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Effect of Various Rootstocks on Vigour and Productivity of Kinnow Mandarin

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Abstract

The performance of Kinnow mandarin (*Citrus reticulata* Blanco) on six citrus rootstocks i.e. Citrumelo 4475, Citrumelo 1452, Volkamariana, Yuma citrange, Mithi and Rough lemon was studied during its sixth and seventh year of transplanting. Plant height was not affected by the rootstocks used. Maximum canopy spread and stem girth were recorded on Mithi while minimum canopy spread and stem girth were on Yuma citrange and Citrumelo 1452 respectively. Fruit set was not influenced significantly by the rootstocks used. Although fruit drops in grafted plants ranged from 35.75-93.33 percent from button to pre-harvest drop, the rootstock means in each drop were non-significant. The highest mean number of fruits/plant was 285 fruits on Citrumelo 4475 and the lowest 77.5 fruits on Yuma citrange rootstock.

Introduction

Among several citrus cultivars in Pakistan Kinnow mandarin ranks first in area and production due to its superb quality for local consumption and export. Recently sporadic reports have started appearing, indicating that Kinnow is on progressive decline. The decline may appear due to a number of, cultural and environmental factors including the use of improper rootstock. Besides affecting the vigour and productivity, rootstock also influences disease incidence and longevity of trees in the orchard.

Growers have sought large, vigorous, highly productive trees in the past. Today smaller high yielding trees are of interest because of their suitability for close planting, but the research for appropriate rootstock has not been very rewarding. A number of experiments have been reported in the literature to find out suitable rootstocks for different commercial species of citrus throughout the world (Wutscher and Shull, 1976; Castle and Phillips, 1980; Hutchison, 1982; Jalikop *et al.*, 1986; Fallahi *et al.*, 1989; Roose *et al.*, 1989; Holtzhausen *et al.*, 1992; Wutscher, 1992; Rao *et al.*, 1996). The performance of different rootstocks is found variable under different climatic and edaphic conditions. Hence it becomes desirable to conduct studies under local conditions to recommend dependable rootstocks.

Materials and Methods

Present studies were conducted at the Experimental fruit Garden, Department of Horticulture, University of Agriculture, Faisalabad on Kinnow mandarin grafted on the following six rootstocks; Citrumelo 4475, Citrumelo 1452, Volkamariana, Yuma citrange, Mithi (a sweet strain of Rough lemon) and Rough lemon. Six years old plants growing under similar soil and cultural conditions were selected. These plants were growing as a part of an on going rootstock research project. The experiment was laid out according to a Randomized complete block design in three replications. To observe the vigour of the plants, plant height, stem girth and width of canopy was measured. To observe the effect of rootstocks on productivity of the plants, twenty flushes of each plant were marked and data were recorded on fruit set (%) and fruit drops i.e. button drop, June drop and pre-harvest drop. For fruit drop, data were collected weekly after fruit set till harvest. At harvesting, total number of fruits per plant were counted to

obtain the yield data. The experiment was repeated the following year (when plant age was seven years), designated as second year of observation and data on same parameters were recorded. The data thus collected were analysed statistically using the Fisher's analysis of variance technique and the means were compared using Duncan's multiple range test at 5 percent probability (Petersen, 1994).

Results and Discussion

Plant vigour: It appeared from the data that none of the rootstocks contributed much towards plant height of the scion cultivar (Table 1 and 2). The data on stem girth and canopy spread reflected the efficiency of a rootstock and its effect on the vigour of scion cultivar. The Mithi rootstock differed significantly for both of these parameters with other rootstocks studied, as this maintained significant superiority over these (Table 1 and 2). The stem girth and canopy spread can not be considered as the only aspects of growth. These could provide, however, a support to understand the effect of rootstock on the vigour of plants. In the present studies Mithi proved the vigorous rootstock for Kinnow as compared to the other rootstocks studied. Many workers have studied the effects of rootstocks on vigour of various citrus cultivars. The results of present study are in accordance with the findings of Jalikop *et al.* (1986), Valle *et al.* (1987) and Rao *et al.* (1996), who have already reported differences among various rootstocks for plant vigour.

