

## Effect of rootstocks on performance of mosambi – sweet orange under irrigated condition in laterite soil of West Bengal, India

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### ABSTRACT

Considering the beneficial effect of rootstock on productivity, quality and longevity on scion varieties, a root stock trial was conducted for 5 consecutive years on mosambi-sweet orange under irrigated condition in laterite soil. The scion of mosambi was taken from single elite mother plant and budded on seven root stocks, viz., Karna Khatta (*Citrus karma*), Jambheri (*Citrus jambheri*), Rangpur lime (*Citrus limonia*), Gandharaj lemon (*Citrus lemon*), Sweet lime (*Citrus limetoides*), Kumquat (*Fortunella spp.*) and local strain of lemon (*Citrus lemon*) were used. Study indicated that plant growth was maximum on Karna Khatta followed by Jambheri and minimum on Kumquat. Maximum number of fruits (291 fruits over a period of 6 years) and fruit yield (7.9 kg) per plant was recorded with karma khatta, followed by Rangpur lime (254 fruits and 7.6 kg respectively); whereas, maximum weight (190 g) and diameter (8.1 cm) of fruits were recorded on kumquat, followed by rangpur lime (150 g and 7.6 cm respectively). Best quality fruits in terms of juice content, T.S.S., total sugar, ascorbic acid and T.S.S. / acid ratio, was with Rangpur lime. Foliar nitrogen and phosphorus content (2.8 % N and 105 % mg P) were highest on Rangpur lime followed by Karna Khatta (2.6 % N and 104 % mg P), while foliar K content did not differ significantly among the different rootstock used. With respect to yield and fruit quality, Rangpur lime and Karna Khatta rootstocks have been found to be for mosambi-sweet orange under irrigated condition in laterite soil of West Bengal.

**Key words:** Laterite soil, mosambi-sweet orange, productivity and fruit quality, root stock

Sweet orange (*Citrus sinensis* Osbeck) is considered as second important citrus species after mandarin orange in India and it shares 23% of production among all the citrus cultivars (Shivankar, 2010). Cultivation of mosambi-sweet orange is gaining popularity in West Bengal and the red laterite zone of the state is considered as the suitable place for production of quality mosambi fruits. Among the various factors responsible for sustainable production and tree longevity, use of suitable rootstock is considered to be the foremost ones (Arora *et al.*, 2012). A number of rootstocks have been recommended for different sweet orange cultivars in various states (Kumar *et al.*, 1993; Sharma *et al.*, 2002, Kusuma grace *et al.*, 2005). It is an established fact that a rootstock – scion combination, which is suitable for one locality, may or may not be the suitable in other areas (Arora *et al.*, 2012). So, a perfect combination of rootstock – scion is to be standardized for specific agro-ecological condition. Information in this direction, particularly for mosambi sweet orange, grown under irrigated condition in laterite soil in West Bengal is scanty. Given this backdrop, an investigation was undertaken to find out the most suitable rootstock for mosambi sweet orange in laterite zone of West Bengal

### MATERIALS AND METHODS

The investigation was carried out at Jhargram, Paschim Medinipur during 2007 to 2011 on mosambi-sweet orange budded on 7 rootstocks viz., Karna Khatta (*Citrus karma*), local strain of Jambheri

(*Citrus jambheri*), Gandharaj cultivar of lemon (*Citrus lemon*), Rangpur lime (*Citrus limonia*), Sweet lime (*Citrus limetoides*), Kumquat (*Fortunella spp.*) and local strain of lemon (*Citrus lemon*). The experiment was laid out in randomized block design with four replications taking three plants in each replication. The plants were planted at 5 m X 5 m spacing. The soil of the experimental site was laterite having pH 5.8; and 320: 32:105 kg ha<sup>-1</sup>, respectively. Uniform cultural practices were followed in all the treatments. The irrigation was given at 15 days interval, started after fruit set and continued before onset of monsoon. The data on growth parameters such as plant height, basal girth and plant spread were recorded at 5 years after planting. The fruit yield was recorded for 5 consecutive years, started from 2 year after planting. The physico-chemical characteristics of fruits were studied for last 3 years and average of each parameter has been presented. The leaves were collected in September (Bhargava, 1999) and subjected to analysis of nitrogen, phosphorus and potassium content, following the method as described by Jackson (1973).

