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EFFECT OF STRUCTURAL CONDITIONS ON VENEER GRAFTING SUCCESS AND SURVIVAL OF MANGO GRAFTS (*MANGIFERA INDICA* cv. BANGANPALLI)

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Abstract

An experiment was carried out to study the effect of time on veneer grafting success and survival of mango grafts at Horticultural College and Research Institute, Dr. Y.S.R. Horticultural University, Anantharajupet, Y.S.R. district of Andhra Pradesh (India) during the year 2012-2013. The results revealed that among the studied five structural conditions, Naturally ventilated polyhouse recorded significantly highest increment in sprout length (6.06 cm), graft height (17.92 cm), number of grafts sprouted (71.27%), minimum days required for sprouting of grafts (12.11 days), number of leaves per graft (17.34) and maximum survival per centage (67.18%) at 90 DAG (days after grafting).

Key words : Veneer grafting, structural conditions, survival, mango.

Introduction

Mango (*Mangifera indica* L.) is the choicest among all fruits of India and enjoys a great popularity. It is considered as the "king of fruits". Besides, having delicious taste, captivating flavor with multifarious colour, it is an excellent source of dietary nutrients. It is grown in almost all parts of the world and occupy a unique place amongst the fruit crops grown in India.

India is the largest producer of mango with an annual production of 151.9 lakh tonnes and an area of 22.97 lakh hectares. Andhra Pradesh stands first in area with 3.91 lakh ha. and second in production with 33.63 lakh tonnes (NHB, 2011). In Andhra Pradesh, Banganpalli is the most predominant commercial cultivar and it is also known as Baneshan in South India and Safeda in North India.

Provision of shade during and after grafting, was found to have beneficial effect on success of grafting. Light is essential for triggering photosynthetic activity and thereby better nourishment of grafts. The rate of photosynthetic activity varies with the level of shade (Swamy, 1993). This was mainly attributed to optimum temperature and relative humidity, but detailed studies were not made to develop technology to produce the grafts throughout the year. The demand for planting material/ veneer grafts is increasing every year, it is important to produce grafts throughout the year. This would be possible of we can take the advantage of by creating optimum temperature and relative humidity in different propagation structures. Therefore, the study was carried out to evaluate the effect of shade level on success of veneer grafting in mango in order to correlate with the prevailing temperature and relative humidity.

Materials and Methods

An experiment was conducted at Horticultural College and Research Institute, Dr. Y. S. R. Horticultural University, Anantharajupet, Y.S.R. district of Andhra Pradesh (India) during the year 2012-2013 in a Factorial Completely Randomized Design with three replications. Local Banglora seedlings of one year old were raised in polythene bags (13 cm × 10 cm) and used as a rootstock. A total of 3150 healthy mango seedlings were used for this experiment. The veneer grafting of mango was done using Banganpalli as scion at an interval of one month for seven consecutive months from 15th July to 15th January under five different structural conditions *i.e.* open condition, 50% shade in net house 75% shade in net house, naturally ventilated poly house and partial shade under

coconut trees. Observations were recorded on five grafts randomly selected 30, 60 and 90 days after grafting. The data were subjected to statistical analysis as per the procedure outlined by Panse and Sukhatme (1985) and the treatment means were compared by critical difference values computed at 5% level of significance.

Results and Discussion

Number of days required for emergence of sprout

There were significant differences among the propagation structures with respect to number of days taken for sprouting of grafts (table 1). Naturally ventilated polyhouse recorded the lowest number of days taken for sprouting (12.11) whereas, the highest number of days taken for sprouting was recorded by grafting in partial shade under coconut trees (13.46 days), which was on par with open condition (12.87 days). The lowest number of days taken for sprouting was observed by grafting on 15th September under naturally ventilated polyhouse (10.60), with regard to interactions. The greatest delay for sprouting was observed by grafting on 15th November under shade net 75% (17.53) followed by grafting on 15th November in partial shade under coconut (16.67 days). Sprouting of grafts was found to show maximum delay by grafting under open field conditions 15th September onwards which might be due to very low temperature that slowed down the process of bud sprouting. Optimum temperature plays an important role in photosynthetic activity and also in bud sprouting. Optimum temperature and water availability increase the rate of photosynthesis leading to production of more food material that facilitate improved growth and development of graft sprout. The advantages of such nature were found to benefit those grafts grafted on 15th July under naturally ventilated polyhouse conditions in the present study as evident from the weather data. Similar results were reported by Singh and Singh (2007) in jamun, Syamal *et al*. (2013) in bael.