Fruit set: Information procured on fruit setting depicted nonsignificant differences for rootstock effect (Table 1 and 2). Fruit set, therefore, appeared not to be affected by the rootstocks used. It suggests that various rootstocks produced identical material responsible for fruit set but it is only the environmental conditions, which were favourable and no significant differences could be identified. The plant vigour could be a contributing factor in inducing fruitfulness. However, increased fruit set can be obtained by increased nitrogen, which has already been proved earlier (Sharpies and Hilgeman, 1969; Smith, 1969).

Fruit drop: Information recorded on various fruit drops i.e. button drop, June drop and pre-harvest drop spelt out non-significant differences for various rootstocks. However, it

Table 1: Performance of Kinnow mandarin grafted on different rootstocks during 1st year of observation*

Rootstock used	Plant height (m)	Stem girth (m)	Canopy spread (m)	Fruit set (%)	Button drop (%)	June drop (%)	Preharvest drop (%)	No. of fruits per plant
Citrumelo 4475	2.54 a**	30.17 bc	2.09 bc	73.66 a	36.15 a	62.67 a	67.25 a	261.33 a
Citrumelo 1452	2.60 a	28.13 c	1.91 bc	70.93 a	57.14 a	64.89 a	70.20 a	212.33 a
Volkamariana	2.63 a	33.33 b	2.37 b	58.95 a	80.74 a	90.04 a	91.68 a	258.00 a
Yuma citrange	2.39 a	35.38 b	1.83 c	63.43 a	35.75 a	71.16 a	78.72 a	53.67 b
Mithi	2.66 a	51.60 a	2.53 a	62.20 a	77.37 a	82.11 a	89.00 a	210.00 a
Rough lemon	2.68 a	30.33 be	1.91 be	59.12 a	55.75 a	72.93 a	85.28 a	65.00 b

* When plants were 6 years old.

** Means sharing similar letters in a column are statistically non-significant at 5% probability (DMR test).

Table 2: Performance of Kinnow mandarin grafted on different rootstocks during 2nd year of observation*

Rootstock used	Plant height (m)	Stem girth (m)	Canopy spread (m)	Fruit set (%)	Button drop (%)	June drop (%)	Preharvest drop (%)	No. of fruits per plant
Citrumelo 4475	2.86 a**	33.33 bc	2.24 bc	74.33 a	36.33 a	62.73 a	67.86 a	310.10 a
Citrumelo 1452	2.93 a	29.33 c	2.09 bc	72.36 a	57.33 a	64.70 a	70.33 a	298.30 a
Volkamariana	2.97 a	35.00 bc	2.65 ab	59.78 a	80.33 a	89.73 a	93.33 a	301.70 a
Yuma citrange	2.72 a	38.33 b	1.95 c	65.66 a	36.23 a	71.15 a	78.17 a	102.00 b
Mithi	2.97 a	51.67 a	2.83 a	62.33 a	77.10 a	81.60 a	89.00 a	280.00 a
Rough lemon	3.00 a	32.33 bc	2.10 be	60.00 a	55.63 a	73.10 a	85.29 a	115.00 b

* When plants were 7 years old.

** Means sharing similar letters in a column are statistically non-significant at 5% probability (DMR test)

ranged between 35.75 to 93.33 percent from button to pre-harvest drops (Table 1 and 2). In all the drops, maximum was in Volkamariana (pre-harvest = 93.33%) and minimum in Yuma citrange (button drop = 35.75%). Data on fruit drops revealed non-significant differences for the rootstock effect which indicate that the fruit drop is not dependent on any particular rootstock. Some unknown factors may be involved for the induction of fruit drop at various intervals. Such factors could be of environmental or physiological nature.

Yield per plant: Data on plant yield revealed significant differences for various rootstock means. Results indicated that Citrumelo 4475, Citrumelo 1452, Volkamariana and Mithi constituted one group while Rough lemon and Yuma citrange formed another group. Members of each group stood at par but former group pre-dominated over the latter (Table 1 and 2). Yield is the outcome of a number of factors. Plant health and vigour also contribute towards the yield. It is interesting to note that four rootstocks behaved alike in their own group. This offers a very weak point to pin out the superiority of a particular rootstock over others. It means that some other factors besides these would be considered to account for the yield factor. Citrumelo 4475 has been widely accepted as a new rootstock in USA due to its performance and is also being adapted for large-scale plantings in South Africa (Wutscher, 1992). In the present study, Citrumelo 4475 also gave the highest yield in terms of number of fruits/tree. While Mithi proved the vigorous rootstock in the present studies.

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