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Growth of mango cv. Langra as influenced by pruning of malformed panicles

Muhammad Aslam Pervez, C.M. Ayyub, Khurram Zia, Basharat A. Saleem ,Waqar Ahmed and Ulfat Hussain
Institute of Horticultural Sciences, University of Agriculture, Faisalabad

Abstract

Impact of removal time of malformed panicles on vegetative and reproductive growth of mango cv. Langra was studied under Faisalabad conditions. Number and size of shoots, size of leaves and panicles and sex ratio were high when malformed panicles were removed earlier i.e. up to the end of March. Incidence of bunchy top was much reduced in shoots emerged on earlier treated terminals. Carryover effect of malformation was more pronounced in terminals pruned late than the early removed terminals. Number and size of leaves, size of panicles and sex ratio were directly related with size of shoots, which were affected by the time of panicle removal.

Key words: - Mango, *Mangifera indica*, malformation, panicle, pruning.

Introduction

Mango is well established item in international trade and is grown in almost all the tropical and subtropical regions of all the continents except Europe (Millington, 1984). But it is commercially grown only in a few countries including Pakistan. Soil and climatic conditions of Pakistan are highly favourable for mango cultivation. But mango industry is facing some challenging problems like insect-pests, diseases, low fruit set, high fruit drop, alternate bearing and malformation etc. (Anjum et al., 1999). Mango malformation is one of the most serious problems; no proper control measure has still been identified since right from its discovery in India during 1891(Watt, 1891). The incidence of floral malformation is more important than the vegetative one because, it affects the yield as malformed panicles are unproductive (Chadha and Pal, 1993).

Different strategies have been adopted by different scientists to check or minimize malformation viz. pruning of malformed panicles fallowed by application of NAA @ 200 ppm (Singh et al., 1983), deblossoming in late February (Malik and Raza, 1985), deblossoming followed by fungicidal+acaricidal spray (Chib et al., 1988), deblossoming between 20th January and 25th February to regenerate malformed free panicles (Tripathy and Ram, 1998), treatment of trees with Rogor + Multiplex + Urea (Thakur et al, 2000), etc. Moreover, resumption of vegetative growth depended upon the duration for which the terminals remained occupied with the panicles. 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., 1999).

Keeping in view the pruning of malformed panicles as the sole preventive measure to minimize the intensity of malformation, malformed panicles were removed on different dates in mango cv. Langra to explore the best time of panicle removal under Faisalabad conditions. The effect of removal of malformed panicles on different dates was assessed by the vegetative growth on treated terminals and reproductive growth on the shoots sprouted on treated terminals.

Corresponding author: Muhammad Aslam Perviz
Institute of Horticultural Sciences,
University of Agriculture, Faisalabad, Pakistan.

Materials and Methods

The study was conducted in the Experimental Fruit Garden, Sq. No. 9, University of Agriculture, Faisalabad, during the year 2001-02. Malformed panicles were removed from 20 years old Langra trees, on the following different dates after their complete emergence.

T0 Unpruned panicles (control)
T1 Pruned on 24-03-01
T2 Pruned on 31-03-01
T3 Pruned on 07-04-01
T4 Pruned on 14-04-01
T5 Pruned on 21-04-01

Data were taken on days to initiate vegetative growth, number of shoots per terminal, length of shoots (cm), number of leaves per shoot, size of leaves (cm^2) and percentage of bunchy top. During the following year (2002) data were taken on size of panicles (cm), sex ratio and malformation percentage.

The experiment was laid out in Randomized Complete Block Design (RCBD) and data recorded were analyzed statistically by using Fisher's analysis of variance techniques and Duncan's multiple range (DMR) test at 5% probability level, to compare treatment means for the parameters studied (Petersen, 1994).

Results and Discussion

Days to initiate vegetative growth: After panicle removal, time of initiation of lateral vegetative growth on treated terminals was recorded in terms of number of days. Unpruned malformed terminals (T0) started vegetative growth very late i.e. after 83 days (Table 1). Malformed terminals removed in March i.e. T1 and T2 started vegetative growth earliest i.e. after 53.25 and 55

days, respectively. No statistical difference was noted when malformed panicles were removed during the first fortnight of April i.e. T3 (63.77) and T4 (65.16). But panicle removal after mid April (T5) resulted in very late lateral vegetative growth (71.75 days), although, slightly earlier than unpruned terminals. Results indicated that sprouting of lateral vegetative growth after panicle removal is affected by removal time. Our results are verified by Muhammad et al. (1999), who reported earliest sprouting in case of terminals from where malformed panicles were removed soon after their emergence. Delayed growth in case of intact panicles (control) was already reported by Willis and Marler (1993). Early removal of malformed panicles induced flushing earlier in the season, which in turn leads to physiological maturation of these flushes, increasing the probability of flowering in the next year, as observed earlier by Singh (1978).

