



## Evaluation of seedlings of different species of citrus under Hadauti region of Rajasthan

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### ABSTRACT

To evaluate seedlings of different species of citrus in terms of growth parameters, an experiment was conducted during 2007-08 at the college of Horticulture and Forestry, (MPUAT), Jhalrapatan, Jhalawar. It was found that Rough lemon had maximum growth in terms of height, number of leaves, length of nodes and number of nodes. The maximum water potential of leaves was recorded under Carrizo rootstock though it was at par with Rough lemon. Leaf area and perimeter were found maximum under Sour orange. It was found that out of the seedlings of different species of citrus tested, Rough lemon had vigorous growth performance.

**Key Words:** Growth variations, citrus, seedlings

### INTRODUCTION

Commonly, citrus is not grown on its own roots (Rajput and Babu, 7). Seedlings of different species are used as rootstocks for raising plants of commercially important types in citrus. They affect growth behaviour of scion invariably (Jones and Lacey, 5). Seedlings, show greater tolerance to adverse soil, climate and disease endemics (Singh, 10) and when used as rootstock for raising scion, by vested stionic effect (Pathak, 6), makes able to grow a particular type of scion even under adversities of soil and climate. It has been observed that more than 20 characteristics are influenced by rootstock including tree vigour and size, depth of rooting, freeze tolerance, adaptation to certain soil conditions, resistance to certain diseases and pests, fruit yield, size, texture, internal quality and maturity date (Castle, 2). In an endeavour to observe the performance of seedlings of different species of citrus numerous works have been made for a particular soil and climatic conditions.

However, information pertaining to performance of seedlings particularly under Hadauti region of Rajasthan, is very scarce. The region is known as mini- nagpur of Rajasthan as far as mandarin production is concerned. Mandarin occupies 8062 hectare area in the region and the total production is of the order of 1.0 lakh ton (Singh *et al.*, 11) known for citrus production especially Nagpur mandarin, in present investigation attempt has been made to draw inferences pertaining to growth performance of seedlings of the Carrizo, Rough lemon, Sour orange and Rangpur lime under this region which

have well proven potential to be used as a rootstocks in various parts of the country. The finding will be of use in observing the impact of seedlings if used as a rootstock on growth behaviour of scion.

### MATERIALS AND METHODS

The present investigation was carried out at the Experimental farm, College of Horticulture and Forestry (MPUAT), Jhalrapatan, Jhalawar during 2007-08. Seeds of rootstocks; Carrizo (*Citrus trifoliata* L. x *C.sinensis* Osbeck), Rangpur lime (*C.limon* Tanaka), Rough lemon (*C.jambhiri* Lush) and Sour orange (*C.aurantium* L) were sown during third week of October, 2007 over raised beds. The plants were shifted in secondary nursery under open during first week of March, 2007. The data were recorded pertaining to variation in height, number of leaves, length of nodes and number of nodes three months after shifting in secondary when plants resumed growth till July. Periodic variation in growth parameters were recorded. Water potential, leaf area and leaf perimeter was also recorded during July in different seedlings. Water potential was observed using PSYPRO, Water potential system, WESCOR, USA. Leaf area and leaf perimeter were recorded using Leaf area meter. The correlation coefficient among different parameters were observed using Pearson correlation (single tail) method. The experimental area falls under Hadauti region of Rajasthan. The region lies in south- eastern part of Rajasthan and dominated by rocky- hilly terrain with shallow soil depth. It receives on average 1000-1200 mm rainfall and the area remains almost free from frost. During summer the temperature touches the mark of 43- 48°C and during winter it falls to 1- 2.6°C. The experiment was carried out in Randomized Block Design with three