### RESULTS AND DISCUSSION

In the present investigation, growth parameters viz., plant height, basal girth and canopy spread significantly varied in mosambi plants grown on different rootstocks (Table 1). Mosambi on Karna Khatta rootstock produced vigorous plant, having maximum plant height (329 cm), basal girth (31 cm) and canopy spread (E-W 440 cm and N-S 390 cm) followed by Jambheri (328 cm, 29 cm and E-W 357

cm and N-S 324 cm respectively) and minimum growth was observed with the plants grown on kumquat rootstock (220 cm, 15 cm, E-W 240 cm and N-S 210 cm respectively). Semi-vigorous growth was noted in the plants on Rangpur lime rootstock. Rootstock trial conducted by Mustafa and Reddy (1990) at Hesaraghata (Bangalore) revealed

maximum tree height and tree volume in mosambi on Rough lemon followed by Rangpur lime rootstock while Pectinifera rootstock was found to be the best for mosambi in respect of growth of girth and tree volume Abohar (Punjab) condition (Mehrota *et al.*, 2002).

**Table 1: Effect of rootstock on growth and fruit yield in mosambi-sweet orange**

Rootstock	Plant growth (5 year after planting)			Number of fruits plant <sup>-1</sup>						Average yield plant <sup>-1</sup> (kg)	
	Height (cm)	Basal girth (cm)	Canopy spread (cm)		2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year	6 <sup>th</sup> year		Average of 5 years
			East	North						West	
Karna Khatta	329	31	440	390	3	8	30	170	80	58.2	7.9
Jambheri – Local strain	328	29	357	324	3	8	14	62	54	28.2	3.8
Lemon cv. andharaj	209	16	210	228	1	2	12	24	46	17.0	2.4
Rangpur lime	257	22	290	275	1	4	38	121	90	50.8	7.6
Sweet lime	240	18	275	228	4	10	5	18	30	13.4	1.9
Kumquat	220	15	240	210	3	15	1	12	29	12.0	2.3
Lemon (local strain)	230	14	230	200	18	17	10	17	45	21.4	3.1
<b>SEm (±)</b>	<b>2.3</b>	<b>1.4</b>	<b>1.9</b>	<b>1.8</b>	<b>0.8</b>	<b>1.2</b>	<b>1.6</b>	<b>2.6</b>	<b>2.2</b>	<b>1.7</b>	<b>0.1</b>
<b>LSD(0.05)</b>	<b>6.8</b>	<b>4.2</b>	<b>5.6</b>	<b>5.2</b>	<b>2.5</b>	<b>3.6</b>	<b>4.7</b>	<b>7.7</b>	<b>6.5</b>	<b>5.1</b>	<b>0.4</b>

**Table 2: Effect of rootstock on physico-chemical properties N, P, K status of sweet orange (pooled)**

Rootstock	Fruit wt (g)	Fruit diameter (cm)	Juice (%)	TSS (°B)	Acidity (%)	Total sugar (%)	TSS Acid <sup>-1</sup> ratio	Ascorbic acid (mg ml <sup>-100</sup> juice)	Foliar status (on dry weight basis)			
									N (%)	P (%)	K (%)	No. of seeds fruit <sup>-1</sup>
Karna Khatta	136	7.3	48.5	8.3	0.20	7.48	41.5	38.2	2.6	104	1.3	11
Jambheri – Local strain	133	7.0	48.0	8.4	0.18	6.76	46.7	38.2	2.3	98	1.3	9
Lemon cv. Gandharaj	140	7.6	44.0	8.9	0.20	8.42	44.5	33.6	2.1	90	1.3	11
Rangpur lime	150	7.6	49.0	9.4	0.20	8.26	47.0	43.7	2.8	105	1.4	12
Sweet lime	142	7.5	47.5	7.9	0.22	6.80	35.9	28.7	1.7	75	1.2	7
Kumquat	190	8.1	46.5	8.0	0.18	6.00	44.4	28.5	1.9	72	1.1	12
Lemon (local strain)	145	7.5	48.0	8.9	0.20	7.30	44.5	27.7	1.9	74	1.2	13
<b>SEm (±)</b>	<b>0.9</b>	<b>0.07</b>	<b>0.3</b>	<b>0.1</b>	<b>0.02</b>	<b>0.06</b>	-	<b>0.5</b>	<b>0.1</b>	<b>1.1</b>	<b>0.02</b>	<b>0.06</b>
<b>LSD(0.05)</b>	<b>2.8</b>	<b>0.2</b>	<b>0.8</b>	<b>0.3</b>	<b>NS</b>	<b>0.2</b>	-	<b>1.4</b>	<b>0.3</b>	<b>3.4</b>	<b>NS</b>	<b>0.2</b>

