RESEARCH PAPER

Asian Journal of Bio Science Vol. 6 Issue 1 (April, 2011) : 29-32

Effect of plant growth regulators and fungicides on pre-harvest fruit drop in Nagpur Mandarin

N.B. PATIL, BHAGYASHREE M. SHEDAME AND S.H. INGLE

BASIX, AMARAWATI (M.S.) INDIA

(Received: October, 2010; Accepted : November, 2010)

Fruits retained on each tree under study were counted prior to first application of spray. Fruit dropped were counted at weekly interval. Minimum pre-harvest fruit drop (11.07 %) was found with the application of T_5 (2, 4-D 10 ppm + Carbendazim 0.1 %). Retention per cent of fruits was found to be maximum (88.93 %) was observed with T_5 (2,4-D 10 ppm + Carbendazim 0.1%). Fruit yield in respect of number of fruits per tree and weight of fruits per tree were found significantly maximum (1058.88 fruits/tree and 159.15 kg respectively) with the spray of T_5 (2, 4-D 10 ppm + Carbendazim 0.1%) which was superior to all other treatments.

Key words : Nagpur Mandarin, Pre-harvest fruit drop, Plant growth regulator

Patil, N.B., Shedame, Bhagyashree M. and Ingle, S.H. (2011). Effect of plant growth regulators and fungicides on pre-harvest fruit drop in Nagpur Mandarin. *Asian J. Bio. Sci.*, **6** (1): 29-32.

INTRODUCTION

India is one of the important citrus growing country and ranks 6th position in the world. Mandarin is most important fruit crop among citrus species. Citrus fruits are highly recognized for their nutritive as well as medicinal values. But, citrus fruits are mainly known for vitamin 'C' (25-85 mg/100 ml of juice), TSS in sweet orange rangeing from 8-11 per cent while titrable acidity ranges from 0.5 to 1.5 per cent for mandarin and orange, TSS-acid ratio being 14:1.

Fruit drop, particularly at pre-harvest stage is a very complex problem and is known to be the net result of lack of adequate production of hormones within the tissue of plant, nutrient deficiency and pathological causes resulting in heavy monitory loss. Under adverse conditions, the losses go to such an extent that, it renders the citrus cultivation unprofitable to the orchardists. Pre-harvest fruit drop occurs mostly due to physiological factors mostly due to formation of abscission layer, pathological factors *i.e.* due to stylar end rot and stem end rot and also due to entomological factors.

Keeping in view the past research work on controlling pre-harvest fruit drop by using growth regulators and fungicides, a very limited research work have been carried out on above aspect under this region particularly in Nagpur mandarin.

RESEARCH METHODOLOGY

The present study on the effect of plant growth regulators and fungicides on pre-harvest fruit drop in Nagpur Mandarin was carried out on 18 year old Nagpur Mandarin trees.

Climate and weather conditions:

Akola has got dry summer and moderately cold winter. During summer, maximum temperature range is 41.3 to 45.05^{0}C and 7 to 10^{0}C in winter as minimum temperature. While maximum relative humidity is 60.94 per cent and 31.23 per cent is minimum. In winter, December is the coolest month with 10^{0}C temperature.

Experimental details:

From 18-year-old mandarin orchard, 72 trees of uniform growth were selected for study.

Crop	:	Mandarin (*Citrus reticulata* Blanco)
Variety	:	Nagpur mandarin
Year of planting	:	1987
Age of tree	:	18 year
Spacing	:	6 x 6 m
Number of trees / treatment	:	2

Total number of experimental trees	:	72
Experimental design	:	RBD
Replication	:	4
Number of treatments	:	9
Location	:	Private orchard of Nagpur mandarin, Kamargaon, Tahasil Murtizapur, District Akola (M.S.).

Treatment details are as follows : T_1 - 2,4-D 10 ppm, T_2 - NAA 10 ppm, T_3 - Carbendazim (0.1%), T_4- Copper oxychloride (0.3%), T_5 - 2,4-D 10 ppm + Carbendazim (0.1%,)T_6 -NAA 10 ppm + Carbendazim (0.1%), T_7 - 2,4-D 10 ppm + Copper oxychloride (0.3%), T_8- NAA 10 ppm + Copper oxychloride (0.3%), T_9– Control (no spray).

Two trees of Nagpur mandarin were taken as a treatment unit and replicated four times. The experiment was started from August, two spray of plant growth regulators and fungicides were given in the first week of August and September (before commencement of pre-harvest fruit drop).

Fruits retained on each tree under study were counted prior to first application of spray. Fruit dropped were counted at weekly interval

Cultural operations:

The plots were kept free from weeds by attending timely spraying of weedicide and followed another cultural operations such as manuring and fertilization. Plant protection measures and irrigation were undertaken uniformly at appropriate time.

