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EARLY AGE PROPAGATION OF THREE COMMERCIAL *CITRUS* SPECIES THROUGH MICROBUDDING TECHNIQUE

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Microbudding technique was explored for early age propagation in Sweet lime, Grapefruit cv. Shambar and Mandarin cv. Feutrell's early under controlled conditions. The technique showed a successful union in sweet lime (76 %) followed by grapefruit (68 %) and Feutrell's early (44.0%). No significant differences were recorded in plant height while stem girth was much higher in grapefruit compared to other citrus species. The leaf blade length (8.76 cm) was maximum in sweet lime where as minimum was (5.76 cm) in Feutrell's early. Sweet lime and grapefruit performance was at par in relation to width of leaf blade while it was minimum (3.02 cm) in the case of Feutrell's early.

Keywords: Microbudding, propagation, *citrus*

INTRODUCTION

Citrus in general is propagated through both sexual and asexual means. Rootstock seedlings are raised through seeds and these seedlings become ready for budding or grafting after 12-18 months after transplanting in nursery beds and budding usually done at any time during spring (Feb, March) or Autumn (Aug, Oct). In Punjab mainly citrus is propagated by T-budding or shield budding on rough lemon (*Citrus jambhiri* L.) rootstock.

Microbudding technique is an innovative method of producing infant citrus trees, which could revolutionize the citrus fruit tree industry by saving growers time, space and money. The technique enables the production of budded plants faster at lower cost as compared to other conventionally budded trees with considerably less space. The procedure was successful with several scion stock combinations that were micro budded through out the year in a green house conditions (Skaria, 2000; Abbas, 2004). Citrus usually takes 3-4 years to bear fruit, but plants produced through microbudding the entire process may be reduced to two years (Skaria and Ana, 1999). The present research studies were initiated to find out early age propagation of three commercial cultivars by microbudding, and to determine the comparative efficacy of this technique in these three contrasting species.

MATERIALS AND METHODS

The plant material [Sweet lime (*C. limettioides* Tanaka), Grapefruit (*C. paradisi* Macf.) cv. Shambar and Mandarin cv. Feutrell's early (*C. reticulata* Blanco)] was obtained from the Experimental Fruit Garden, Institute of Horticultural Sciences, University of Agriculture, Faisalabad. Seeds of rough lemon (*C. jambhiri* L.) were sown in greenhouse under control conditions at 27°C (Abbas, 2002). 4-6 months old seedlings were transplanted in pots and kept at 25 ± 2°C. Leaf manure, sand and silt in 1:1:1 ratio was mixed, sterilized and were put into the plastic pots measuring 15 x 20 cm. The plants were supplemented with 5ml L^{-1} Hoagland solution, as a source of nutrients (Abbas, 2004). The plants were irrigated on weekly basis. Bud wood of 3 and 4 mm in size of each species was used for microbudding. The buds of both sizes were microbudded to rough lemon at the height of 10 and 14 cm. Data on microbudding success percentage, number of days to emerge first leaf, height of plant, scion diameter, number of leaves, and leaf width of microbudded plants was recorded for ten weeks. The experimental design was laid out according to completely randomised design (Steel and Torrie, 1984).

RESULTS AND DISCUSSION

Microbudding success percentage

Sweet lime when budded with 4 mm scion size on 10 cm height and Grapefruit cv. Shambar budded on 14 cm height with 3 mm scion size gave successful combination with 76% and 68 % success, respectively. The lowest success percentage was observed in Mandarin cv. Feutrell's early, when the budwood of 3mm and 4mm scion size was microbudded at 14cm and 10cm height (Table). Sweet lime was better in getting maximum success with overall combination of height and size compared to Feutrell's early with lowest success. These results showed similarity with Ochoa *et al.* (2000). They observed 61 % success in

Table: Success of microbudding technique in three citrus cultivars

Cultivar	Budwood Size (mm)	Rootstock Budding Height (cm)	Microbudding Success%	No. of Leaves	Leaf Length (cm)	Leaf Width (cm)	Scion Stem Diameter (mm)	Plant Height (cm)	No. of days to form First Leaf
Grapefruit "Shambar"	3	10	36.00cd	4.80bc	7.92ab	4.08ab	2.64de	12.5a	16.35(b)
		14	68.00ab	7.20a	6.64c	3.50bc	2.45def	9.08e	
	4	10	28.00d	2.60d	8.44a	4.90c	2.35ef	9.00e	
		14	36.00cd	7.20a	6.76ac	3.86bc	3.8a	19.76a	
Mandarin "Feutrell's Early"	3	10	28.00d	6.80a	6.36c	3.56bc	3.00bc	8.76e	17.05(b)
		14	24.00d	2.40d	6.68bc	3.82bc	2.30f	13.56c	
	4	10	24.00d	3.60cd	5.76c	3.02c	2.52def	17.28b	
		14	44.00c	4.00bc	6.76bc	3.60bc	2.52def	11.44cd	
Sweet lime	3	10	44.00c	4.20bc	8.68a	4.48a	2.22f	16.22a	19.80(a)
		14	60.00b	6.80a	6.02c	3.24bc	2.74cd	11.92cd	
	4	10	76.00a	5.00a	5.76c	3.08c	3.23a	12.58c	
		14	36.00cd	2.60a	8.76a	4.90a	3.18b	10.22de	

