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EVALUATION AND PERFORMANCE OF MANGO TREE PROPAGATED BY WHIP-GRAFTING TECHNIQUE IN SEMI ARID REGION OF BORNO STATE

[1]Benisheikh, A.A.G, [2]Kolo, F.B.K. [3]Kolo, B.S, [4]Kurama. A.M [5]Mala.Modu
[1]Biotechnology Center, [5]Dept of Forest and Wildlife University of Maiduguri, Borno State, Nigeria.
[2,3]Department of S.L.T, Ramat Polytechnic Maiduguri, Borno State.
[4]Imam malik Islamic Centre P.O.Box 47 Maiduguri.

ABSTRACT
Experiment was conducted at Imam Malik Plant Nursery Unit of Maiduguri, Borno State. During the period of June 2008-December 2009, to investigate the use of whip-grafting technique for mango propagation, evaluation and performance of Mango propagated were determined using the Scion which is detached from the parent tree. The treatments were rootstock diameters of 1.5, 1.5 to 0.5 cm; Scion hardening methods in which the leaves were either removed or trimmed to half leaves, scion length of 8-9 or 15-16 cm, glasshouse and nursery shed conditions and two cultivars, namely Bokorram and Man lawan. The most viable scions with the highest number of successful graft were obtained when scions in which all the leaves were removed, were grafted on rootstock 0.5 diameter. There was no significant difference between two mango cultivars, but Manlawan tended to have higher values.

KEYWORDS: evaluation, performance, Mango tree, Propagated, by whip-grafting, technique, semi-arid region, Borno State

INTRODUCTION

The mango (*Magnifera indica*) member of family Anacardiacea, is amongs the most important tropical fruits of the world. Global production of mangoes is concentrated mainly in Asia and more precisely in India. Total world production was 24420116 metric tons in 1999(FAOSTAT,2000) with developing countries accounting for about 98% of total production. Nigeria still occupies the 8th position in the world ranking of mango producing countries as at 2002(2). Anacardiacea in order sapindales, is also called as king of the fruits (purseglove, 1972). (3), it originated in south east Asian or indo-Burma Region having 41 recognized species of mango originating as forest trees with fibrous and resinous fruits (Mukherjee, 1951,1967).

Mango has been cultivated for thousands of years in India (Mukherjee,1953 and Bompared, 1993) and its cultivation is as old as Indian civilization (Decandolle, 1884).

Though soil and climatic conditions are highly suitable for mango production, in semi arid region of Borno state, but certain inherent constraints are involved in its poor production, such as long juvenility, high clonal heterozygocity, one seed per fruit, recalcitrant seeds and large area requirement for assessment of hybrids. Thus, propagation by whip-grafting technique has quite helpful to overcome the problems.

Mango is self fertile (Sturrock, 1944) but cross pollination increases fruit set (Popenoe, 1917). There are two main types of mangoes, the Indian types with monoembryonic seeds and susceptible to anthracnose while the Indo-Chinese types with polyembryonic seeds and are tolerant to anthrocnose (Lespinasse and Frederic, 1998). Required hybrid populations can be maintained by grafting scions on established, plants and pre-selection of mango hybrids to discriminate undesired materials. Sharma *et al*. (1972). Found emergence of new growth flushes, with fruiting or immediately after harvesting as an indication of regular bearing. However the constraints of its product can also be minimized by minimizing the high fruit drop, shortening juvenility and polyembyony dilemma for the breeder and asset in rootstock propagation.

Grafting methods in which the mango scion is detached from the parent tree include crown grafting, budding and cleft grafting (Hartman and Kester 1983, Sidahmed 1992). The success of grafting methods depends on season, age, of Both rootstock and scion and cultivar (Ram and Sirohi,m 1989).

Whip-grafting and cleft grafting is generally used with rootstock of large diameters and normally more than one scion is inserted. However a modification has been recently made where younger rootstock and one scion can be used for large scale mango propagation (Kanwar and Bhajwa,1972).

