were abnormal and may be the major reason for reduced fruit set at these concentrations. These data agree with that of Crisosto[20] and Dennis[6] who reported a decrease in yield and fruit set by ethephon and gibberellic acid application.

Dennis[6] reported that gummosis occurred at high ethephon concentrations in all Prunus species he studied. These results also confirmed by our finding, but we were unable to detect any side effects due to any gibberellic acid concentrations in either year of our study with Shahruodi apricot. This trial demonstrated that growth regulators influence time of flowering, fruit set and fruit quality. However, conclusion needs to be proved in further trials set in different climatic conditions.

ACKNOWLEDGMENTS

This research supported by Seed and Plant Improvement Research Institute. The authors express appreciation to Mrs. S. Akhavan and Mrs. S. Bina for lab analysis and M. Farokh and A. Eravani for technical assistance.

REFERENCES

1. Sedgley, M., 1990. Flowering of deciduous perennial fruit crops. Hortic. Rev., 12: 223-264.
2. Proebsting, E.L., 1969. Effects of growth regulators on fruit bud hardiness in Prunus. Hortic Sci., 4: 254-255.
3. Bukovac, M.J., F. Zucconi, R.P. Larsen and C.C. Kesner, 1969. Chemical promotion of fruit abscission in cherries and plums with special reference to (2-chloroethyl) phosphonic acid. J. Am. Soc. Hortic. Sci., 94: 226-230.
4. Proebsting, E.L., 1973. Bloom delay and frost survival in ethephon-treated sweet cherry. Hortic. Sci., 8: 46-47.
5. Proebsting, E.L.Jr. and H.J. Mills, 1976. Ethephon increases cold hardiness of sweet cherry. J. Am. Soc. Hortic. Sci., 101: 31-33.
6. Dennis, F.G. Jr., 1976. Trials of ethephon and other growth regulators for delaying bloom on tree fruits. J. Am. Soc. Hortic. Sci., 101: 241-245.
7. Murdoc, B.A. and N.H. Ferguson, 1990. Effects of fall ethephon and gibberellic acid applications on bloom delay, flowering and fruiting of plum. Hortic. Sci., 25: 1110.
8. Crisosto, C.H., P.B. Lombard and L.H. Fuchigami, 1987. Spring applications of ethephon and ethylene inhibitors on bloom delay. Acta Hortic., 201: 195-201.
9. Buban, T. and I. Turi, 1985. Delaying bloom in apricot and peach trees. Acta Hortic., 192: 57-63.
10. Durner, E.F. and T.J. Gianfagna,1988. Fall ethephon application increases peach flower bud resistance to low-temperature stress. J. Am. Soc. Hortic. Sci., 113: 404-406.
11. Gianfagna, T.J., 1988. Chemical control with ethephon of bud dormancy, cold hardiness and time of bloom in peach trees. Plant Growth Reg. Soc. Am. Quart., 17: 39-47.
12. Durner, E.F., 1995. Dormant pruning and fall ethephon application influence peach pistil hardiness. J. Am. Soc. Hortic. Sci., 120: 823-829.
13. Proebsting, E.L.Jr. and H.J. Mills, 1964. Gibberellin-induced hardiness responses in Elberta peach flower buds. Proc. Am. Soc. Hortic. Sci., 85: 134-140.
14. Stembridge, E. and I. H. LA. Rue, 1969. The effect of Potassium – gibberellate on flower bud development in Red-Skin peach. J. Am. Soc. Hortic. Sci., 4: 492-495.
15. Soni, S.L. and Y. H. Yousif, 1978. Inducing delay in flowering of apricot with growth-regulators. Ind J. Agric. Sci., 48: 197-200.
16. Southwick, S.M. and J.T. Yeager, 1991. Effects of postharvest gibberellic acid application on return bloom of patterson apricot. Acta Hortic., 293: 459-466.

17. Southwick, S.M. and J.T. Yeager, 1992. Flowering and fruiting in patterson apricot in response to postharvest application of gibberellic acid. In: Proceeding of Western. Plant Growth Regulator Society, 4: 63-71.
18. Corgan, J.N. and F.B. Widmoyer, 1971.The effects of gibberellic acid on flower differentiation, date of bloom and flower hardiness of peach. J. Am. Soc. Hortic. Sci., 96: 54-57.
19. Walser, R.H., D.R. Walker and S.D. Seely, 1981. Effect of temperature, fall defoliation and gibberellic acid on rest period of peach leaf buds. J. Am. Soc. Hortic. Sci., 106: 91-94.
20. Crisosto, C.H., A.N. Miller, P.B. Lombard and S. Robbins, 1990. Effect of fall ethephon applications on bloom delay, flowering and fruiting of peach and prune. Hortic. Sci., 25: 426-428.