Number of grafts sprouted (%)

The number of grafts sprouted was found to vary significantly among different times of grafting, propagation structures and their interactions (table 1). Among the propagation structures, the highest number of grafts sprouted was recorded by grafting under naturally ventilated polyhouse (71.27%) and the lowest was recorded in open condition (62.06%). Among the interactions, the highest number of grafts sprouted was observed by grafting on 15th July under open condition (87.77%) followed by grafting on 15th July under shade net 50% (84.44%). The lowest was recorded by grafting on 15th October in partial shade under coconut (35.55%). The highest number of grafts sprouted in July under open condition might be due to the favorable climatic conditions in terms of high temperatures and high relative humidity values. Similar opinion was also expressed by Iqbal (1982) in mango, Gowda and Melanta (1991) in cashew and Shinde *et al*. (2010) in jamun.

Number of leaves per graft

The data on number of leaves per graft showed significant differences among different times, propagation structures and their interactions at 90 days after grafting (table 2). The number of leaves per graft was found to be highest (17.34) under naturally ventilated polyhouse at 90 days after grafting. Grafting in partial shade under coconut was found to record the lowest number of leaves per graft (12.01). Among the interactions, the highest (24.60) number of leaves was observed by grafting on 15th July under open condition while the lowest (10.07) value recorded by grafting on 15th November in partial shade under coconut.

Sprout length

The data obtained on sprout length revealed that there were significant differences among different times, propagation structures respect to sprout length (table 2). The highest sprout length (6.06 cm) was recorded by grafting under naturally ventilated polyhouse followed by partial shade under coconut (5.93 cm), while the lowest (5.21 cm) sprout length was recorded by grafting under open conditions at 90 days after grafting. The interaction effect due to time of grafting and propagation structures was found to be non significant.

Graft height

There were significant differences among the time of grafting, propagation structures and their interactions with respect to graft height (table 3). The highest graft height (17.92 cm) was recorded by grafting undernaturally ventilated polyhouse followed by partial shade under coconut (17.62 cm) and shade net 50% (17.59 cm) while the lowest (17.03 cm) graft height was recorded by grafting under open condition at 90 days after grafting. The interaction effect between times of grafting and propagation structures was found to be non significant at 90 days after grafting.

The vigour of grafts as presented in the above discussion can be also attributed to the better compatibility of the scion-stock combination as evident from the data on sprout height and graft height. Height of sprout indicates the fresh out growth from the scion whereas height of graft reflects the total vertical growth of scion. Both of these values would be generally high where there

Table 1 : Effect of time and propagation structure onnumber of days required for emergence of sproutingand number of grafts sprouted in Mango cv. Banganpalli.

PS / Time	Number of days required for emergence of sprouting						Number of grafts sprouted					
	OC	SN	SN 50%	NVP 75%	PSC	Mean	OC	SN	SN 50%	NVP 75%	PSC	Mean
July	10.80	11.40	10.87	10.80	11.60	**11.09**	87.77	84.44	80.00	83.33	70.00	**81.11**
August	11.00	11.60	11.33	11.27	11.53	**11.35**	47.77	41.11	70.00	61.11	68.89	**57.77**
September	11.20	11.67	11.27	10.60	11.80	**11.31**	53.33	77.77	47.78	67.78	58.88	**61.11**
October	11.67	12.53	12.60	12.07	14.53	**12.68**	38.88	36.66	42.22	53.33	35.55	**41.33**
November	14.13	15.60	17.53	15.87	16.67	**15.96**	66.66	72.22	73.33	78.88	65.55	**71.33**
December	16.00	13.47	11.40	11.20	15.67	**13.55**	74.44	70.00	72.22	83.33	76.66	**75.33**
January	15.23	15.67	15.33	13.00	12.40	**14.28**	65.55	55.55	77.78	71.11	73.33	**68.66**
Means	**12.87**	**13.13**	**12.90**	**12.11**	**13.46**		**62.06**	**62.54**	**66.19**	**71.27**	**64.12**	

