Journal of Applied Horticulture, 21(1): 67-69, 2019

Standardization of time and method of propagation in avocado

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Abstract

Avocado is propagated by seed in India. The plants produced from seeds are not uniform and take long time to start bearing and fruit quality is unreliable. The propagation of superior clones of avocado by vegetative method is essential to avoid these problems. Thus a study was conducted to standardize the method and time of propagation of avocado through vegetative means. There were four methods of multiplication namely veneer grafting, cleft grafting, T- budding and patch budding which were performed in all the months of the year at CHES (IIHR), Chettalli. After 90 days of grafting , mean percent success was highest in cleft grafting (32.5%) while lower mean success was observed in veneer grafting (8.3%), T- budding (7.5%)and patching budding (5.8%). Among different months, highest mean success was recorded in month of September (32.5%) followed by 22.5 per cent in the month of March and August. Among different combinations of months and propagation methods, highest success (70 %) was recorded in cleft grafting performed in the month of September. This was closely followed by same method done in the month of March (60%). The success in cleft grafting is higher than other three methods in all 12 months. The growth of the scion was higher in grafting methods than budding methods. The percent transplantable seedlings after one year were highest (60%) in cleft grafting done in the month of September. It was concluded that cleft grafting in the month of September and March was found most suitable for the vegetative propagation of avocado under humid tropical conditions.

Key words: Avocado, propagation, grafting, budding

Introduction

Avocado (*Persea americana* Mill) is a native of tropical America specifically from Mexico and Central America. It is one of the most nutritive fruits and contains higher protein (up to 4%), fat (up to 30%) and low sugars (< 1.0 %). Avocado is mainly used fresh or in sandwich filling or in salads. It can also be used in ice creams and milk shakes and the pulp may be preserved by freezing. Avocado can be grown on a wide range of climate and soil conditions but it is sensitive to poor drainage and cannot withstand water-logging. In India, avocado was introduced from Sri Lanka in the early part of the twentieth century (Ghosh, 2000). It is grown at a limited scale in some parts of Tamil Nadu, Kerala, Karnataka and North Eastern Himalayan states. However plants are found growing in the home gardens of several other of the states of the country.

The cultivation of avocado is now gaining popularity by virtue of it's nutritional properties and increasing health awareness. In Kodagu (Karnataka) and The Nilgiri regions (Tamil Nadu), avocado is grown as one of the mixed crops in coffee-based cropping system. Almost each house is maintaining few plants of avocado (Chithiraichelvan *et al.*, 2002; Tripathi *et al*, 2014). In India, avocado is usually multiplied by seedlings originated from zygotic embryo mono-embryonic seed (Chithiraichelvan *et al.*, 2006). Due to cross-pollination, there is great variability in the seedlings produced from seeds, it is impossible to obtain genetically uniform plant as required for plantation of commercial orchards. These seedlings plants take long time to start bearing and fruit quality is unreliable (Whiley *et al.*, 2002).Vegetative propagation of superior clones of avocado by budding or grafting is essential to avoid these problem. Grafting/budding is also beneficial in utilization of rootstocks with *Phytophthora* and salinity tolerance for elite line and varieties (Castro *et al.*, 2009). Thus, there is a need to standardize the time and method of propagation in avocado under the tropical humid conditions of India so that the vegetatively propagated plants may be provided to the growers to get better yield and quality in future.

Material and methods

The experiment was conducted at Central Horticultural Experiment Station, Chettalli, Kodagu, Karnataka. The climate of Coorg is humid tropical with moderate temperature. The weather condition of Chettalli is given in Fig 1. Four method of propagation namely cleft grafting, veneer grafting, patch budding and T - budding were tried in all twelve months of the year starting from January to December with three replications and 10 plants were maintained each replication. For raising rootstocks, large sized fruits from vigourous trees were collected and the seedlings were raised in the potting medium of 1:1:1 (soil: sand: Farmyard Manure) for rootstock purpose. Four to six months old vigourous seedlings were used for grafting/budding.

The shoots of current season's growth of three to four months age from elite trees were used as scion material. The leaves from the scion shoots were removed 3 days prior to grafting. The grafting/budding was done on 15th of every month. The survival and growth of scion was recorded after 3 months of budding / grafting. The number of transplantable grafts/budlings was recorded after one year of budding/grafting. The data were analyzed using standard statistical procedures as described by Panse and Sukhatme (1995).

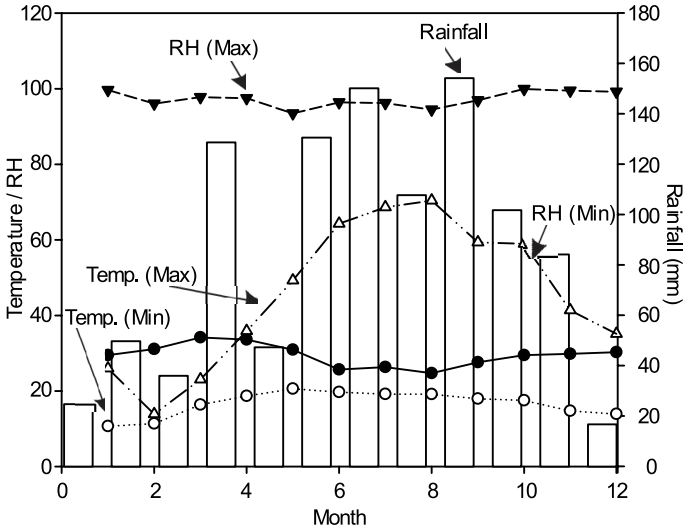

Fig. 1. Average weather conditions at experimenal site

Results and discussion

Grafting success: The data revealed that highest mean success of grafting was recorded in cleft grafting (32.5%) which was higher than other methods *viz.* veneer grafting (8.3%), patch budding (7.5%) and T- budding (5.8%). Among the different months of grafting, highest mean success was recorded in the month of September which was 32.5 per cent. This was closely followed by cleft grafting done in March month with 22.5 percent success. Among various combinations of methods and time of propagation, highest success (70%) was recorded in cleft grafting performed in the month of September. This was closely followed by cleft grafting done in the month of March with 60 percent success. The success was lower (10%) in winter months in cleft grafting. Moderate success (up to 40 %) was recorded in cleft grafting during the months of June, July and August.

