

Influence of Forcing Methods on Citrus Scion Growth in the Nursery

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ABSTRACT

In an effort to meet the ever increasing demand for budded citrus seedlings, for field planting, three forcing methods, namely: (1) Complete cutting back, (2) Looping partial cutting back and (3) Bending and tying served as the subplot treatments in the study. These forcing methods were superimposed on two popular sweet orange cultivars 'Agege 1' and Valencia late which served as the main plots, using Cleopatra mandarin rootstock seedling in Ibadan, Southwestern Nigeria. The experiment was laid out in 2 x 3 split plots design in randomized complete block.

Bending and tying method of forcing had 75.1% bud break and was significantly different from the percentage bud breaks of other forcing methods. There was no significant varietal differences in varietal bud break. Interaction was observed between cultivars and the forcing methods. Bending and tying method also had better growth attributes in number of leaves, scion length and diameter than the rest forcing methods. 'Agege 1' cultivar was also significantly different from Valencia late in most of the growth attributes measured. Twenty-four weeks after budding, bending and tying forcing method had 41.6cm-scion length, a mean value more than the minimum 30cm recommended for seedling field establishment. Looping partial cutting back and complete cutting back forcing methods had 29.6cm and 25.6cm respectively, yet to attain recommendation for field establishment.

Bending and tying method of forcing with the highest percent bud success and shortest period of citrus budding production is recommended in the nursery under the present condition.

INTRODUCTION

There is the need to increase budded citrus seedling production, with the increasing demand for budded citrus seedling in Nigeria. Many factors affect bud success and subsequent scion growth in the nursery. These factors include the skill of the budder, temperature, soil moisture, age of the rootstock at budding, rootstock/budstick type, wrapping materials, budding time/season, height of budding and forcing methods (Olaniyan, 1991; Aubert and Vulliam, 1998).

Forcing is a post budding operation employed in the production of citrus budded seedlings in the nursery. Its physiological basis is on the destruction of the apical dominance of the rootstock terminal stem and thus enabling growth processes to set out in the scion. If the apical dominance of the rootstock is not disturbed or destroyed, the bud success will be low and scion growth will be dormant or delayed (Young and Saule, 1978). Several methods of forcing are commonly used, it varies from one nursery to another. There is little agreement on which forcing

method is most effective in any given situation. In California, bending and tying is the most common forcing method (Plant and Opitz, 1973), whereas in Nigeria and Mediterranean areas it is complete cutting back/nicking forcing method (Aubert and Vulliam, 1998). The rootstock is cut just above the bud union. There is the need to compare the different types of forcing on 'Agege 1' and Valencia late sweet orange varieties (*Citrus sinensis* (L.) Osbeck). The two Sweet orange varieties are popularly cultivated in Southwestern Nigeria. Selecting the most suitable forcing method(s) may lead to higher bud success and vigorous budlings within relatively shorter nursery period, thereby increasing the turnout of budded seedlings.

MATERIALS AND METHODS

The study was conducted at the fruit nursery of the National Horticultural Research Institute (NIHORT), Head Quarters in Ibadan. The site lies between longitude 3°50' and 3°52' East and latitude 7°23'

and 7°25' North. The soils in the experimental area belong to the main soil series of Egbeda, Olorunda and Iwo (Jaiyeola, 1974). The area has wet season with high rainfall, from April to October and the dry season with low rainfall is from December to February with annual rainfall of 1280mm. The maximum temperature range is about 27.9°C – 34.7°C and minimum temperature range is about 20.0°C – 22.8°C. There is a wide range in temperature during the harmattan between December and February, with relatively cold late evenings and early morning and exceptionally hot noon. Relative humidity of NIHORT area is fairly high with ranges of about 73-87%, 38-47% and 83-95% at 09hrs, 15hrs and 21hrs respectively.

Nursery raised, eight months old cleopatra mandarin rootstock seedlings were budded with scions of Agege 1 and Valencia late Sweet orange cultivars in February, 1997 on separate plots (main plots). Each treatment plot area was 2.0m x 2.0m consisting thirty six seedlings with 1.0m guard row demarcating one plot from another. The size of each replicate was 5.0m x 7.0m (35.0m²) consisting of two main plots (Agege 1 and Valencia late). The total experimental area was 7.0m x 32.0m (224.0m²). Three forcing methods were employed, namely:

1. Complete cutting back (CCB)/Nicking above bud union.
2. Looping/partial cutting back of rootstock stem above bud union (L), and
3. Bending and tying to the base of the rootstock (BT).

The forcing treatments served as the sub-plots thus the experimental design was 2 x 3 split plots in randomized complete block layout replicated four times. The forcing treatments were imposed two weeks after budding. Budding was done within 3 days by the same set of budders to prevent variation due to budding skill and time.

Data collected included percent bud break and scion growth (Number of leaves, scion length and diameter). The data was subjected to analysis of variance and the means compared by least significant difference at P=0.05.