	F-test	S.Em.±	C.D. (5%)	F-test	S.Em.±	C.D. (5%)
Time of grafting (M)	*	0.25	0.71	*	1.04	0.88
Propagation structures (P)	*	0.21	0.60	*	2.34	2.95
Interaction (M x P)	*	0.56	1.59	*	2.49	6.60

PS - Propagation structures, **OC** - Open Condition, **SN 50%** - Shade net 50%, **SN 75%** - Shade net 75%, **NVP**- Naturally Ventilated Polyhouse, **PSC** - Partial Shade Coconut. *Significant at 5% level, **NS** - Non significant.

Table 2 : Effect of timeand propagation structure on sprout length (cm) and Number of leaves per graftin Mango cv. Banganpalli at 90 DAG.

PS / Time	Length of sprout (cm)						Number of leaves per graft					
	OC	SN	SN 50%	NVP 75%	PSC	Mean	OC	SN	SN 50%	NVP 75%	PSC	Mean
July	5.33	5.60	6.64	7.37	6.79	**6.34**	24.60	18.67	20.53	21.60	12.33	**19.55**
August	6.46	6.36	5.39	7.42	6.78	**6.48**	19.47	17.20	17.87	22.20	13.07	**17.96**
September	5.82	4.92	5.00	6.16	5.44	**5.46**	15.20	14.80	15.27	16.93	12.47	**14.93**
October	4.27	5.04	5.37	5.05	5.95	**5.14**	12.53	13.73	11.27	16.07	11.93	**13.11**
November	4.14	4.16	3.70	4.54	5.28	**4.36**	11.40	14.00	12.47	13.93	10.07	**12.21**
December	4.40	5.14	5.82	5.00	5.34	**5.14**	12.93	12.93	11.73	15.93	11.87	**13.08**
January	6.03	6.93	7.50	6.01	6.83	**6.66**	13.40	13.47	14.47	14.73	13.13	**13.89**
Means	**5.21**	**5.45**	**5.63**	**5.93**	**6.06**		**15.64**	**14.97**	**14.83**	**17.34**	**12.01**	

	F-test	SEm±	C.D.(5%)	F-test	SEm±	C.D. (5%)
Time of grafting (M)	*	0.25	0.70	*	0.47	1.32
Propagation structures (P)	*	0.21	0.59	*	0.40	1.12
Interaction (M x P)	NS	0.52	-	*	1.05	3.00

PS - Propagation structures, **OC** - Open Condition, **SN 50%** - Shade net 50%, **SN 75%** - Shade net 75%, **NVP**- Naturally Ventilated Polyhouse, **PSC** - Partial Shade Coconut. *Significant at 5% level, **NS** - Non significant; DAG: Days after grafting.

is a high degree of graft compatibility. From the data presented in tables 4.5 and 4.6, it is clear that any time or propagation environment will be more successful to produce maximum graft take only when good rate of growth in scion sprouts is maintained in coordination with a better extension of all growth flushes along with the main axis of scion.

The highest values in respect of these parameters were recorded by the grafts prepared during warmer months *i.e.*, July, August and January in the order. Warm conditions coupled with humid conditions in July and August found to favour good graft take compared to warm conditions alone from January onwards.

Similarly among the propagation structures naturally ventilated poly house was found to excel in sprout length and height of graft also, it was at par with partial shade under coconut, which recorded maximum figures at 90 days after grafting. Therefore, it is clear that maintenance of maximum sprout length and height of graft is not completely capable to yield higher success of grafting.

Table 3 : Effect of timeand propagation structure on graft height (cm) and survival percentage of veneer grafting in Mango cv. Banganpalli at 90 DAG.

