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EFFECTS OF PANICLE THINNING ON VEGETATIVE AND BLOOMING BEHAVIOUR OF MANGO (*Mangifera indica* L.) CV. LANGRA

Khurram Ziaf, Muhammad Ibrahim Chaudhary and Raheel Anwar
Institute of Horticultural Sciences, University of Agriculture, Faisalabad.

Different types of panicles (healthy, malformed, barren and lately barren) were thinned on different dates to minimize alternate bearing by enhancing early vegetative growth, and to lessen the intensity of malformation. Early thinning of all types of panicles increased early flushing in mango cv. Langra and these early flushes bloomed in the next season. Number of flushes was more in treated terminals than the untreated ones. Thinning of malformed panicles followed enhanced flushing and reduced reproductive malformation during the next year by producing healthy panicles as compared to untreated ones. Thinning of healthy panicles was however, more conducive to increase number of flushes of large size, early in the season, as well as blooming in the next season.

Key words: Mango, panicle thinning, vegetative growth, reproductive growth

INTRODUCTION

Mango is one of the oldest and the most popular fruit of tropics and subtropics. It currently ranks 5th in the world as regard total production, while 2nd in Pakistan after Citrus (Anonymous, 2004). Soil and climatic conditions of Pakistan are highly suitable to produce a yield of high quality. It is however, unfortunate that the mango industry is facing some challenging problems like alternate bearing, malformation, unreliable fruit setting, poor cropping, insect-pests and diseases. All the commercial cultivars suffer from the intricate problems of alternate bearing and malformation, which appear mainly due to enigmatic blooming and vegetative growth behaviour (Chacko, 1991). Growth of mango occurs as terminal flushes and thus a period of growth may follow a period of quiescence, which appears essential to ensure flowering (Popenoe, 1939; Chacko, 1986). Physiological maturity appears directly related with flower bud differentiation (Sen and Malik, 1946; Singh, 1978). Resumption of vegetative growth depends upon the duration for which the terminals remained occupied with panicles or fruit. Vegetative growth appears from some of the distal axillary buds of the shoots after the fruit is harvested and this flowering and vegetative growth pattern escalates substantially the phenomenon of irregular bearing in mango (Singh *et al.*, 1995). The terminals resumed vegetative growth from May to September, when the panicles were removed artificially (Muhammad *et al.*, 1999a). Similarly, the terminals from where the malformed panicles were removed immediately after appearance sprouted early in the season and showed less tendency of floral malformation during the following year (Muhammad *et al.*, 1999b). While, if these malformed panicles continue on the tree without flowering and fruiting, they limit the growth of the tree or branch (Khan & Khan, 1962; Shawky *et al.*, 1980). Mango blooms heavily but fruit reaching at maturity are less than or equal to 1% (Prakash and Ram, 1984). Due to heavy flower and fruit drop, most of the panicles remain barren but still hanging on the tree and restrict the lateral vegetative growth, inducing the problem of alternate bearing. Therefore, this project was aimed at devising the solution of alternate bearing and malformation by the complete removal of unproductive (barren, lately barren and malformed) panicles.

MATERIALS AND METHODS

This experiment was conducted on mango cv. Langra, at the Experimental Fruit Garden, Sq. No.9, University of Agriculture, Faisalabad, during 2001-2002. Fifteen years old healthy and uniform trees were selected. Randomized complete block design was employed having 16 treatments, replicated thrice. Following different types of panicles were removed on different dates (Table 1) after their complete emergence as indicated below.

Intact panicles of each type were tagged as control. After panicle thinning data on various vegetative and reproductive characteristics were collected. Date of initiation of lateral vegetative growth was noted by regular observation of treated and untreated terminals and each flush was tagged. Number of flushes on these shoots was counted at the end of growing season and size was measured with the help of measuring tape. During the second year of study, reproductive behaviour of these flushes was studied and number of malformed panicles was counted. Data were analyzed statistically by using Fisher's analysis of variance technique and Duncan's multiple range (DMR) tests at 5% level of significance to compare the treatment means for the parameters studied (Petersen, 1994).