Table 1: - Effect of removal of malformed panicles on the vegetative growth of Mango cv. Langra

Treatment	Days to initiate veg. growth	No. of shoots / terminal	Length of shoots (cm)	No of leaves / shoots	Size of leaves (cm^2)	Bunchy top (%)
T0	83.08 a	7.00 de	6.35 d	5.45 c	48.35 e	81.73 a
T1	53.25 d	14.33 a	14.92 a	10.33 a	116.49 a	47.52 d
T2	55.00 d	11.00 b	13.85 a	9.66 a	98.95 b	41.80 d
T3	63.77 c	10.33 bc	11.50 b	7.82 b	83.57 c	55.07 c
T4	65.16 c	8.33 cd	9.42 bc	7.13 b	76.27 c	64.14 b
T5	71.75 b	5.00 e	8.95 c	6.84 b	64.11 d	70.69 b

Table 2:- Effect of removal of malformed panicles on reproductive growth of Mango cv. Langra.

Treatment	Size of panicles (cm)		Sex ratio (% age of hermaphrodite flowers)		Malformation (%age)
	Healthy	Malformed	Healthy panicles	Malformed panicles	
T0	8.25	6.00	36.09	-	82.00 a
T1	20.68	15.5	65.87	36.25	48.00 e
T2	18.85	12.50	66.58	32.52	42.00 e
T3	16.65	10.00	60.25	42.48	55.00 d
T4	14.45	8.50	56.43	24.10	64.00 c
T5	10.25	5.50	49.20	20.85	71.00 b

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

Number of shoots per terminal: - Number of shoots sprouted from the treated or untreated malformed terminals were significantly different among the treatments (Table 1). Minimum number of shoots (5.00) were recorded in T5, statistically similar to T0 (7.00 shoots). Early removal of malformed panicles favoured more number of shoots as in T1 (14.33), T2 (11.00) and T3 (10.00). Shoots emerged after panicle pruning because decapitation of the panicle may have overcome the inhibitory effect of the terminal bud, as reported by Singh et al. (1995). Number of shoots per treated terminal decreased with increasing the time of panicle removal, as it is clear form the results. Similarly, delayed panicle removal has effects similar to unpruned terminals. Similar findings were previously reported by Muhammad et al. (1999), who also added that these early sprouted flushes showed less tendency of floral malformation during the following year.

Length of shoots: - Shoots of maximum length was recorded in T1 (14.92 cm) and T2 (13.85 cm), followed by T3 (11.50 cm) while, minimum shoot length was recorded in T0 (6.35 cm). Results depicted that the length of shoots has some correlation with number of shoots and days to initiate vegetative growth. Terminals from where malformed panicles were removed earlier had more shoots, which emerged earlier and had more length than the shoots sprouted on terminals treated late in the season. Results also revealed the carryover effect of malformed panicles, which not only affected the number of shoots but also has suppressive effect on the growth of newly emerged shoots, as in case of T4, T5 and T0. So, early removal of malformed terminals supported the trees by producing more shoots of large size.

Number of leaves per shoot: - Number of leaves per shoot followed the same pattern as the length of shoots. Large sized shoots (T1) had more leaves (10.33 per shoot) than small sized shoots as in T4, T5 and T0, which had 7.13, 6.84 and 5.45 leaves per shoot, respectively. Results clearly depicted that number of leaves per shoot were directly linked to the size of shoot i.e. larger the shoot size, greater would be the number of leaves per shoot. Moreover, removal time of malformed panicles not only affected sprouting and size of the shoots but also the number of leaves per shoot. Shoots with more flushes carried more leaves than did the

shoots with fewer flushes; same was already reported by Singh (1978), which confirms our findings.