Mass propagation of superior cultivars of mango suitable for export can only be achieved by the adoption of a grafting method where the scion is detached from the mother tree.

Longer scions resulted in significantly higher percentage of successful grafts than shorter ones. Grafted seedlings kept under glasshouse conditions resulted in 100% successful grafts as compared to those kept in the nursery shed due to the high relative humidity levels maintained in the glasshouse

MATERIALS AND METHODS

Experiments were conducted at Imam Malik plant Nursery unit of Maiduguri, Borno State, Nigeria between June 2008 and May 2009. Rootstock seedlings from "Duksharima (local breed) cultivar were grown from seeds and raised in nursery beds. After one month, seedlings stock transferred to pot filled with river bank silt and left in the nursery until they reached the suitable size for grafting and the other half was grafted in the nursery shed. The glasshouse was set at 25˚c during the night and 70% relative humidity.

Scion from "Bokorram and Manlawan" cultivars was selected from healthy parent trees grown in a private orchard at Jere area of Borno state. Healthy shoots containing swelling terminal buds were detached from mother plants on the same day of the experiments and kept in polyethylene bags ready for grafting.

Whip-grafting technique was use to study the evaluation and performance of propagated trees using rootstock diameter, scion length and scion hardening method on the success of grafting. Rootstock diameters were 0.5, 0.5-1.5 and 1.5cm, scion lengths were 8-9 and 15-16cm. two scion hardening methods were used. In the first method, all the leaves were detached before grafting, while in the second method 4-5 leaves surrounding the terminal bud were trimmed to half leaves. The treatments were arranged in a randomized complete block design with five replications.

The rootstock was decapitated 25cm above the soil surface and them split for subsequent insertions of the scion. The based end of the scion was wedged by making slanting cuts on both sides. Then, the split of the rootstock was opened and the cleft of the scion was slipped into it in such a way that the cambial layers of both the scion and rootstock were facing each other and met firmly. The graft union was then wrapped with paraffin film, and covered with a thin transparent polyethylene bag to ensure high relative humidity. Polyethylene bag were removed as soon as new leaves were formed and turned to green colour. Data on success of grafting were taking at weekly interval but results were presented only for the initial (first) week. The success of grafting was expressed in terms of scion viability which was rated using a scale of 1 to 5 as shown below 1, scion green and healthy, number of survived grafts was recorded after four months and expressed as percentage of total grafts.

Another experiments was carried out from July to December, 2009 to investigate the effects of the environment, viz nursery shed or glass house conditions on the success of grafting. Root stock diameters of 0.5-1.5cm and scion length of 8-9 and 15-16cm were used. Grafting was carried out but similar to the first experiments and success of grafting was followed in a similar manner. Half the grafted seedlings were raised at the previously mentioned conditions. The treatments were arranged in a randomized complete block design with five replications.

RESULTS AND DISCUSSIONS

The evaluation and performance of the whip-grafted mango were determined using parameters such as scion diameter scion hardening methods, scion viability and the numbers of successful grafts are indicated in Table 1. Scion diameter had a significant effect on both scion viability and number of successful grafts. Both parameters increased as scion diameter decreased to 1.5 to 0.5cm. When a rootstock diameter of 1.5 cm was used, scions appears yellow and severely desiccated after one week from grafting, while a rootstock diameter of 0.5 cm resulted in fairly green and healthy scions. The high percentage of successful grafts obtained with the smallest rootstock diameter was probably due to the juvenility of the thin rootstock. Juvenile rootstocks usually have vascular cambiums with active merstematic a successful graft union.

The interaction effects of cultivar and rootstock diameter on these parameters followed the same trend as described before between mango cultivars, Manlawan tended to have higher values than duksharima (Table 2).
The main effects of scion hardening methods were highly significant (Table 1). The highest values were obtained when all the leaves were removed from the scion as compared to scions in which the terminal 4 and 5 half leaves were retained. The high values of scion viability and the high percentage of successful grafts to the fact removal of leaves reduced the process of transpiration from the scion. And hence prevented its desiccation and resulted in the formation of a successful graft union.

