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Growth Performance of Different Rootstocks of Citrus

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Abstract

Citrus is one of the most important tree fruits grown exclusively across the globe in sub-tropics. In Malwa plateau region of India, especially in Hadauti division of Rajasthan consisting of Jhalawar, Kota, Bundi and Baran districts, mandarin orange finds favor among orchardists. For raising mandarin orange, use of different root stocks is in vogue. To observe the performance of different root-stocks, an experiment using Carrizo (*Citrus sinensis*) (L.) Osbek. × *C. trifoliata* L.), Rangpur lime (*C. limonia* Usbek.), Rough lemon (*C. jambhiri* Lush.) and Sour orange (*Citrus aurantium* Linn.) was attempted. The seeds of all these species were sown immediately after extraction in raised beds under open condition during the third week of October. Out of these rootstocks, Rough lemon responded quickest germination followed by Rangpur lime, Carrizo and Sour orange. Irrespective of the species, germination commenced within 23 days and it continued for next 17 days in Rangpur lime and Rough lemon, 32 days in Sour orange and for 99 days in Carrizo. The maximum number of node/plant was found in the Carrizo plants which shows a promise for use as dwarfing rootstock. However, vigor of plant was maximum in Rough lemon.

Key words : Citrus, Growth performance, Primary nursery, Rootstocks, Secondary nursery.

In India, orange covers an area of 1.83 lakh hectares and the production is of the order of 12.36 lakh tonnes accounting for 3.8 and 2.5% share under total acreage and production respectively in the fruits (1). The fruits of mandarin oranges (*Citrus reticulata* Blanco.) are recognized as the principal source of vitamin C and folic-acid from ancient time. Hesperidin, naringin, tangeretin and nobiletin found in fruits in various proportions, possess anti-inflammatory and anti-allergic activities (2). These flavonoids improve circulatory system of the body. For these therapeutic and nutritive attributes, oranges find place in regular diet of people. Further, being amenable to cultivate well under tropical/sub-tropical regions of the country, oranges are cultivated extensively in the states like Maharashtra, Rajasthan, Karnataka, Madhya Pradesh, Nagaland, Mizoram, Tamil Nadu, West Bengal and Meghalaya. Among these states, Maharashtra holds the key position in orange cultivation and 60—70% country's orange production is met in by the state alone. In Malwa plateau region of India, especially in Hadauti division of Rajasthan consisting of Jhalawar, Kota, Bundi and Baran districts, mandarin orange finds favor among orchardists. Extensive research led to the development of many selections, mutants, hybrids which are getting used as rootstocks (3—6). The rootstocks like Rough lemon, Rangpur lime, Trifoliate orange and Sour orange are most widely used rootstocks in the world for citrus (7). However, the performance of different rootstocks suiting to the geo-physical condition of Hadauti region of Malwa plateau is unknown. With a view to observe the performance of different rootstocks, especially for hadauti region of Malwa plateau an experiment using Carrizo (*Citrus sinensis* L.) Osbek. × *C. trifoliata* L.), Rangpur lime (*C. limonia* Usbek.), Rough lemon (*C. jambhiri* Lush.) and Sour orange (*Citrus aurantium* Linn.) was attempted.

Methods

The experiment was undertaken at the college of Horticulture and Forestry, Jhalawar, Rajasthan, during 2007-08. The seeds of rootstocks of Carrizo, Rangpur lime, Rough lemon and Sour orange were sown during third week of October, 2007 over raised beds. The seeds were collected from Agricultural Research Station, Sriganganagar (RAU), Rajasthan. The data pertaining to peak period of germination, length of plumule, number of nodes, number of

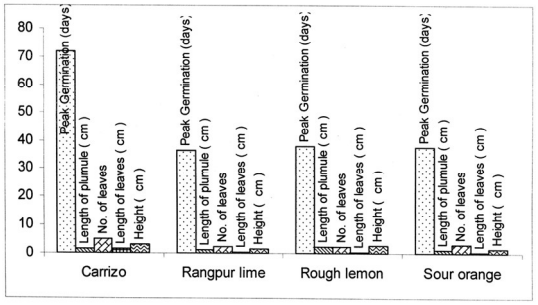

Figure 1. Growth of different rootstocks in primary nursery.

