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Influence of plant growth regulators on fruit production of sweet orange

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ABSTRACT

Mosambi-cultivar of sweet orange is very popular in West Bengal and it is successfully grown in Paschimanchal (Red and laterite zone) of West Bengal. Fruit dropping in mosambi is a serious problem at there, leading to considerable yield loss. To minimize such drop, an investigation was made in a private orchard at Jhargram with plant growth regulators, consisting of 7 treatments viz., NAA at 15, 20, 25 and 30 ppm; GA_3 at 25 ppm; 2, 4-D at 10 ppm and water spray (control). Four sprays were made, starting from pea stage of fruit development, at an interval of 20-30 days. Three consecutive years of study indicated that NAA at 15 ppm was the most effective in reducing the fruit drop at different months after fruit set which resulted in doubling of fruit production as compared to control. The next effective growth regulator was 2, 4-D at 10 ppm. The fruit weight was significantly improved due to application of plant growth regulators but not the fruit quality like TSS, acidity, vitamin C and juice content in fruit.

Key words: Fruit yield and quality, laterite soil, plant growth regulators, sweet orange

Fruit drop in citrus is a serious problem worldwide. Flowering, fruit set and its retention depend on several factors and hormonal regulation is one of them. Citrus trees produce a very large number of flowers, 30-150 times more than they can bear the fruits Huchche *et al*., 2012). Due to heavy production of flowers, a high post setting drop of fruit lets is occurred and growers are not much concern about this drop (Huchche *et al*., 2012). The fruit dropping, which is continued from marble stage of fruit development to till harvest (Mohan *et al*., 1986), need to be controlled or minimized for getting profitable income. There are several growth regulators which have been tired to check this malady (Randhawa *et al*., 1961; Jawanda *et al.,* 1972; Mohan *et al*., 1986 and Antoniolli *et al*., 2003) at different situation on different cultivars of sweet orange. But in mosambi, a popular variety of sweet orange, which is performing very well in laterite zone of West Bengal in respect of production and fruit quality (Ghosh and Tarai, 2007), little information is available regarding suitable growth regulators for controlling fruit drop. Although an attempt was made with 2, 4- D and GA_3 to control the fruit drop in mosambi-Sweet orange, grown in similar agro-climatic situation under rainfed condition, where 2, 4 - D at 10 ppm and GA_3 at 25 were reported to be better (Ghosh *et al*., 1995).The GA_3 is considered as one of the costly chemicals which may not be acceptable by the growers, while NAA, a cheaper chemical, and no attempt has yet been made earlier with this chemical to control fruit drop in mosambi sweet orange grown under irrigation condition in laterite soil of West Bengal, an investigation was therefore, made in this direction.

MATERIALS AND METHODS

The investigation was carried out in a private farm at Jhargram on 7 year-old mosambi-sweet orange plants, budded on Rough lemon root stock, planted at 5 m spacing in tree to tree and raw to row. The study was made for three consecutive years *i.e.* 2009, 2010 and 2011 on uniform healthy trees adopting randomized block design having four replications with two plants in each. There were seven treatments *viz*., NAA at 15, 20, 25 and 30 ppm; GA_3 at 25 ppm; 2, 4-D at 10 ppm and control (water spray). The growth regulators were sprayed four times and first spray was given at pea stage of fruit development. The interval between 1st and 2nd spray was 20 days, while for subsequent sprays, it was 30 days. Sticker (APSA-80) was used in the spray solution and spraying was done after sun set every time. The data on the number of fruits dropped were recorded at monthly interval on tagged 100 fruits tree^{-1} basis in each year and average was mentioned. The tagging was made before the first spray. Number of fruits tree^{-1} was recorded at maturity in every year. Fruit weight was taken from 10 randomly selected fruits tree^{-1} basis. The TSS was measured by using refractometer while acidity and vitamin C were estimated following the methods of A.O.A.C. (1990).

RESULTS AND DISCUSSION

It is cleared from the data presented in table 1, revealed that the fruit drop was lowest in the trees, sprayed with NAA at 15 ppm, in all the months *i.e.* April to August followed by NAA at 20 ppm. This observation corroborated the findings of Sandhu *et al.* (1986) who reported that application of 10 ppm 2, 4 - D could be replaced by 15 ppm NAA in different cultivars of sweet orange for controlling fruit drop. Beneficial role of NAA application in reducing fruit drop may be explained from the fact that it maintains the ongoing physiological and biological process of inhibition of abscission (Tomaszewska and Tomaszewska, 1970). It has been reported that fruit

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drop synchronizes with the period of low auxin production in the fruit (Luckwill, 1957) and suggested for application of auxin which would be helpful in increasing auxin level and thereby resulted in reduce fruit drop (Luckwill, 1957). It was further noted that the intensity of fruit drop was different in different months. The highest intensity of dropping was in the month of April followed by August (pre-harvest drop) and minimum in May irrespective of the treatments which may be due to climatic condition in the zone.