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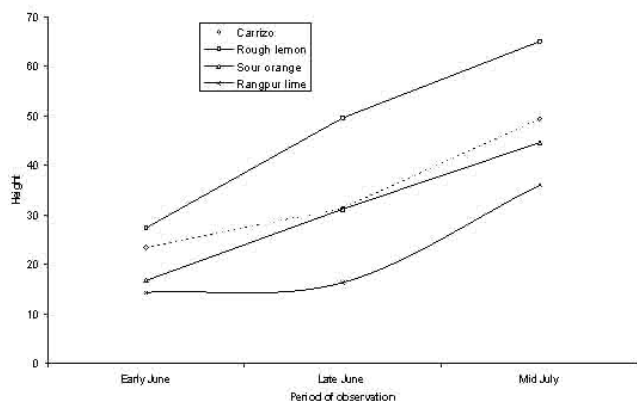
replications and 10 plants formed unit for recording the data. The recorded data were subjected to analysis and their significance was recorded at 5% level of significance.

### RESULTS AND DISCUSSION

With advancement of growing period, significant variations in height, number of leaves, length of nodes and in number of nodes were recorded. Maximum height (47.33 cm) of plants was there under Rough lemon plant (Table 1, Fig. 1). During July, the height was maximum (48.75 cm). It had significant edge over the height observed during early June and late June. Regarding interaction, Rough lemon plant during July had maximum height (65 cm).

**Table 1.** Variation in Height (cm) of seedlings of different species of citrus during successive periods.

Rootstock	Period of observation			
	Early June	Late June	Mid June	Mean
Carrizo	23.4	31.4	49.4	34.73
Rough lemon	27.4	49.6	65	47.33
Sour orange	16.8	31.2	44.6	30.87
Rangpur lime	14.4	16.4	36	22.27
Mean	20.5	32.15	48.75	33.8
	CD (0.05)			
Rootstock	0.95			
Period	0.82			
Rootstock X Period	1.65			

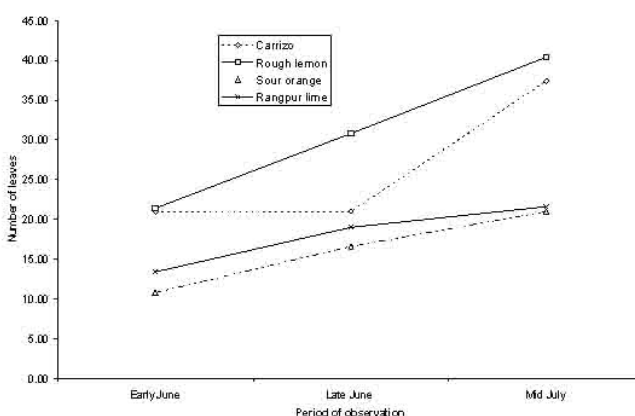


**Fig. 1.** Variation in Height (cm) of seedlings of different species of citrus during successive periods.

All rootstocks expressed variations in number of leaves (Table 2 Fig. 2). Maximum number of leaves (30.87) was recorded in Rough lemon which was significantly higher than Carrizo, Rangpur lime and Rough lemon respectively. Significantly higher number (30.10) of leaves was observed during July. Interaction

**Table 2.** Variation in Number of leaves of seedlings of different species of citrus during successive periods.

Rootstock	Period of observation			
	Early June	Late June	Mid June	Mean
Carrizo	21.00	21.00	37.4	26.47
Rough lemon	21.40	30.80	40.4	30.87
Sour orange	10.80	16.60	21.0	16.13
Rangpur lime	13.40	19.00	21.6	18.00
Mean	16.65	21.85	30.10	22.87
	CD (0.05)			
Rootstock	0.719			
Period	0.622			
Rootstock X Period	1.245			



**Fig. 2.** Variation in Number of leaves of seedlings of different species of citrus during successive periods.

effect of rootstock and period was found significant. Maximum number of leaves (40.4) was recorded in Rough lemon during July.