Nutritional supply:

The recommended dose of 1200g N, 400g P_2O_5 and 400g K_2O per tree was given along with 50 kg FYM. Half dose of nitrogen and full dose of P_2O_5 and K_2O were applied in the second week of January and remaining half dose of nitrogen (600g) was applied in first week of March.

Observation recorded:

Fruit drop per cent:

Number of fruits dropped under each experimental tree was counted at weekly interval and fruit drop per cent was worked out.

Fruit retention per cent:

The total numbers of fruits on experimental tree were counted before the first spray and also at the time of harvesting. Finally, the fruit retention per cent was worked out.

Yield :

Number of fruits per tree:

The numbers of fruits per tree were recorded by counting at each picking and finally total number of fruits per tree was calculated.

Weight of fruits per tree (kg):

Fruit weight was recorded at each picking and finally total weight of fruits in kg per tree was recorded.

Cost benefit ratio:

All the technologies and package of practices were followed as per the schedule and requirement including the additional expenditure incurred on each treatment. From total income and total expenditure, cost benefit ratio was worked out.

The data recorded in respect to above parameters were subjected to statistical analysis and for interpretation of results. The Randomized Block Design (RBD) is used for statistical analysis (Gomez and Gomez, 1984).

RESULTS AND ANALYSIS

The results of studies are presented under following headings:

Fruit drop:

The observations on pre-harvest fruit drop were recorded at weekly interval and the findings obtained are presented in Fig. 1.

Data presented in Fig.1 reveal that the growth regulators and fungicides significantly influenced on pre-harvest fruit drop in Nagpur mandarin. Significantly minimum fruit drop (11.07 %) was observed in treatment T_5 (2,4-D 10 ppm + Carbendazim 0.1 %) and it was superior to all other treatments. However, maximum (33.15 %) pre-harvest fruit drop was observed in T_9 (control). All the treatments were significantly superior over control. The results are in close conformity with the findings of Dhillon and Dhatt (1999) who stated that the significant reduction in pre-harvest fruit drop with the application of 10 ppm 2, 4-D was in September inKinnow mandarin. Deng *et al.* (2002) observed that spraying of 2,4-D + Brotomax at colour break stage reduced the pre-harvest fruit drop in Tarocco orange.

Table 1 : Effect of plant growth regulators and fungicides on cost benefit ratio of Ambia bahar in Nagpur Mandarian

Treatments	Normal cost of cultivation (Rs./ha)	Additional cost for control of fruit drop (Rs./ha)	Total cost of cultivation (Rs./ha)	Yield (fruits/ ha in lack)	Total income (Rs./ha in lack)	Cost Benefit Ratio
T_1 - 2,4-D 10 ppm	60873	2460	63333	2.42	1.452	1:2.25
T_2 - NAA 10 ppm	60873	2572	63445	2.37	1.422	1:2.24
T_3 - Carbendazim 0.1%	60873	3180	64053	2.16	1.296	1:2.02
T_4 - Copper oxychloride 0.3%	60873	4284	65157	2.13	1.278	1:1.96
T_5 - 2,4-D 10 ppm + Carbendazim 0.1%	60873	3840	64713	2.93	1.758	1:2.72
T_6 - NAA 10 ppm + Carbendazim 0.1%	60873	3952	64825	2.55	1.530	1:2.36
T_7 - 2,4-D 10 ppm + Copper oxychloride 0.3%	60873	4944	65817	2.62	1.572	1:2.39
T_8 - NAA 10 ppm + Copper oxychloride 0.3%	60873	5056	65929	2.48	1.488	1:2.26
T_9 - Control (no spray)	60873	-	60873	1.86	1.116	1:1.83

Note:
Growth regulators : 1. 2, 4-D - 28 g @ Rs. 20 / g
NAA - 28 g @ Rs. 24 / g
Aceton : 2. - 100 ml @ Rs. 100 /200 ml
Fungicide : 1. Carbendazim - 2.76 kg@Rs. 500/ kg
Copper oxychloride - 98.25 kg @ Rs. 300/ kg
Spraying charges : 1. - 30 units @ Rs. 60/ day
Fruit rate : 2. - @ Rs. 600/1000 fruit

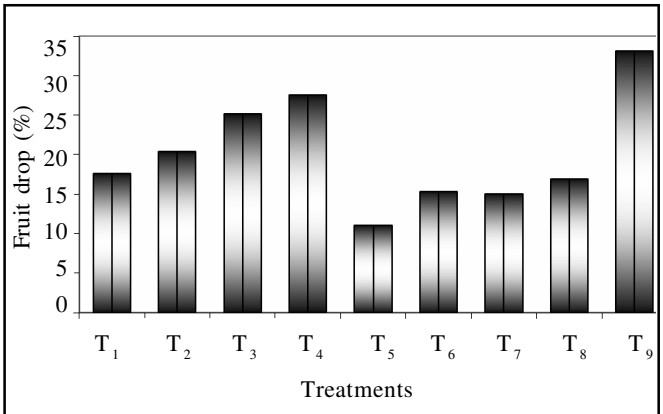

Fig. 1 : Effect of plant growth regulators and fungicides on pre-harves fruit drop in Nagpur mandarin (%)