RESULTS

There were significant differences in percent bud break among the forcing methods twenty-eight days

after budding (Table 1). However, there was no significant difference between Agege 1 and Valencia late in percent bud break. Bending and tying forcing method was significantly superior to complete cutting back and lopping methods in percent bud break. Percent bud break of 53.87% recorded for looping was generally low for adoption. On later growth, bending and tying forcing method was better in scion growth (leaf number, scion length and diameter) than the other two forcing methods for most of the sampling periods (Table 2). Complete cutting back forcing method was significantly better than looping forcing method in number of leaves, twenty-four weeks after budding. However, looping forcing method was significantly superior to complete cutting back forcing method in scion length (Table 3). Their values were below 30cm scion length recommended for field establishment (Anonymous, 1977). There was also varietal superiority of scion growth attributes of Agege 1 over Valencia late, except in leaf number (Table 2). Interaction of forcing methods and varietal differences was also significant for the growth attributes, twenty-four weeks after budding (Table 3).

Table 1: Forcing and Varietal effects on Percentage bud break of citrus scion 28 days after Budding

	Percentage (%)			
	BT	L	CCB	Variety means
AG	73.49	49.75	73.79	65.68
VL	76.79	57.98	63.81	66.19
Forcing means	75.14	53.87	68.80	

CV (variety) = 9.14%

CV (Forcing) = 7.42%

LSD (P=0.05) forcing = 5.33

LSD (P=0.05) Variety = ns

LSD (P=0.05) Forcing x Variety = 7.54

AG = Agege 1, VL = Valencia late

BT = Bending and tying, L = Looping

CCB = Complete cutting back

Table 2: Influence of different forcing methods on Citrus Scion growth in the nursery.

Forcing methods	Mean Stem diameter (cm) Weeks after budding				Means Number of Leaves Weeks after budding				Means Scion length (cm) Weeks after budding			
	6	12	18	24	6	12	18	24	6	12	18	24
CCB	0.14	0.22	0.35	0.49	7.78	13.77	17.35	21.63	9.66	14.53	20.92	25.59
L	0.13	0.24	0.41	0.54	8.01	13.05	16.55	18.75	10.20	16.64	22.66	29.62
BT	0.21	0.45	0.59	0.74	10.55	17.88	22.49	26.59	13.21	23.21	32.88	41.65
LSD (P=0.05)	NS	0.17	0.15	0.10	NS	3.12	5.15	1.47	NS	5.85	6.52	1.73
CV%	15.21	12.25	14.25	4.78	18.55	13.22	12.12	7.42	19.22	15.21	14.44	14.91

Table 3: Forcing and Varietal effects on number of leaves, length and diameter of scion of Agege 1 and Valencia sweet orange cultivars twenty-four weeks after budding in the nursery.

Growth parameters	Varieties	Forcing Methods			Variety means
		BT	L	CCB	
Number of leaves (NL)	Agege 1	24.25	18.73	23.60	22.19
	Valencia	28.92	18.78	19.67	22.46
	Forcing means	26.59	18.75	21.63	
Scion length (cm) (SL)	Agege 1	40.83	34.46	27.69	34.33
	Valencia	42.46	24.78	23.59	30.25
	Forcing means	41.65	29.62	25.59	
Scion Diameter (cm) (SD)	Agege 1	0.79	0.57	0.57	0.64
	Valencia	0.64	0.51	0.42	0.52
	Forcing means	0.71	0.54	0.42	
	CV % (Variety)	LSD (P=0.05) Variety	CV% (Forcing)	LSD (P=0.05) forcing	LSD (P=0.05) Forcing x Variety
NL	9.11	NS	7.42	1.47	2.08
SL	7.09	2.97	4.91	1.73	2.44
SD	4.20	0.03	4.78	0.10	0.14

DISCUSSION

Buds have more chances to be successful, when there are processes that enhances the accumulation of specific carbohydrates and high indoleacetic acid (IAA) (Derpoll *et. al.* 1993). Bending and tying method could have favoured more carbohydrates and higher production of IAA which enhanced more bud success. Bending and tying forcing method, supported factors that improved bud success and

scion growth. This method of forcing suppressed growth of

rootstock sprout, while also supporting photosynthesis through its undisturbed plant parts. On the growth differences between Agege 1 and Valencia late Sweet orange varieties, scion varietal differences incompatibility with rootstock has been reported by Rice *et al.*, (1990), John and Malcolm

(2001). incompatible scion and stock should be avoided. Cleopatra mandarin rootstock was more compatible with Agege 1 scion than Valencia late variety in scion later growth.

CONCLUSION

The results obtained revealed that bending and tying method of forcing enhanced highest percent bud break and attained transplantable budlings faster than other forcing methods. Agege 1 Sweet orange performed better than Valencia late in scion later growth.

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