Significant variation in length of nodes of different rootstocks was noted which are presented in Table 3 and through Fig 3. The maximum length of node (5.13 cm) was recorded in Rough lemon. It was significantly higher than that recorded in Carrizo (4.29 cm), Rangpur lime (3.41 cm) and Sour orange (1.41 cm). Maximum length of nodes (5.42 cm) was observed during July which was significantly different than that recorded during late June (3.78 cm) and early June (1.50 cm) respectively. The interaction effect of rootstock and period was found significant. Maximum length (7.54 cm) of nodes was noted under Rough lemon during mid July. It was on a par (7.5 cm) with Carrizo.

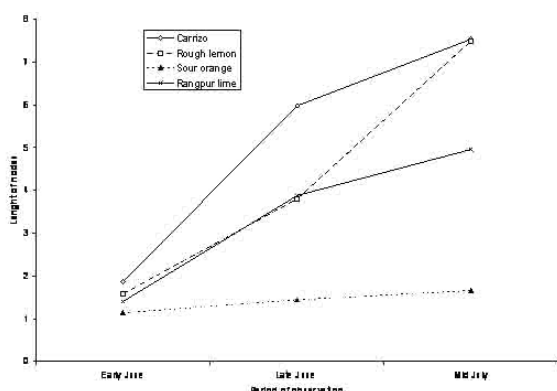
Different rootstocks varied significantly in their number of nodes (Table 4, Fig. 4). Significantly higher (4.80) number of nodes was found in Rough lemon than all other seedlings. Sour orange and Rangpur lime were on a par with respect to number of nodes. Significant

**Table 3.** Variation in Length of nodes (cm) of seedlings of different species of citrus during successive periods.

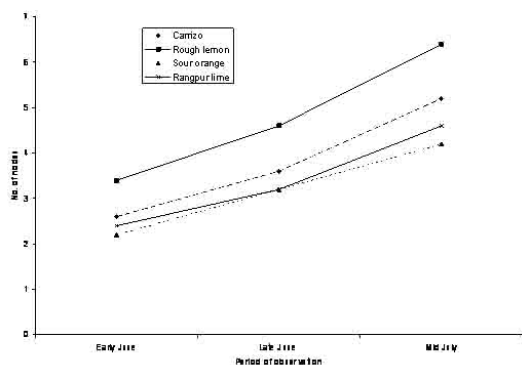
Rootstock	Period of observation			Mean
	Early June	Late June	Mid June	
Carrizo	1.58	3.8	7.5	4.29
Rough lemon	1.86	5.98	7.54	5.13
Sour orange	1.14	1.44	1.66	1.41
Rangpur lime	1.4	3.88	4.96	3.41
Mean	1.50	3.78	5.42	3.56
	CD (0.05)			
Rootstock				0.314
Period				0.272
Rootstock x Period				0.544

**Table 4.** Variation in Number of nodes of seedlings of different species of citrus during successive periods.

Rootstock	Period of observation			Mean
	Early June	Late June	Mid June	
Carrizo	2.6	3.6	5.20	3.80
Rough lemon	3.4	4.6	6.40	4.80
Sour orange	2.2	3.2	4.20	3.20
Rangpur lime	2.4	3.2	4.60	3.40
Mean	2.65	3.65	5.10	3.80
	CD (0.05)			
Rootstock				0.373
Period				0.323
Rootstock x Period				0.646



**Fig. 3.** Variation in Length of nodes (cm) of seedlings of different species of citrus during successive periods.



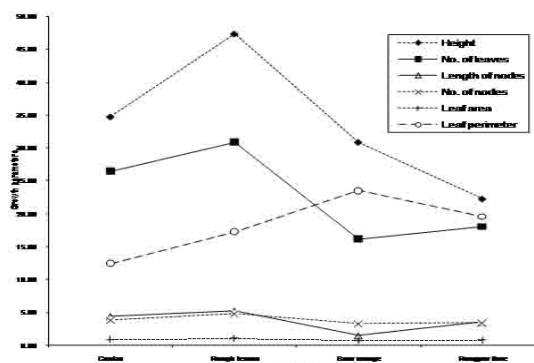
**Fig. 4.** Variation in Number of nodes of seedlings of different species of citrus during successive periods.

variation in number of nodes was noted in seedlings of different species of citrus during different periods. However, significantly maximum number of nodes (5.10) was recorded during July. Pertaining to interaction, Rough lemon during mid July had significantly higher number (6.40) of nodes.