'Hamlin' sweet orange when microbudded on sour orange rootstock under the temperature regime 26.6-32.2°C.

Number of days to emerge first leaf after microbudding and number of leaves on microbudded plants

The number of days taken by the microbudded citrus plants to emerge their first leaf showed non-significant results. However, significant differences were recorded regarding number of leaf emergence from bud size and rootstock height treatments (Table). Maximum number of leaves (7.2) was recorded in Grapefruit cv. Shambar having 3 mm and 4 mm scion bud size budded at 14 cm height. The lowest leaves were obtained in Mandarin cv. Feutrell's early with 3 mm scion and in sweet lime having 4mm scion size, budded at 14 cm height gave 2.4 and 2.6 numbers of leaves, respectively. Similarly grapefruit with 4 mm scion size, budded at 10 cm height also gave the lowest (2.6) number of leaves. These three combinations showed non-significant effect on number of leaves. Overall Grapefruit performed better because it may have good tendency to produce leaves with rough lemon rootstock at 14 cm height. Abbas (2002) reported that maximum number of leaves (6) was observed in Musambi sweet orange scion buds of 3 mm size microbudded on rough lemon rootstock at 23 cm height.

Scion diameter of micro budded plants (mm)

Maximum scion diameter (3.8mm) was observed in Grapefruit cv. Shambar with 4 mm scion size budded at 14 cm height. This combination proved the best among all other combinations. The trend was followed by sweet lime with 4 mm scion size budded at 10 cm height and gave 3.23 mm of scion diameter. The lowest values were observed in sweet lime (2.2mm) and Mandarin cv. Feutrell's early (2.3mm) with 3 mm scion size budded at 14 cm height (2.3 mm scion diameter) and sweet lime with 3 mm scion size budded at 10 cm and 14cm height, respectively. The results showed that Grapefruit cv. Shambar was more responsive compared to all others for giving the better results in scion diameter development (Table). Lim *et al.* (2000) observed the similar results and reported that 5.66 mm of scion diameter was obtained under open environmental conditions, when shogun scion budded on Tangerine rootstock.

Height of micro budded plants (cm)

The interaction of height, size and type of species of microbudded plants showed that maximum height (19.76) cm was obtained in the combination of Shambar with 4 mm scion size, microbudded at 14 cm height. It was significantly highest than all other combinations with respect to providing more growth and development (Table). The lowest height (8.76cm) was recorded in Feutrell's early when budded at 10 cm height with 3 mm scion size. These results are in accordance with the findings of Abbas (2002) that Kinnow mandarin, microbudded at 6-inch rootstock with 4 mm scion size, showed maximum 10.65 cm height.

Leaf length and width of micro budded plants (cm)

The maximum length of leaf blade (8.76) cm was observed in sweet lime budded at 14 cm height with 4 mm bud size. Almost similar pattern was observed for sweet lime with 3 mm scion and Shambar with 4 mm scion size budded at 10 cm height (Table). The lowest leaf length (5.76) was found in Feutrell's early, microbudded at 10 cm height with 4 mm scion size.

The maximum leaf width (4.9) was observed in grapefruit and sweet lime of similar scion size (4mm), budded at 10 cm and 14 cm height, respectively. However, sweet lime budded at 10 cm height with 4 mm scion gave 3.08 cm leaf width, while Feutrell's early with 4 mm scion size budded at 10 cm height also gave the lowest (3.02cm) leaf width, which are statistically non significant from one another (Table). Grapefruit cv. Shambar performed better for leaf width, which shows its suitable stock-scion combination and top of this it seems that this species have peculiar growth characteristics.

CONCLUSION

Microbudding technique could be significantly and effectively utilized to produce citrus plants for early orchard establishment. Further more, besides the early orchard establishment this technique may also reduce the time for biological indexing of virus and virus-like diseases in citrus plants in general.

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