

# Effect of plant growth regulators and fungicides on quality of Nagpur Mandarin



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

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## SUMMARY

Fruits retained on each tree under study were counted prior to first application of spray. Randomly ten fruits were selected from dropped and retained fruits on tree in September, October and November and comparative quality analysis was carried out. Comparative analysis of retained and dropped fruits in the months of September, October and November showed the ascending order for average weight, average volume, TSS and number of seeds and found maximum i.e. 152.13 g, 161.27 cc, 9.68 % and 10.67 seeds/fruit, respectively in retained fruits in the month of November and minimum 109.80 g, 114.94 cc, 8.20 % and 9.22 seeds/fruit, respectively in the month of September in dropped fruits. The minimum acidity (0.92%) and ascorbic acid (51.10 mg/100 ml juice) was observed in retained fruits in November. While maximum acidity (1.48%) and ascorbic acid (80.52 mg/100 ml juice) were found in dropped fruits in September. The number of seeds per fruit was not significantly influenced by the application of plant growth regulators and fungicides. Maximum cost benefit ratio (1:2.72) was observed in treatment T<sub>5</sub> (2,4-D 10 ppm + Carbendazim 0.1%).

See end of the article for authors' affiliations

Correspondence to :  
N.B. PATIL  
BASIX, AMRAVATI  
(M.S.) INDIA

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Citrus is grown in 49 countries of the world and it is choicest fruit having high consumer preference both as a fresh fruit as well as refreshing processed juice. Brazil ranks first in production followed by USA and China. Other important citrus growing countries are Spain, Mexico, India, Italy, Egypt etc. Maharashtra stands first in area under citrus cultivation.

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 monetary 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 styler end rot and stem end rot and also due to entomological factors.

In India, the problem of pre-harvest fruit

drop in citrus has not been tackled extensively, although some work using plant growth regulators only has been done, but hardly any attempt has so far been made to evaluate the relative efficacy of plant growth regulators when mix with other materials. Very little attention has been paid to Nagpur mandarin and thus little information is available on the effect of plant growth regulators and fungicides on pre-harvest fruit drop in Nagpur mandarin.

The investigation of many research workers such as Sharma and Randhawa (1967), Jawanda *et al.* (1972) observed that several plant growth regulators minimize the fruit drop to a considerable extent.

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. Present investigation on the effect of plant growth regulators and fungicides on intensity of fruit drop in Nagpur

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mandarin was undertaken.

## MATERIALS AND METHODS

The present 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°C and 7 to 10°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°C temperature.

### Experimental details:

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

Crop	: Mandarin ( <i>Citrus reticulata</i> 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<sub>1</sub> - 2,4-D 10 ppm, T<sub>2</sub> - NAA 10 ppm, T<sub>3</sub> - Carbendazim (0.1%), T<sub>4</sub> - Copper oxychloride (0.3%), T<sub>5</sub> - 2,4-D 10 ppm + Carbendazim (0.1%), T<sub>6</sub> - NAA 10 ppm + Carbendazim (0.1%), T<sub>7</sub> - 2,4-D 10 ppm + Copper oxychloride (0.3%), T<sub>8</sub> - NAA 10 ppm + Copper oxychloride 0.3%, T<sub>9</sub> - 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 sprays 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. Randomly ten

fruits were selected from dropped and retained fruits on tree in September, October and November and comparative quality analysis was carried out.

### 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<sub>2</sub>O<sub>5</sub> and 400g K<sub>2</sub>O per tree was given along with 50 kg FYM. Half dose of nitrogen and full dose of P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O were applied in the second week of January and remaining half dose of nitrogen (600g) was applied in first week of March.

### Observation recorded:

Quality parameters of retained and dropped fruits:

Ten retained and dropped fruits were selected in the months of September, October and November and comparative analyses were carried out in respect of average weight, volume, TSS, acidity and ascorbic acid content in fruit juice.

Number of seeds/fruit:

Seeds from the segments of fruit were counted and average seeds was calculated.

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) was used for statistical analysis (Gomez and Gomez, 1984).

## RESULTS AND DISCUSSION

The results obtained from the present investigation are summarized below :

### Comparative study of quality parameters of retained and dropped fruits in Nagpur mandarin:

The comparative study of retained and dropped

fruits in respect of average weight, volume, TSS, acidity, ascorbic acid, and number of seeds per fruit were carried

out in September, October and November and presented in Table 1.