Variations in water potential, leaf area and leaf

**Table 5.** Variation in Water potential, Leaf area and Leaf perimeter of seedlings of different species of citrus.

Rootstock	Water potential (- MPa)	Leaf area (cm <sup>2</sup> )	Leaf perimeter (cm)
Carrizo	0.03	8.66	12.38
Rough lemon	0.03	21.60	17.26
Sour orange	0.04	26.56	23.52
Rangpur lime	0.05	24.56	19.52
CD (5 %)	0.007	0.110	0.078



**Fig. 5.** Variation in Water potential, Leaf area and Leaf perimeter of seedlings of different species of citrus.

perimeter as observed under seedlings of different species are presented in Table 5. The minimum leaf water potential was observed in Rangpur lime (-0.05 Mpa) which was significantly lower than the sour orange (-0.04 Mpa). Carrizo and Rough lemon were at par with each other. Sour orange had maximum leaf area (26.56 cm<sup>2</sup>) significantly higher than Rangpur lime, Rough lemon and Carrizo. Leaf perimeter was significantly higher (23.52 cm) in Sour orange followed by Rangpur lime, Rough lemon and Carrizo.

**Table 6.** Correlation between different growth parameters in seedlings of different species of citrus.

Growth parameters	Height (cm)	Number of leaves	Length of nodes(cm)	Number of nodes	Leaf area (cm <sup>2</sup> )	Leaf perimeter (cm)
Height (cm)	1	0.860	0.601	0.895	-0.241	-0.337
Number of leaves	0.860	1	0.910*	0.939*	-0.560	-0.727
Length of nodes(cm)	0.601	0.910*	1	0.857	-0.533	-0.780
Number of nodes	0.895	0.939*	0.857	1	-0.242	-0.470
Leaf area(cm <sup>2</sup> )	-0.241	-0.560	-0.533	-0.242	1	0.939*
Leaf perimeter(cm)	-0.337	-0.727	-0.780	-0.470	0.939*	1

\* Correlation - significant at 0.05 % level

Correlation among different growth parameters are presented in Table 6. Height of seedlings was found positively correlated with number of leaves, length of nodes and number of nodes while it was found negatively correlated with leaf area and leaf perimeter. Significant positive correlation was noted among number of leaves and length of nodes, no. of leaves and no. of nodes, leaf perimeter and leaf area. Leaf area and leaf perimeter were found negatively correlated with all other parameters. From the table it appears that number of leaves, length of nodes and no. of nodes had positive correlation with height of seedlings of different species

Significant variation in height, no. of leaves, length of nodes and no. of nodes were noted with advancement of growing periods. It may be due to ongoing development process accounted to cell division, expansion and differentiation governing size, shape and structure of plants (Taiz and Zeiger, 13). Rough lemon had maximum height, no. of leaves, length of nodes, and no. of nodes over Carrizo, Sour orange and Rangpur lime. It may be due to better potency of Rough lemon to absorb and translocate nutrients besides better photosynthetic ability as appears clearly from more no. of leaves. The role of leaves in photosynthate production has been highlighted by Sestak (8). The vigorous attribute of Rough lemon has also been highlighted by Singh (9) and by Bhullar and Nauriyal (1). The positive correlation of no. of nodes, length of nodes and no. of leaves with height may be explained in the light of photosynthate production and consequently the energy generation. The role of energy in regulation of growth has been narrated by Singh (12). Leaf area and perimeter showed negative correlation with height and related attributes. It may be due to inefficient translocation of photosynthate produced in leaves to another organ. Photosynthetic rate, efficiencies and its influence on crop has been elaborated by Evans (3) and by Gifford and Evans (4) where they reported an association of crop response and photosynthetic efficiency.

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