The interaction effects of rootstock diameter and scion hardening method on scion viability and number of successful grafts were highly significant (Table 3). The best results were obtained when scions from which all the leaves were removed grafted on rootstocks of diameters ranging from 0.5 to 1.5 cm.

The main effects of environment and scion length on the number of successful grafts were significant. The glass house environment had significant higher successful grafts (100%) than nursery shed environment (85%). This is due to the high level of relative humidity maintained in the glasshouse which reduced to water loss from the scion and hence resulted in a successful union. Longer scion (15-16cm) resulted in a significantly ($p \leq 0.05$) higher percentage of successful grafts than and shorter ones (8-9cm). Ram and Sirori (1989) reported similar findings and suggested the use of relatively longer scions.

Neither rootstock diameter nor scion length had any significant effect on number of successful grafts under glasshouse conditions. This was due to the favorable environmental conditions prevailing in the glasshouse where relative humidity was very high, thus encouraging quick healing of the grafts union. However, under nursery shed conditions, longer scions grafted on thinner rootstocks resulted in significantly higher percentages of successful grafts obtained under nursery shed conditions was less than that obtained under glasshouse conditions. This was because the environmental conditions in the nursery shed, manifested in the level of relative humidity, was less than optimum for maximum success of graft union formation. These results suggest that the maintenance of high levels of relative humidity is of outmost importance for successful whip-grafting in mango and that nursery shed conditions can be used only during the rainy season.

RECOMMENDATIONS

Based on the outcome of the above results, we recommend the use of whip-grafting technique for mango propagation using diameters of 0.5 to 1.0 cm and scions 15cm long with all the leaves removed. During the selection of the scion we have to consider some important aspects; the scion wood must carry healthy buds that will grow into leafy shoot and the one year old wood is the best for whip-grafting. These shoots grew during the the previous year. Grafted seedlings should be kept in controlled conditions of relative humidity levels not less than 80% to ensure high success of graft union.

Table 1. Performance of roots stock grafting mango using diameter and scion hardening method on scion.

Treatment	Scion viability a week after grafting	Number of successful grafts (%)
Rootstock diameter (cm)		
1.5	1.92c	31.36
0.5-1.5	3.3b	64.0b
0.5	3.8a	76.59
Level of significance	#	##
Scion hardening method	4.1	82.0
All leaves retained	1.8	36.7
Level of significance	##	##

and # # significance at $p<0.05$ and 0.01 respectively. Means followed by the same letter within each column are not significantly different, according to Duncan's multiple range test.

Table 2. evaluation of mango cultivar and rootstock diameter on success of grafting.

Cultivar	Rootstock diameter(cm)	Scion viability of a week after grafted	Number of successful grafts (%)
Bokorram	1.5	2.0c	61.5c
	0.5-1.5	3.5ab	60.0ab
	0.5	4.0a	70.0a
Manlawan	1.5	1.7c	43.4c
	0.5-1.5	3.7b	65.0b
	0.5	3.4ab	77.0ab
Level of significance		#	# #

and # indicate significance at p≤0.05 and 0.01 respectively means followed by the same letter within each column are not significantly different according to Duncan's multiple range .

Table 3. Determination of the rootstock diameter and scion hardening method on scion viability and number of successful grafts

Rootstock diameter(cm)	Scion hardening method	Scion viability after a week of grafting	Number of successful graft(%)
1.5	All leaves removed 4-5 half leaves retained	2.8b 1.0c	55.0b 20.0c
0.5-1.5	All leaves removed 4-5 half leaves retained	4.9a 1.7c	93a 35bc
0.5	All leaves removed 4-5 half leaves retained	4.7a 2.8b	98a 55b
Level of significance		##	##

indicates significance at p≤0.01
Means followed by the same letter within each column are not significantly different, according to Duncans multiple test.

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Corresponding author
Benisheikh, A.A.G,
Biotechnology **C**enter, University of Maiduguri, Borno **S**tate, Nigeria
E-mail:abbabenisheikh@yahoo.com