Size of leaves (cm^2):- Size of the leaves was also significantly affected by the removal of malformed panicles at different times (Table 1). Leaves were small sized in untreated terminals (48.35 cm^2) and in those from which malformed panicles were removed very late i.e. T5 (64.11 cm^2). Removal of malformed panicles up to mid April resulted in shoots with medium sized leaves i.e. 83.57 and 76.27 cm^2 sized leaves in T3 and T4, respectively. Leaves of reasonably large size were recorded in T1 and T2 i.e. 116.49 and 98.95 cm^2 size, respectively, which were statistically significant. It revealed that time of removal of malformed panicles not only affected the shoot size and number of leaves per shoot but also affected the leaf size significantly.

Bunchy top (% age):- Removal time of malformed panicles significantly affected bunchy top (%age) in sprouted shoots (Table 1). Bunchy top was maximum (81.73%) in shoots from where malformed panicles were not removed i.e. control (T0). Minimum bunchy top (41.80%) was observed in T2, followed by T1 (47.52%), although both were statistically similar. Incidence of bunchy top was considerably high in shoots of those terminals from where malformed terminals were removed late in the reason i.e. T4 (64.14%) and T5 (70.69%). Results showed the carryover effect of malformation i.e. incidence of bunchy top increased with increasing the time of panicle removal. Results are verified by the findings of Muhammad et al. (1999), who reported that early removal of malformed panicles just after their emergence reduced malformation, which was helpful in promoting healthy vegetative growth during the season.

Size of panicles: - During the 2nd year of study, size of healthy and malformed panicles which emerged on the shoots of previous season (2001) was recorded and compared. Healthy panicles of largest size were observed in T1 (20.68 cm), followed by T2, T3, T4, T5 and T0, in which panicles of 18.85, 16.65, 14.45, 10.25 and 8.25 cm, respectively were observed. Similar trend was noted in case of newly emerged malformed panicles (Table 2). Small size of the malformed panicles was in response to disease (malformation) as stated by Hassan (1944) that primary, secondary and tertiary rachises were short and hypertrophied in malformed panicles. Results depicted the influence of removal time of malformed panicles on the size of healthy panicles emerged during next year. Reduction in size of healthy panicles was found to be correlated with the time of removal of malformed panicles (during the previous year), which indicated the carryover effect of malformation, as reported by Muhammad et al. (1999). Decrease in size of healthy panicles might also be due to small size of shoots in the respective treatments, as larger the shoot size, larger was the size of panicles and vice versa. It can be concluded that size of panicle was affected indirectly by the removal time of malformed panicles, as shoot size affected the size of panicles and shoot size was affected directly by the time of removal of malformed panicles.

Sex ratio: - Sex ratio of malformed as well as healthy panicles was calculated as percentage of hermaphrodite flowers in a panicle and compared. Early panicle removal resulted in large sized shoots with more number of leaves of large size (Table 2). Such shoots gave rise to healthy panicles of large size with higher number of hermaphrodite flowers than the small sized shoots with small sized panicles. Hermaphrodite flowers were 65.87%, 66.58%, 60.25%, 56.43%, 49.20% and 36.09% in T1, T2, T3, T4, T5 and T0, respectively. Hermaphrodite flowers were drastically less (20.85 to 42.48%) in malformed panicles as compared to healthy ones. Percentage of hermaphrodite flowers decreased with delay in removal of malformed panicles during the previous year. Results showed the carryover effect of previous year's malformation on the sex ratio (percentage of hermaphrodite flowers) of healthy and malformed panicles. Similar findings were described by Kausar (1959), who observed high proportion of unisexual staminate flowers in malformed panicles.

Malformation (%age):- Malformation during the 2nd year of study was found to be affected by the time of pruning of malformed panicles (pruned during the 1st year of study). Minimum malformation (%age) was recorded in T2 (42%), followed by T1 (48%). Malformation in T3, T4, T5 and T0 was 55%, 64%, 71% and 82%, respectively. The result revealed that incidence of malformation increased gradually with delay in removal of malformed panicles during the previous year, which showed the carryover effect of malformation. Our results do not confirm the findings of Ram et al. (1997), that new shoots which emerged after the fruit harvest as a result of pruning had very low incidence of malformation (> 1.0%). They also stated that pruning of shoots in February-March was of little importance because new shoots which appeared in March-April took about 8-10 months to flower and such shoots might had enough inoculums of fungus to cause the malformation. While our results, that shoots emerging earlier in the season after early pruning of malformed panicles had less malformation than the shoots emerged late due to delayed pruning of malformed panicles, are verified by the findings of Muhammad et al. (1999). They reported more malformation on sites where pruning of malformed panicles were delayed during the last blooming season i.e. 47.94% malformed panicles on the last year's malformed branches.

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