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Original Research

Pruning Time and Fungicide Spray Affect Inflorescence Malformation in Mango cv. Samar Bahisht Chaunsa

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ABSTRACT

Mango being one of the most important fruit crops in Pakistan is facing a serious issue of malformation. If it is not treated, it renders great economical losses. Samar Bahisht Chaunsa is an excellent quality exportable cultivar of mango, but it is also the most vulnerable to inflorescence malformation. Therefore, the present study was carried out to address the malformation issue in mango cv. Samar Bahisht Chaunsa during 2016-18. The treatments comprised of pruning during March, pruning during April, pruning during March along with spray of Topsin-M @ 2 g L^{-1}, pruning during April along with spray of Topsin-M @ 2 g L^{-1} and leaving plants un-pruned without spray as control. The tree branches were pruned up to 20 cm beneath the malformed inflorescences. Data on number of days taken to initiate growth, number of emerged flushes, number of bloomed flushes and number of malformed inflorescences were recorded. Pruning during March in combination with 2 g L^{-1} Topsin-M spray significantly affected all the parameters. The minimum number of days (37) taken for growth initiation, the highest number of emerged flushes (3.5) as well as bloomed flushes (3.2) along with the least number of malformed inflorescences (1.4) were recorded for the aforementioned treatment. Un-pruned and non-sprayed branches (control) did not initiate growth.

Keywords: *Floral malformation, flushes, malformed inflorescence, Mangifera indica.*

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INTRODUCTION

Mango (*Mangifera indica* L.) is the 2nd most important fruit crop of Pakistan and ranked 5th for production in the world (Anonymous, 2016). In Pakistan, it is mainly produced in provinces of Sindh and Punjab. It covers an area of about 168 thousand hectares with production around 1735 thousand tons per annum (Anonymous, 2018). The malformation is one of the most devastating diseases of mango around the globe. It is of great distress because of its widespread, destructive nature, and unknown etiology and control (Kumar et al., 1993; Marasas, 2009). The range of susceptibility to the disease varies with respect to cultivar, age of the plant and agro-climatic conditions of the area. In Pakistan, none of the cultivars is completely resistant to malformation (Ibrahim and Ziaf, 2003). The highest malformed inflorescences (53-72%) was recorded in cv. Samar Bahisht Chaunsa, followed by cv. Malda (43-45%) (Anjum et al., 1999). Forty-three mango cultivars were evaluated against malformation and the maximum (69%) malformed panicles were found in Lab-e-Mashooq and the minimum (8%) in Gulabe Khas (Hafiz et al., 2008). Literature supports several remedies and counter measures to control the malady (Lopez–Estrada et al., 2005). Control measures that are found to be effective in reducing the damage caused by malformation are pruning of malformed panicles and application of growth regulators and chemicals. Clipping at 45 cm behind the panicles after harvest (in July) and spray of Benomyl (2 sprays, one in January and the other in September) showed about 70% decrease in severity over the previous year in mango cv. Anwar Rataul (Iqbal et al., 2011). Pruning of malformed branches 80 or 30 cm far from the last malformed bud after harvesting reduced the ratio of malformed buds as well as boosted the emission of healthy buds (Lopez–Estrada et al., 2005). Pruning of branches up to 22.5 cm beneath the malformed panicles in mango cv. Malda resulted in early sprouting (13 days), greater survival of branches (83-100%) with the maximum number of new flushes (2.5-2.65 flushes) and higher percentage of normal panicles (34-38%). Pruning followed by a spray of Topsin-M fungicide improved the effect instead of pruning alone (Ahmad et al., 2012). Reduction in malformation was observed by pruning shoots 22.5 cm below the malformed inflorescence during flowering season followed by fungicide application (Singh et al., 1983). Floral malformation was best reduced by removal of all the affected inflorescences with three additional nodes behind the inflorescences and spray with one of the chemicals i.e. NAA 200 mg L^{-1}, IBA 500 mg L^{-1}, phosphoric acid 500 mg L^{-1}, GA 350 mg L^{-1}, zinc sulphate 50 g L^{-1} and cuprous oxide 4 g L^{-1} as compared to untreated trees of mango cv. Taimour and Mabrouka (Mahrous, 2004). Fortnightly pruning of healthy, malformed, barren and lately barren inflorescences promoted the growth of lateral shoots that bore

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fruit, minimized alternate bearing and proved useful to reduce inflorescence malformation (Ibrahim and Ziaf, 2003). Removal of affected inflorescences just after their emergence reduced the carry- over effect of malformation to zero, while delaying the removal of malformed inflorescences increased the carry-over effect (Muhammad et al., 1999). There was a distinct difference between the panicles pruned at the length of 5-7 cm and those pruned at the length of 15 cm in their abilities to induce auxiliary panicles in mango cv. Haden (Shu, 1993). In mango cultivars Keit and Tommy Atkin, pruning of panicles at apical bud point, at the time of flowering, tend to produce expeditious flowers as well as fruit development and produced a large number of fruits per panicle (Yeshitela et al., 2003).