In veneer grafting, highest success was only 20 percent in the month of July, August and September. T- budding and patch budding gave 20% success in the months of August and September but no success was recorded in these methods in most of the months (Table 1). The higher success in cleft grafting may be due to higher alignment of parenchymatous tissues of scion and rootstocks. The higher length of diagonal cut surface promotes proper alignment of vascular bundles of both graft partners to ensure fast union of grafts. Further higher success rate in cleft grafting may be due to growth of cambium both side of the graft because of equal diameter of scion and rootstock. (Ayala-Arreola *et al.* 2010, Simon and Elsa, 2013).The lower success in veneer grafting,T- budding and patch budding may be due to lesser contact of the growing cells.

The lower success in budding was due to lesser joining area for Cambium (Whitsell *et al.*, 1989). Higher success in cleft grafting up to 46 percent was earlier reported by Chithiraichelvan *et al.* (2006).The higher success in all the methods of propagation in rainy months may be attributed to the prevalence of higher relative humidity and moderate temperature during rainy season which may have provided better environmental conditions for graft union. The lower success in December , January and February months may be due to lower relative humidity and higher variation in the day and night temperatures.

Scion growth: As for as scion growth is concerned , it was highest in the cleft grafting (7.97 cm) followed by veneer grafting (5.01 cm). Less growth was recorded on patch budding (3.23 cm) and T- budding (2.75 cm) after three months of grafting / budding. The mean scion growth in different months ranged from 4.45 cm to 9.10 cm but there was no significant difference among the scion length in different months.Among various combinations of propagation methods and months of propagation, highest scion growth (10.3 cm) was observed in cleft grafting performed in the month of September. This was followed by cleft grafting in the month of October with 9.4 cm scion growth (Table 2)). Higher scion growth in grafting methods may be directly related with the length of scion used for multiplication. The higher length of scion in grafting resulted in faster growth while the single bud of budding methods taken more time to grow. Higher scion growth in rainy months may probably due to the active growth period of the plants (Whitsell *et al.*, 1989).

Percent transplantable grafts: The data revealed that highest transplantable grafts after one year were recorded in cleft grafting

Table 1. Grafting Success (%) in different methods of propagation after 3 months

Months/ Method	Cleft grafting	Veneer grafting	Patch budding	T-budding
January	10	0	0	0
February	10	0	0	0
March	60	10	10	10
April	30	10	0	0
May	30	0	10	0
June	40	10	10	10
July	40	20	10	10
August	40	20	20	10
September	70	20	20	20
October	30	10	10	10
November	20	0	0	0
December	10	0	0	0
Mean	32.5	8.3	7.5	5.8
CD (0.05)	Method	5.32	Month	5.68
	Int	8.25		

Table 2. Length of scion (cm) in different methods of propagation after 3 months

Months/ Method	Cleft grafting	Veneer grafting	Patch budding	T-budding
January	5.9	-	-	-
February	6	-	-	-
March	7.5	5.2	2.5	2.6
April	7.3	5.1	-	-
May	8.5	-	3.2	-
June	8.5	5.1	3.1	2.9
July	8.1	5.3	3.2	2.8
August	8.8	5.4	3.5	2.6
September	10.3	5.6	3.2	2.9
October	9.4	3.4	3.9	2.7
November	8.1	-	-	-
December	7.2	-	-	-
Mean	7.97	5.01	3.23	2.75
CD (0.05)	Method	0.89	Month	NS
	Int	2.11		

Table 3. Percent transplantable grafts after one year

Months/ Method	Cleft grafting	Veneer grafting	Patch budding	T-budding
January	10	0	0	0
February	10	0	0	0
March	50	0	10	0
April	30	0	0	0
May	30	0	0	0
June	40	0	0	0
July	40	10	0	0
August	40	10	0	0
September	60	10	0	10
October	30	10	0	0
November	20	0	0	0
December	10	0	0	0
Mean	30.8	3.3	0	0.83
CD (0.05)	Method	5.02	Month	5.31
	Int.	2.01		

(30.8 %) which was higher than other methods veneer grafting (3.3%), patch budding (0%) and T- budding (0.83%). Among different months of grafting/budding, highest transplantable grafts were recorded in the month of September which was 20.0 per cent. This was closely followed by March month with 15.0 percent success. Among various combinations of method and time of propagation, highest success (60%) was recorded in cleft grafting performed in the month of September. This was closely followed by cleft grafting in the month of March with 50 percent success. The numbers of transplantable grafts were very low or nil in veneer grafting, T- budding and patch budding in most of the months (Table 3). The results revealed that the mortality of grafts after 3 months was very low as most of the grafts once the reunion took place. This may be correlated with the faster growth of avocado seedlings and the climatic conditions.

On the basis of the above results, it was concluded that cleft grafting in the month of September or in the month of March is most appropriate for multiplication of avocado under humid tropical conditions of conditions of Western Ghats. The results of the study will be useful in multiplication of elite lines of avocado and helpful in expansion of avocado cultivation in subtropical humid region of the country.

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Received: October, 2018; Revised: November, 2018; Accepted: December, 2018