RESULTS AND DISCUSSION

Days to initiate lateral vegetative growth: Thinning of panicles induced earlier initiation of lateral vegetative growth as evident from the results in Table 1. The terminals from where the barren panicles were removed by the end of March sprouted earliest i.e. after 46 days while, terminals with lately barren panicles sprouted last of all i.e. after 91 days. First flush emerged after 65, 62 and 66 days when healthy panicles were thinned by mid March, end of March and mid April, respectively while, after 63, 70 and 74 days in case of malformed panicles thinned by the end of March, mid and end of April, respectively. Terminals sprouted after 46, 57 and 74 days when barren panicles were thinned by the end of March, mid and end of April, respectively, and after 65, 69 and 73 days in case of lately barren panicles thinned on mid and end of April and mid May, respectively. Results clearly depict that all the unthinned terminals i.e. healthy, malformed and lately barren ones, behaved statistically similar producing first flush after 82, 83 and 91 days, respectively, except those terminals with intact barren panicles which initiated lateral vegetative growth after 73 days. The promotion of vegetative growth after panicle thinning seems to be due to diversion of photosynthates towards the lateral buds which is in confirmation to the findings of Singh *et al.* (1995) that decapitation of terminal bud may have diverted the assimilates towards the lateral buds in mango which promoted the vegetative growth. Initiation of vegetative growth after panicle thinning was in accordance to the statement of Chacko (1986) that reduction in the flowering shoot lead to the promotion of vegetative growth of mango. Sprouting delayed gradually in accordance with the time of removal of panicles in all the treatments, which was in agreement to the findings of Muhammad *et al.* (1999), except in treated healthy terminals. Slightly late initiation of flush emergence in lately barren terminals than healthy ones was due to the late removal of panicles (i.e. after fruit set). Our findings that intact panicles delay the emergence of first flush in all types of terminals, is supported by the findings of Willis and Marler (1993).

Table 1. Effect of panicle thinning on vegetative & reproductive characteristics of mango

Type of panicle	Treatment	Time of thinning	Days to initiate veg. growth	No. flushes per terminal	Length of flushes (cm)	No. of ter. with rep. growth	No. of malformed panicles
Healthy panicles	T1	Control (Intact)	82 abc	2.08 cd	8.20 a	0.25 e	0.00 b
	T2	15-03-01	66 de	3.67 abc	14.04 a	1.25 a	0.00 b
	T3	30-03-01	62 de	3.92 a	9.04 a	0.75 bcd	0.00 b
	T4	15-04-01	66 de	3.75 ab	9.59 a	0.92 ab	0.75 a
Malformed panicles	T5	Control (Intact)	83 ab	1.00 d	9.28 a	0.08 e	0.25 a
	T6	30-03-01	63 de	2.58 abcd	10.32 a	0.33 de	0.00 b
	T7	15-04-01	70 cde	1.67 d	9.72 a	0.33 de	0.00 b
	T8	30-04-01	74 bcd	3.00 abcd	11.64 a	0.83 abc	0.25 a
Barren panicles	T9	Control (Intact)	73 bcd	2.08 cd	7.75 a	0.33 de	0.00 b
	T10	30-03-01	46 f	1.50 d	9.64 a	0.42 cde	0.00 b
	T11	15-04-01	57 ef	1.67 d	8.93 a	0.25 e	0.00 b
	T12	30-04-01	74 bcd	1.50 d	9.72 a	0.17 e	0.25 a
Lately barren panicles	T13	Control (Intact)	91 a	3.00 abcd	9.64 a	0.33 de	0.00 b
	T14	15-04-01	65 de	1.42 cd	9.41 a	0.08 e	0.00 b
	T15	30-04-01	69 cde	2.25 bcd	11.36 a	0.75 bcd	0.00 b
	T16	15-05-01	73 cde	1.75 d	10.11 a	0.42 cde	0.50 a

Figures sharing same letters in a column are statistically non-significant.

Number of flushes per terminal: Information procured on number of flushes per terminal exhibited significant superiority of healthy terminals treated by the end of March which produced 3.92 flushes per terminal (Table 1). Statistically similar results were obtained for healthy panicles (thinned by mid & end of March & end of April), malformed panicles (thinned by the end of March & end of April) and untreated lately barren terminals which produced 3.67, 3.92, 3.75, 2.58, 3.00and 3.00 flushes, respectively. Minimum number of flushes (1.00) was found in untreated malformed terminals, which were statistically similar to terminals carrying untreated healthy, barren and lately barren panicles and also at par with all treated terminals with different types of panicles except those from where healthy panicles were thinned on different dates. Terminals with intact lately barren panicles behaved exceptionally well, by producing 3.00 flushes per terminal. Fruit drop at early stage might have diverted the supply of nutrients from developing fruit towards the vegetative buds in terminals with lately barren panicles. Flushes emerged after thinning of malformed panicles but not significantly greater than the untreated terminals. Very few flushes from barren treated terminals reflect deficient status of these terminals which was also evident form the early flower drop. Less number of flushes in lately barren treated terminals verify the findings of Singh *et al.* (1974) who reported that more developed the inflorescence, lower was the probability of return bloom, as it was in case of lately barren terminals. More number of flushes per terminal in treated than untreated ones was a positive sign towards the reduction of alternate bearing. These newly emerged flushes increased the probability of bearing inflorescence during the next blooming season to give a reasonable crop, which was otherwise not possible as revealed from the results of untreated terminals. Moreover, thinning of malformed panicles also yielded better results in terms of more vegetative growth in treated terminals than untreated ones.