Although Samar Bahisht Chaunsa is an excellent quality exportable cultivar of mango in Pakistan, but also it is the most susceptible to inflorescence malformation. The current study was conducted to search out the optimum time of pruning the malformed inflorescences during the flowering season and to compare pruning alone and pruning plus fungicide spray with non-pruned and non-sprayed plants to minimize the malformation phenomenon in mango cv. Samar Bahisht Chaunsa.

MATERIALS AND METHODS

The current study was carried out at the Horticultural Research Station, Bahawalpur during 2016-18. Fifteen uniform plants of mango cultivar Samar Bahisht Chaunsa (20-22 years old) duly affected by floral malformation were selected. Five plants were assigned for a replication and one plant for a complete treatment application in a replication. So, all of five treatments were replicated thrice. Ten branches having malformed inflorescences from each plant were tagged for data recording; however, all affected inflorescences on the same plant were treated equally and the whole plant was sprayed with the fungicidal solution (Topsin-M 2 g L^{-1} of water) according to treatments. The following 5 treatments were applied during March and April each year; T_1 = Pruning of branches during March (at the early appearing of malformed inflorescences), T_2 = Pruning of branches during April (at the full appearing of malformed inflorescences), T_3 = Pruning of branches during March + Spray of 2 g Topsin-M fungicide / Liter of water, T_4 = Pruning of branches during April + Spray of 2 g Topsin-M fungicide / Liter of water and T_5 = Control (no pruning and no fungicidal spray).

The experiment was laid down in a Randomized Complete Block Design with three replications. The branches having malformed inflorescence were pruned 20 cm beneath the malformed inflorescences. The parameters used in the study were days taken to initiate growth, number of emerged flushes, number of bloomed flushes and number of malformed inflorescences appearing from each treated branch. The total number of inflorescences as well as healthy and diseased ones, were recorded for each branch in the following year. The parameters under study were recorded as follows.

Days taken to initiate growth

The treated branches were tagged and observed throughout the experimental period i.e. about one year. The count of days was started right from the date of pruning the affected branch to the date showing growth initiation. The days were averaged over the number of branches tagged per treatment per replication (Ahmad et al., 2012).

Number of emerged flushes

The count of flushes emerging from the tagged branch was recorded and summed up over the experimental period, then averaged over tagged branches per treatment per replication (Ahmad et al., 2012).

Number of bloomed flushes

The count of flushes that bloomed from the treated branch was recorded and added over the experimental period, then averaged over treated branches per treatment per replication (Muhammad et al., 1999).

Number of malformed inflorescences

The number of malformed inflorescences that emerged from the treated branch was recorded and added over the experimental period. It was averaged by dividing over treated branches per treatment per replication (Ahmad et al., 2012).

Application of manure and fertilizer (FYM = 100 kg, N = 1.5 kg, P_2O_5 = 1.0 kg and K_2O = 1.0 kg per plant), and irrigation was applied according to the recommended schedule for all the experimental plants.

Two years data were pooled, subjected to statistical analysis (Analysis of Variance technique) and treatment means were compared by LSD test at α= 0.05 (Steel et al., 1997).

RESULTS

Days taken to initiate growth

The average of two year's data regarding days taken to initiate growth indicated that the branches pruned during March at the early appearing of floral malformation up to 20 cm beneath the malformed inflorescences plus spray of Topsin-M @ 2 g L^{-1} (T_3) took the least time (37 days) to initiate growth, followed by the pruning of branches during March (39 days). However, these two treatments remained statistically at par with each other. The maximum number of days were taken to initiate growth, when branches were pruned during April (49 days). No initiation of growth was observed in the branches under control treatment (Table 1).

Number of flushes emerged

The number of flushes emerged from branches pruned at the early appearing of floral malformation up to 20 cm beneath the malformed inflorescences plus spray of Topsin-M @ 2 g L^{-1} (T_3) produced significantly the maximum flushes (3.5 flushes), followed by the pruning of branch during March without Topsin-M spray (T_1) (2.7 flushes). However, T_1 was statistically similar to pruning of branch during April plus spray of Topsin-M @ 2 g L^{-1} (T_4) (2.5 flushes) and pruning of branch at the full appearing

Table 1: Effect of pruning time of malformed inflorescences + fungicide spray on growth initiation time, number of emerged and bloomed flushes and number of malformed inflorescences appeared in mango cv. Samar Bahisht Chaunsa (average of two years data).