Table 1: Effect of growth regulators on fruit drop and yield in mosambi - sweet orange grown in laterite soil.

Treatments	*Fruit drop (%)					Number of fruits plant^{-1}			
	April	May	June	July	August	2009 (6 yr. old)	2010 (7yr. old)	2011 (8 yr old)	Average
NAA-15 ppm	35 (36.27)	22 (27.97)	24 (29.33)	25 (30.00)	28 (31.95)	50	84	252	129
NAA-20 ppm	41 (39.82)	26 (30.66)	31 (33.83)	38 (38.06)	44 (41.55)	32	40	194	89
NAA-25 ppm	52 (46.15)	33 (35.06)	38 (38.06)	42 (40.40)	49 (44.43)	25	47	224	99
NAA-30 ppm	54 (47.29)	35 (36.27)	38 (38.06)	44 (41.55)	50 (45.00)	20	37	230	96
GA_3-25 ppm	56 (48.45)	32 (34.45)	34 (35.67)	52 (46.15)	67 (54.94)	17	35	210	87
2, 4-D 10 ppm	41 (39.82)	29 (32.58)	34 (35.67)	49 (44.43))	52 (46.15)	46	72	230	116
Control (water spray)	50 (45.00)	45 (42.13)	49 (44.43)	51 (45.57)	53 (46.72)	20	45	170	78
SEm (±)	**1.0**	**0.8**	**0.9**	**0.9**	**1.1**	**1.2**	**2.0**	**2.9**	**2.1**
LSD (0.05)	**3.1**	**2.4**	**2.6**	**2.8**	**3.4**	**3.5**	**5.8**	**8.6**	**6.2**

Note: Average of 3 years, Figures in parentheses are angular transformed data*

Table 2: Effect of growth regulators on physico-chemical characteristics in fruits of mosambi-sweet orange grown in laterite soil (Average of 3 years)

Treatments	Fruit weight (g)	TSS (^{0}B)	Acidity (%)	Vit. C mg/ml^{-100})	Juice (%)
NAA – 15 ppm	139	8.5	0.26	35.1	48.6
NAA – 20 ppm	142	8.4	0.31	33.1	47.7
NAA – 25 ppm	135	8.2	0.28	35.0	45.0
NAA – 30 ppm	131	8.3	0.34	37.0	47.1
GA_3 - 25 ppm	139	8.4	0.24	34.5	46.8
2, 4-D -10 ppm	144	8.5	0.28	35.4	46.9
Control (Water spray)	120	8.4	0.34	35.8	47.9
SEm (±)	**1.3**	**0.2**	**0.01**	**0.4**	**0.03**
LSD(0.05)	**3.9**	**N.S.**	**N.S.**	**N.S.**	**N.S.**

A significant and positive role on fruit production was observed with the application of NAA and 2, 4-D. Fruit number was highest in the trees, sprayed with NAA at 15 ppm (129 fruits plant^{-1}) followed by 2, 4-D at 10 ppm (116 fruits plant^{-1}) and it was lowest with control plants (78 fruits plant^{-1}). Highest fruit number with NAA 15 ppm was because of minimum fruit drop. It was observed that effectiveness of NAA concentration in fruit production was drastically reduced from 15 ppm.

Beneficial effect of growth regulators on fruit weight was also observed (Table 2). It was noted that all the treatments (growth regulators) was helpful in increasing fruit weight significantly as compared to control. Similar observation was also noted by Daulta and Beniwal (1983) in Campbel Valencia sweet orange. They noted that all the growth regulators treatment increased the fruit weight significantly except 2, 4-D at 5 ppm.

Fruit quality in the fruits of different treatment was not significantly improved as compared to control. The findings was in line with the observations of Mohan *et al*., 1986 in Jaffa sweet orange; Medeiros *et al*., 2000 in Hamlin sweet orange; Antoniolli *et al*., 2003 in Westin sweet orange.

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