Length of flushes: Although length of flushes varied greatly among the treatments, ranging from 7.75cm to 14.04cm, yet the results were statistically non-significant (Table 1). Flushes of minimum length i.e. 7.75 cm were produced by untreated barren terminals. While maximum flush length i.e. 14.04 cm, was recorded in terminals where healthy panicles were thinned by mid March. As results for length of flushes were non-significant, therefore, size of flushes seems to be independent of thinning treatments and types of panicles thinned, which appears to be affected by climatic conditions and nutritional status of the terminals. These results are in line with the findings of Singh *et al.* (1995) who stated that time of decapitation of terminal bud had not affected much the length of new shoots.

Number of terminals with reproductive growth: Data depicted maximum reproductive growth in terminals form where healthy panicles were thinned by mid March i.e. 1.25 terminals (Table 1), although results were statistically similar to thinning of healthy panicles by mid April (0.92) and of malformed terminals by the end of March (0.83). Terminals from where malformed panicles were thinned on different dates had statistically less reproductive growth than healthy terminals except those treated by the end of April. All the barren and lately barren terminals behaved statistically alike irrespective of the time of thinning. Terminals with un-thinned healthy, malformed, barren and lately barren panicles showed statistically non-significant results, as these had 0.25, 0.08, 0.33 and 0.33 terminals with reproductive growth, respectively. Results showed superiority of treating the terminals with healthy panicles over others, although other treatments also induced reproductive growth, which is a positive sign of lessening the irregularity of bearing. Results also showed that more the number of flushes per treated terminal, higher were the probability of blooming as in case of healthy and malformed treated terminals (Fig. 1). Higher photosynthetic resources could be the factor related to flowering potential in mango trees (Singh, 1978), which were more in terminals with more number of flushes. The development of flower and fruit results in heavy depletion of reserve food materials mobilized from roots and branches (Chacko, 1986). Depletion of reserves was evident in the form of lesser number of terminals with reproductive growth after thinning of malformed, barren and lately barren panicles and also in unthinned panicles of all types.

Number of terminals with malformed panicles: Data (Table 1) shows that the terminals which were thinned late in the season i.e. healthy (mid of April), malformed (end of April), barren (end of April) and lately barren (mid May), suffered from malformation. On these terminals, flushes appeared late in the season, which had malformed panicles in the next flowering season. No malformed panicle was observed in terminals with intact panicles (untreated terminals of different types), except those with malformed panicles, which might be due to carryover effect of malformation. Results verify the findings of Muhammad *et al.* (1999a) who observed more floral malformation on sites where pruning of malformed panicles was delayed during the last blooming season. Results clearly depict the positive impact of early panicle thinning on the lessening the intensity of malformation.

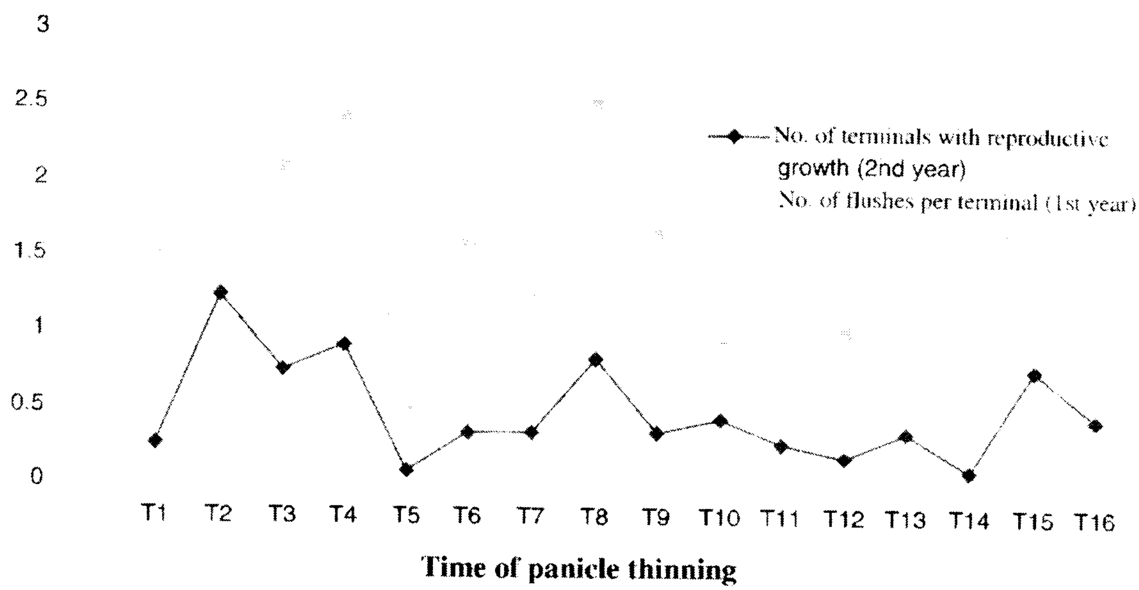

Fig. 1 Relationship of vegetative growth (1st year with reproductive growth (2nd year)

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