Degree of yield expression of a scion variety, grafted on specific rootstock is considered as one of the important indicators for rootstock- scion suitability under a certain condition. The perusal of the data (Table 1) indicated that mosambi on Karna Khatta rootstock gave significantly maximum number

of 58.2 fruits (average of 5 years) followed by Rangpur lime (50.8). There was one observation that irrespective of rootstock, fruit production in mosambi plants started at 2<sup>nd</sup> year after planting, increase gradually up to 5<sup>th</sup> year and thereafter showed a declining trend in fruit yield. mosambi plants on

Karna Khatta produced maximum number of fruits (170 fruits plant<sup>-1</sup>), followed Rangpur lime (121 fruits plant<sup>-1</sup>) in 5<sup>th</sup> year. Fruit production in mosambi plants on sweet lime, Kumquat and lemon (both Gandharaj and Local strain) was found to be poor. Better yield performance of mosambi sweet orange on Rangpur lime rootstock was reported by Mustafa and Reddy (1990) under Bangalore condition. Rootstock trial for mosambi sweet orange conducted at various locations indicated that Rubidoux trifoliolate was the best under Ranchi (Bihar) condition (Kumar and Ganapathy, 1992); Pectinifera for Abohar, Panjab (Mehrotra, *et al.*, 2002), while in the present study, Karna Khatta was found to be the best in terms of fruit yield (7.9 kg plant<sup>-1</sup>) followed by Rangpur lime (7.4 kg plant<sup>-1</sup>).

Perusal of the data presented in table 2 revealed significant differences in fruit characters of mosambi sweet orange grown on different root stock. Fruit weight was highest on Kumquat rootstock (190 g) followed by Rangpur lime (150 g) whereas; minimum fruit weight was recorded with Jambheri (133 g) and Karna Khatta (136 g). Kusuma Grace *et al.* (2005) recorded maximum weight and diameter of Sathgudi sweet orange fruits on Rangpur lime rootstock at Tirupati (Andhra Pradesh). Fruit size (diameter) was also found to be maximum (8.1 cm) on Kumquat and minimum (7.0 cm) on Jambheri. Quality parameter of mosambi fruit varied significantly with different rootstocks (Table 2). Maximum and minimum juice content was recorded with Rangpur lime (49%) and Gandharaj lemon (44%) respectively. Kusuma Grace *et al.* (2005) also recorded highest juice content in Sathgudi fruit on Rangpur lime rootstock.

Maximum TSS (9.4<sup>0</sup>B) was observed with Rangpur lime rootstock and lowest with sweet lime (7.9<sup>0</sup>B). Mustafa and Reddy (1990) recorded highest TSS from mosambi fruits on Pomeroy trifoliolate orange rootstock while Mehrotra *et al.*, (2002) recorded significantly higher TSS (9.8%) on Pectinifera rootstock. Acidity in mosambi fruit did not differ significantly among the treatments. However, T.S.S. / acid ratio, which determines the organoleptic taste, was found to be maximum with Rangpur lime (47.0) and lowest with sweet lime (35.9). In terms of ascorbic acid content, Rangpur lime was found to be the best (43.7 mg / 100 ml) followed by Karna Khatta and Jambheri (38.2 mg / 100 ml) whereas, lowest ascorbic acid content with local strain of lemon (27.7 mg / 100 ml). Highest ascorbic acid content in mosambi fruits, as recorded by various workers, was on rough lemon (Mustafa and Reddy, 1990) under Bangalore condition and Rangpur lime (Kumar and Ganapathy, 1992) under Ranchi condition.

Foliar nutrient of mosambi grown on different rootstock has been presented in Table 2. Maximum nitrogen, phosphorus and potassium

content in leaf tissue of mosambi were recorded with Rangpur lime (2.8 %, 105 mg % and 1.4 % respectively) followed by Karna Khatta (2.6 %, N, 104 mg % P and 1.3 % K) and these two rootstock-scion combinations also resulted in higher fruit production. Differential foliar nutrient status of citrus grown on different rootstock was also reported by Taylor and Dimsey (1993). The nutrient absorbing ability of Rangpur lime and Karna Khatta rootstock might have resulted in higher foliar nutrient status, which ultimately contributed to better fruit yield of mosambi sweet orange.

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