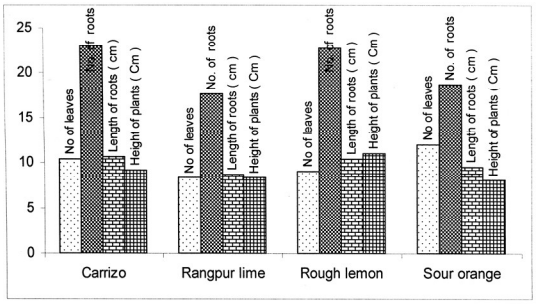

Figure 2. Growth of different rootstocks in secondary nursery.

leaves, length of leaves and height of plants in primary nursery after one month of sowing were recorded and those number of leaves, number of roots, length of roots and height of plant in secondary nursery after a week of shifting were recorded. The duration during which maximum number of seeds germinated was recorded to observe peak period of germination. The plants were shifted in secondary nursery during first week of March, 2007. The experiment was laid out in randomized block design with three replications. The recorded data were subjected to analysis and their significance was recorded at 5% level of significance.

Results and Discussion

Growth Performance of Rootstocks in Primary Nursery

Carrizo showed the most delayed peak period of germination (Table 1). In this species, peak period of germination was 72.0 days followed by 38.00 days in Rough lemon, 37.33 days in Sour orange and 36.33 days in Rangpur lime. Regarding length of plumule, it was maximum (2.39 cm) in Rough lemon followed by Carrizo, Sour orange and Rangpur lime. In Carrizo, the height of plant at the germination was 3.23 which was significantly higher over the height (2.72 cm) of Rough lemon. The height of Rangpur lime plant at the time of germination was 1.45 cm and it was closely followed by Sour orange in which it was 1.27 cm. After 24 days of sowing, the number of nodes, number of leaves and length of leaves were maximum in Carrizo and the corresponding value for these traits were 5.16, 5.00 and 1.40 cm. respectively. These values were significantly different and were closely followed by Rough lemon in which the corresponding values were 1.46, 2.33 and 0.56 cm respectively. Sour orange had significantly higher number of nodes (1.26) and number of leaves (3.00) over Rangpur lime in which the number of node was 1.20 and number of leaves was 2.33. The length of the leaves was recorded significantly higher in Rough lemon over Rangpur lime.

Growth Performance of Rootstocks on Secondary Nursery

In secondary nursery maximum number of leaves was observed in Sour orange (12.0) followed by Carrizo (10.33) Rough lemon (9.0) and Rangpur lime. Maximum number of roots (23.00) was observed in Carrizo followed by Rough lemon (22.66), Sour orange (18.66) and Rangpur lime (17.66). Regarding length of roots, it was significantly higher in Carrizo followed by Rough lemon (10.43), Sour orange (9.5) and Rangpur lime (8.66). Significantly higher height (11.03 cm) of plants at the time of shifting in secondary nursery was observed in Rough lemon followed by Carrizo (9.2), Rangpur lime (8.36) and Sour orange (8.06). The invigorative behavior of Rough lemon has been reported.

The delayed peak period of germination in Carrizo compared to Sour orange, Rough lemon and Rangpur lime might be due to relatively more concentration of seed germination inhibitory substan-ces

Table 1. Growth and performance of different rootstocks of citrus.

	Treatment/ rootstocks	Primary nursery				Secondary nursery			
		Peak period of germination (days)	Length of plumule (cm)	No. of leaves	Length of leaves (cm)	Height (cm)	No. of leaves	No. of roots	Length of roots (cm)	Height of plants (cm)
1	Carrizo	72.0	1.46	5.00	1.40	3.23	10.33	23.00	10.66	9.20
2	Rangpur lime	36.33	1.03	2.33	0.50	1.45	8.33	17.66	8.66	8.36
3	Rough lemon	38.00	2.39	2.33	0.56	2.72	9.00	22.66	10.43	11.03
4	Sour orange	37.33	1.35	3.20	0.40	1.72	12.00	18.66	9.50	8.06
	CD (5%)	03.08	0.17	1.05	0.17	0.07	1.15	1.64	0.63	0.52
	SE ±	01.59	0.09	0.54	0.85	0.03	0.59	0.85	0.33	0.27

usually found in the seeds. The function of germination inhibitors has been narrated by Evenari (8). These germination inhibitors may be phenolics, coumarin and abscissic acid. Further, mucilage, which imbibes upon absorption of moisture following imbibitions of seeds, restricts oxygen supply to the embryo proves as an inhibitor (9), may being in lar-ger quantity might delay peak period of germination in Carrizo. It may have consequent impact upon growth and vigor of the seedlings. The difference in growth behavior may be due to genetic make up of the rootstocks. In primary nursery, Carrizo had the maximum height of plants over Rangpur lime, Rough lemon and Sour orange. It may be due to better exploring capability of roots of Carrizo as compared to other rootstocks in context along with its more root proliferation (Table 1). In secondary nursery, maximum height of the plant was recorded in Rough lemon. Regarding the vigor of Rough lemon, it may be due to more exploration of nutrients through its more number of roots in comparison to other root stocks. It has been well narrated (10) that the absorption of high water and nutrient from the soil is related to the capacity of the plant to develop extensive root system.

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