Treatments	Days taken to initiate growth			Number of flushes emerged			Number of flushes bloomed			Number of malformed inflorescences		
	2016-2017	2017-2018	Mean	2016-2017	2017-2018	Mean	2016-2017	2017-2018	Mean	2016-2017	2017-2018	Mean
T_1 = Pruning of branches during March	44.4b*	34.0bc	39.2c	2.6b	2.8ab	2.7b	2.3b	2.5b	2.4b	1.8a	2.0a	1.9b
T_2 = Pruning of branches during April	48.6ab	50.0a	49.3a	2.2b	2.4b	2.3b	2.2b	2.0b	2.1b	2.0a	2.3a	2.2a
T_3 = T_1 + Spray of fungicide (Topsin-M @ 2 g L^{-1})	43.1 c	31.1c	37.1c	3.7a	3.3a	3.5a	3.1a	3.3a	3.2a	1.3b	1.5b	1.4c
T_4 = T_2 + Spray of fungicide (Topsin-M @ 2 g L^{-1})	49.1a	38.1b	43.6b	2.4b	2.6b	2.5b	2.1b	2.3b	2.2b	1.9a	2.1a	2.0a
T_5 = Control (no pruning and no fungicide spray)	-	-	-	0.0c	0.0c	0.0c	-	-	-	-	-	-
LSD (5%)	4.5	3.8	4.7	0.9	0.6	0.7	0.7	0.6	0.7	0.2	0.3	0.2

**Means sharing similar letter(s) in every column under each parameter are statistically non-significant. No growth was initiated in T_5, hence no flush was emerged, bloomed and malformed.*

of malformed inflorescences (T_2) (2.3flushes) for the parameter under study. The branches under control treatment (T_5) did not produce any flush (Table 1).

Number of flushes bloomed

The data recorded on the number of flushes bloomed indicated that the flushes from branches pruned up to 20 cm beneath the malformed inflorescences during March plus a spray of fungicide (T_3) bloomed significantly to the maximum number with 3.2 bloomed flushes, while other three treatments i.e., pruning of branch during March without a spray of Topsin-M (2.4 flushes), pruning of branch during April plus spray of Topsin-M (2.2 flushes) and pruning of branch during April without a spray of Topsin-M (2.1 flushes) were statistically at par. The branches under control (T_5) did not have any flush so no blooming occurred during the experimental period (Table 1).

Number of malformed inflorescences

The data on the number of malformed inflorescences appearing from pruned branches showed that the branches pruned at the early appearing of floral malformation up to 20 cm beneath the malformed inflorescences plus spray Topsin-M @ 2 g L^{-1} produced the lowest number of malformed inflorescences (1.4 inflorescences), followed by the pruning of branches during March (1.9 inflorescences). However, pruning of branch during April (2.2 inflorescences) and pruning of branch during April with a spray of Topsin-M (2.0 inflorescences) showed statistical similarity in their effect. The branches under control treatment (T_5) did not show any growth initiation in terms of flush or inflorescence appearance during the period of study (Table 1).

DISCUSSION

Chaunsa cultivar of mango is reported to be the most susceptible to floral malformation (Anjum et al., 1999). Pruning of branches bearing malformed inflorescences either at early appearing (during March) or at the full appearing of floral malformation (during April) with or without a spray of fungicide may reduce the incidence. The current investigations revealed that pruning of branches during March up to 20 cm, followed by spray of fungicide (Topsin-M @ 2 g L^{-1}) is the most appropriate practice as the treated branches took the minimum time to initiate growth, emerged the highest number of newly bloomed flushes and produced the minimum number of malformed inflorescences, but pruning of branches during April was found to decrease the number of new flushes that might bloom into minimum inflorescences with more malformed inflorescences. This can be explained either by difference of nutrient status or physiological activities of the branches with malformed inflorescences subjected to pruning treatments, i.e. the longer the panicles have grown (at full blooming), the less active and/or less nutrients can the branches supply to the new growth (Shu, 1993), consequently the initiation of new flower buds delayed in this study. Earlier, Muhammad et al. (1999) reported that the removal of affected inflorescences just after their emergence reduces the carry-over effect of malformation to zero, while delaying the removal of malformed inflorescences increased the carry-over effect. Thus, early removal of such inflorescences helps to promote healthy vegetative growth in the season and normal inflorescences on the terminals in the next blooming season. Previously, it was found that cutting off the terminal buds during or just before flowering increased the auxiliary flower bud induction and decreased the incidence of malformation (Khader, 1989). Distinct differences between the panicles pruned at the length of 5-7 cm and those pruned at the length of 15 cm in their abilities to induce axillary panicles were also reported previously (Shu, 1993).

Further, pruning followed by a spray of Topsin-M had a better effect than that of pruning alone in the current study for both times of pruning by removing the malformed inflorescences up

to 20 cm beneath. Similar results were reported in a previous study (Ahmad et al., 2012). The control (un-pruned branches without spray) had none of the emerged or bloomed flushes that might be due to blocking effect of the dried panicles on the treated branches (Shu, 1993) or malformed inflorescence as in the case of our study or the carry-over effect (Muhammad et al., 1999).

The present study showed that delay in the pruning of malformed inflorescences up to full appearance may lead to more loss in economic yield compared to early pruning of malformed inflorescences, followed by a spray of Topsin-M @ 2g L^{-1}. Thus, early removal of such inflorescences helped to promote healthy vegetative growth in the season and normal inflorescences on the terminals in the next blooming season.

CONCLUSION

It is inferred from the study that pruning of malformed inflorescences (up to 20 cm beneath the inflorescences) during March followed by a spray of fungicide (Topsin-M @ 2g L^{-1}) proved beneficial to reduce the incidence of malformation.

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