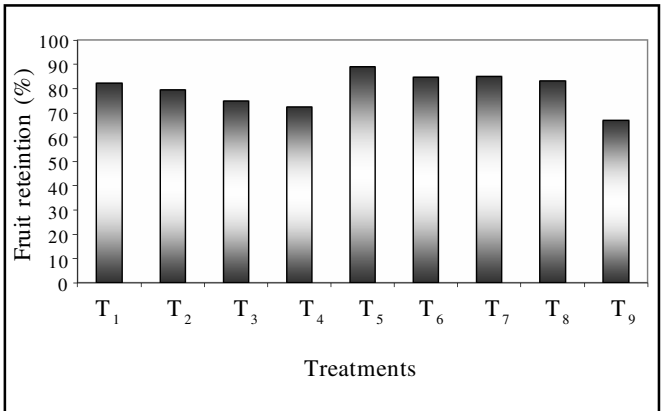

Fig. 2 : Effect of plant growth regulators and fungicides on fruit reteintin in Nagpur mandarin (%)

Retention per cent:

The observations on retention percentage of fruits after pre-harvest fruit drop were recorded and the findings obtained are presented in Fig. 2. It reveals that growth regulators and fungicides significantly influenced on retention percentage of fruit after pre-harvest fruit drop of Nagpur mandarin. Significantly maximum retention of fruits (88.93 %) was observed with treatment T_5 (2,4-D 10 ppm + Carbendazim 0.1 %) and was significantly superior over all other treatments.

The results are in close conformity with the findings of Singh *et al.* (1999), who observed that Blitox (0.1%) + 2,4-D 10 ppm retained the maximum fruits closely followed by Bavistin (0.1%) + 2,4-D (10 ppm) in Kinnow mandarin.

Yield:

Effect of plant growth regulators and fungicides on yield in respect of both number of fruits per tree and weight of fruits per tree were recorded and are presented with Fig. 3 and Fig. 4.

Data presented in Fig. 3 reveal that the plant growth regulators and fungicides significantly influenced on yield in terms of number of fruit per tree. Significantly maximum number of fruits per tree (1058.88) were obtained with treatment T_5 (2,4-D 10 ppm + Carbendazim 0.1 %) and was superior over all other treatments.

Data presented in Fig. 4 reveal that the yield in terms of weight of fruits per tree was significantly influenced by foliar application of growth regulators and fungicides.

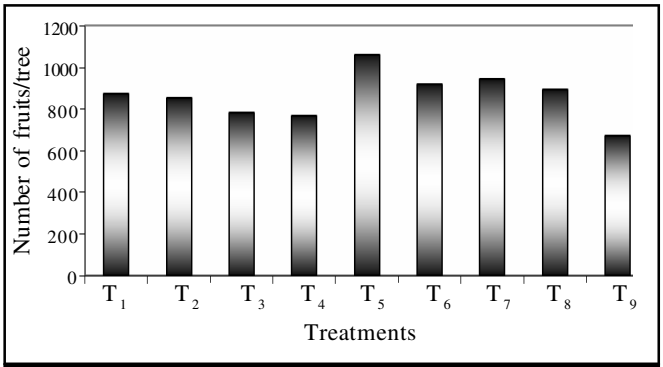

Fig. 3 : Effect of plant growth regulators and fungicides on number of fruits

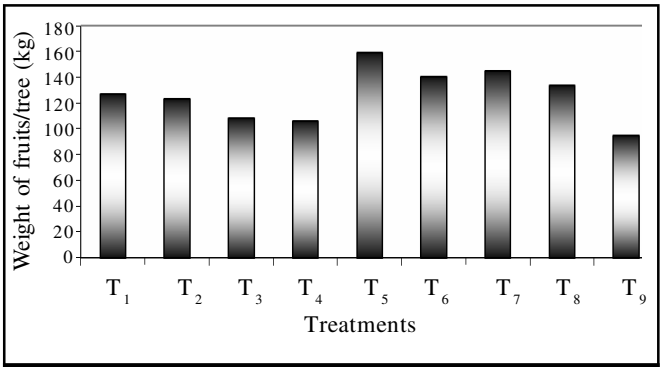

Fig. 4 : Effect of plant growth regulators and fungicides on weight of fruits

Maximum yield (159.15 kg) was observed with T_5 (2,4-D 10 ppm + Carbendazim 0.1 %) treatment and it was superior to other treatments.

Similar results were found by Bajwa *et al.* (1971) who observed the maximum yield in terms of both number and weight of fruits per tree with 2,4-D 20 ppm. Similar result was obtained by Stewart *et al.* (1951) in Washigton Navel orange and by Chunderwat and Randhawa (1972) in Saharanpur variety (special) grape fruit.

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