PS / Time	Graft height (cm)						Survival percentage					
	OC	SN 50%	SN 75%	NVP	PSC	Mean	OC	SN 50%	SN 75%	NVP	PSC	Mean
July	18.26	18.42	18.08	19.32	19.29	**18.67**	76.66	85.44	77.22	88.25	77.00	**80.91**
August	17.22	18.83	18.40	17.65	18.54	**18.20**	62.33	71.11	63.33	85.55	77.22	**71.93**
September	17.11	16.76	16.34	17.20	16.96	**17.29**	45.55	63.33	67.70	62.22	46.66	**57.11**
October	16.42	17.53	17.07	17.12	17.09	**17.04**	33.33	32.22	37.77	41.11	31.11	**35.11**
November	14.62	15.93	16.10	16.00	18.07	**16.14**	61.11	66.66	64.44	70.00	64.44	**65.33**
December	17.06	17.63	16.12	17.12	18.16	**17.22**	48.88	58.89	55.55	42.22	53.33	**51.77**
January	18.48	18.02	17.77	18.96	17.36	**18.12**	74.00	73.33	68.89	80.90	61.78	**71.81**
Means	**17.03**	**17.59**	**17.12**	**17.62**	**17.92**	**17.45**	**57.41**	**64.42**	**62.14**	**67.18**	**58.80**	

	Graft height (cm)			Survival percentage		
	F-test	SEm ±	C.D.(5%)	F-test	SEm ±	C.D. (5%)
Time of grafting (M)	*	0.26	0.74	*	1.44	4.07
Propagation structures (P)	*	0.22	0.63	*	1.22	3.44
Interaction (M x P)	NS	0.59	-	*	3.23	9.11

PS- Propagation structures, **OC** - Open Condition, **SN 50%** - Shade net 50%, **SN 75%** - Shade net 75%, **NVP**- Naturally Ventilated Polyhouse, **PSC** - Partial Shade Coconut. *Significant at 5% level, **NS** - Non significant; DAG: Days after grafting.

As evident from the results obtained in partial shade under coconut, which was also earliest to produce sprout. These results are in agreement with findings of Nayak and Sen (2000) in mango, Pampanna and Sulikeri (2000) in sapota, Ghosh *et al.* (2004) in custard apple, Islam *et al.* (2003) and Baskaran *et al*. (2008) in jackfruit, Angadi and Karadi (2012) in jamun,

Percentage of survival of grafts

The differences in percentage of survival of grafts due to times of grafting, propagation structures and their interaction were found to be significant (table 3). Among propagation structures, the highest (67.18%) percentage of survival of grafts was recorded by grafting under naturally ventilated polyhouse, which was followed by grafting under shade net 50% (64.42%) and the lowest (57.41%) was recorded by grafting under open condition. Among the interactions, the highest graft survival (88.25%) was observed by grafting on 15th July under naturally ventilated polyhouse followed by grafting on 15th August under naturally ventilated polyhouse (85.55%), July under shade net 50% (85.44%) and January under naturally ventilated polyhouse (80.90%). Grafting on 15th October in partial shade under coconut was found to record the lowest graft survival (31.11%).

Under Anantharajupeta conditions, veneer grafting in mango was found to be highly successful by performing the grafting work under naturally ventilated poly house in the month of July. Higher survival percentage (88.25%) was due to the environmental condition prevailed during this month under naturally ventilated poly house. Maximum temperature was ranging between 22-42 ^{0}C, relative humidity from 31.68 - 90.70 % and light intensity from 36.61 K lux which could have resulted in maximum survival of grafts during the early part of monsoon was mainly due to favourable weather conditions which could have resulted in maximum cambial activity in both stock and scion. Besides, the scion seemed to be in a physiologically active condition for better sap flow at that time.

These observations are conformity with the fact that shade, humid and warm conditions after grafting will result in increased survival percentage of grafts as reported by Singh *et al.* (1989), Islam *et al.* (2004) in mango and Ghosh *et al.* (2010) in sapota.

Conclusion

In mango length of sprout, number of sprouted grafts, graft height, number of days required for emergence of sprouting, number of leaves per graft and survival percentage showed superior in naturally ventilated poly house condition at 90 DAG. The minimum survival percentage of veneer grafting was recorded in the open condition at 90 DAG.

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