**Table 1 : Comparative study of quality parameters of retained and dropped fruits in Nagpur mandarin**

Quality parameters	September		October		November	
	Retained	Dropped	Retained	Dropped	Retained	Dropped
Average weight (g)	109.80	103.52	131.26	126.73	152.13	143.28
Average volume (cc)	114.94	106.91	135.70	130.11	161.27	145.32
TSS (%)	8.20	7.90	8.80	8.55	9.68	9.40
Acidity (%)	1.40	1.48	1.12	1.21	0.92	1.11
Ascorbic acid (mg/100ml)	60.80	80.52	56.30	78.07	51.10	74.07
Number of seeds / fruit	9.22	7.80	9.84	7.95	10.67	8.97

**Table 2 : Effect of plant growth regulators and fungicides on number of seeds per fruit in Nagpur mandarin**

Treatments	Number of seeds / fruit
T <sub>1</sub> - 2,4-D 10 ppm	11.04
T <sub>2</sub> - NAA 10 ppm	10.67
T <sub>3</sub> - Carbendazim (0.1%)	9.87
T <sub>4</sub> - Copper oxychloride (0.3%)	9.73
T <sub>5</sub> - 2,4-D 10 ppm + Carbendazim (0.1%)	11.68
T <sub>6</sub> - NAA 10 ppm + Carbendazim (0.1%)	11.46
T <sub>7</sub> - 2,4-D 10 ppm + Copper oxychloride (0.3%)	11.33
T <sub>8</sub> - NAA 10 ppm + Copper oxychloride (0.3%)	11.12
T <sub>9</sub> - Control (no spray)	9.21
'F' test -	NS
S.E. ±	0.531
C.D. (P=0.05)	-
C.V. %	9.842

Data presented in Table 1 reveal that the average weight, volume, TSS, number of seeds went on increasing as the fruit developed and found maximum in the retained fruits as compared with dropped fruits. The maximum average weight (152.13 g) was observed in November in retained fruits than that of dropped fruit (143.28 g). Similarly, the maximum volume (161.27 cc), TSS (9.68 %) and number of seeds per fruit (10.67) were observed in retained fruits in the month of November while that of minimum *i.e.* 145.32 cc, 9.40 % and 8.97, respectively in dropped fruits.

The acidity per cent and ascorbic acid content in the fruits juice were observed maximum in dropped fruits as compared to the retained fruits in all three stages of analysis. Maximum acidity per cent (1.48 %) and ascorbic acid content (80.5 mg/100 ml juice) was observed in dropped fruits in the month of September

**Table 3 : Effect of plant growth regulators and fungicides on cost benefit ratio o in Nagpur Mandarin**

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 lakh)	Total income (Rs./ha) in lakh	Cost Benefit Ratio
T <sub>1</sub> - 2,4-D 10 ppm	60873	2460	63333	2.42	1.452	1:2.25
T <sub>2</sub> - NAA 10 ppm	60873	2572	63445	2.37	1.422	1:2.24
T <sub>3</sub> - Carbendazim 0.1%	60873	3180	64053	2.16	1.296	1:2.02
T <sub>4</sub> - Copper oxychloride 0.3%	60873	4284	65157	2.13	1.278	1:1.96
T <sub>5</sub> - 2,4-D 10 ppm + Carbendazim (0.1%)	60873	3840	64713	2.93	1.758	1:2.72
T <sub>6</sub> - NAA 10 ppm + Carbendazim (0.1%)	60873	3952	64825	2.55	1.530	1:2.36
T <sub>7</sub> - 2,4-D 10 ppm + Copper oxychloride (0.3%)	60873	4944	65817	2.62	1.572	1:2.39
T <sub>8</sub> - NAA 10 ppm + Copper oxychloride (0.3%)	60873	5056	65929	2.48	1.488	1:2.26
T <sub>9</sub> - Control (no spray)	60873	-	60873	1.86	1.116	1:1.83

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

and decreased in the subsequent months. While minimum acidity (0.92 %) and ascorbic acid content (51.10mg/100 ml juice) was observed in retained fruits in the month of November. These results were found in conformity with the findings of Kaur and Kaur (1997) in Kinnow mandarin and Ramanjula and Reddy (1989) in Sathgudi sweet orange.

#### Number of seeds:

Effect of growth regulators and fungicides on number of seeds per fruit are presented in Table 2. It reveals that numbers of seeds per fruit were not significantly influenced by growth regulators and fungicides. However, maximum number of seeds (11.68) was observed with treatment T<sub>5</sub> (2,4-D 10 ppm + Carbendazim 0.1 %). While minimum number of seeds (9.21) was observed in treatment T<sub>0</sub> (control). Babu *et al.* (1984) noticed that 2,4-D increased the number of seeds per fruit. Das and Narayana (1974) found increased number of seeds per fruit with application of 2,4-D 10-50 ppm in Mosambi.

#### Effect of plant growth regulators and fungicides on cost benefit ratio of Ambia bahar in Nagpur mandarin:

Considering the normal cost of cultivation and additional cost incurred for control of fruit drop in each treatment in Nagpur mandarin, cost benefit ratio was worked out and presented in Table 3. It was observed that the plant growth regulators and fungicides were effectively influenced on cost benefit ratio in Nagpur mandarin. Maximum (1:2.72) cost benefit ratio was observed with treatment T<sub>5</sub> (2,4-D 10 ppm + Carbendazim 0.1%) by producing maximum yield. While minimum (1:1.83) cost benefit ratio was observed with

treatment T<sub>0</sub> (control).

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Authors' affiliations:

**BHAGYASHREE M. SHEDAME**, Department of Agricultural Process Engineering, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, AKOLA (M.S.) INDIA  
**S.H. INGLE**, Department of Plant Pathology, College of Agriculture, JALGAON (M.S.) INDIA

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