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EFFECT OF DIFFERENT SEASONS OF AIR LAYERING ON SUCCESS PERCENTAGE AND OTHER GROWTH ATTRIBUTES OF JACKFRUIT (*ARTOCARPOUS HETEROPHYLLUS* LAM.) UNDER EASTERN INDIA

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ABSTRACT
A study was conducted at Instructional Farm, Jaguli, under the Faculty of Horticulture, Bidhan Chandra Krishi Viswa vidyalaya, Mohanpur, West Bengal during the year 2010 and 2011 to investigate the effect of different seasons of air layering on success percentage and other growth attributes of jackfruit (*Artocarpus heterophyllus* Lam.) under eastern India. The results of the experiments revealed that maximum success percent (76.70 %), number of leaves (30.16), number of primary root (10.50) and root length (10.48 cm) by air layering during the month of August. Whereas earliest root initiation (32.33 days), maximum number of secondary root (14.83), fresh weight of roots (1.31 g) and dry weight of roots (0.70 g) were observed in the month of July. Maximum shoot length was observed in the month of September (59.53 cm). Air layering done in the month of January showed poor results in all the parameters.

INTRODUCTION

Jackfruit (*Artocarpous heterophyllus* Lam.) is one of the minor underutilised fruit of India. The jackfruit is indigenous to India, bearing the largest fruit among the edible fruits. Production and productivity is affected by various factors in which unavailability of quality planting materials of selected variety is one of the serious impediment (Kumar *et al*., 2014). Air layering is cheap and easy method of propagation. Season is the important factor for layering in woody plants because rooting on layers is affected by light and presence of sufficient moisture and optimum temperature (Bose *et al*., 1986).A similar work related to the effect of season on air layering has been done by Kumar (2000) and Dhillon and Mahajan (2000) in litchi. Most of the earlier research work on air layering in jackfruit is confined to growth regulator treatments (Lavania *et al*., 1995).Seed propagation is the common method of propagation in jackfruit but propagation through seed is not desirable as it is highly heterozygous (Singh, 1986) that leads to variation in fruit quality. Jackfruit can be propagated by different methods but the results are inconsistent. There is lack of knowledge of suitable methods and season of propagation in this region; hence information in this regard is required. The paper deals with finding the most appropriate season for air layering in jackfruit under the agro-climatic zone of eastern India, with regard to success percentage and other growth attributes.

MATERIALS AND METHODS

The study was conducted at Instructional Farm, Jaguli, under the Faculty of Horticulture, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, West Bengal (India) during the year 2010 and 2011.The experiment was laid out in Completely Randomized Design (CRD). In all, there are 6 (six) treatments comprising of different months *viz*. June, July, August, September, January and February and each treatment was replicated 3 (three) times. 10 (ten) shoots were layered in each treatment of each replication for the experimental purpose as followed by Lavania *et al*., 1995. The technical procedure for layering, selection of mother plant and shoots were done as per the methods given by Kumar (2012) and Patel *et al*., 2016. After detaching the rooted layers, 5 (five) layers are randomly selected from each replication for recording the data (Kumar, 2000), after 90 days of operation. The parameters include success percent, days to initiate rooting, numbers of leaves, length of shoot, length of longest root (cm), number of primary and secondary roots, dry and fresh weight of roots (g). For root initiation, frequent and keen observation was made and the appearance of the first root was recorded as

days required, from the date of operation. The length of shoot and roots were measured with help of measuring scale. For counting the roots, ball of media is soaked in water, so that soil and adhering debris is dissolved and the fine roots are separated without any damage. The data was statistically analysed by method of analysis of variance as described by Panse and Sukhatme, 1984.

RESULTS AND DISCUSSION

The observation recorded on various parameters showed significant variation due to air layering operation conducted during different months. The results along with critical discussion and relevant reference are presented below.

Success percent

The maximum success percent was recorded with air layering done in the month of August (76.70 %) and second best performance was observed in the month of July (72.00 %). The lowest success percent was recorded in the month of January (48.90 %). A moderate result (62.20 %) was recorded in the month of June which is statistically *at par* with air layering done in September (Table 1).The probable reason for maximum success during monsoon particularly the month of August could be due to congenial environment such as high humidity and temperature leading to higher cell activity and increased production of carbohydrates and photosynthates, which causes the dormant adventitious buds in the girdled area to grow more rapidly into roots (Kumar, 2012). Khosla *et al*., 1982 also opined that rooting response to seasonal changes appears to be regulated by balance of internal translocation of substances, including carbohydrate, nitrogenous substance, hormonal growth regulators and co-factors acting synergistically with auxins. A similar results were reported by Kumar (2000) and Dhillon and Mahajan (2000) in litchi. The results are also in conformity with the findings of Tomar (2011) in jackfruit and Tomar (2016) in *Spondias pinnata*.

Days to rooting

The earliest root initiation was observed during the month of July (31.00 days), whereas the air- layering operation done during the month of March took maximum days to initiate rooting (56.66 days). The operation carried during the month of August and September showed relatively better

Table 1: Effect of different months on the success (%) and other vegetative growth parameters with air-layering in jackfruit

	Success (%)			Days to rooting			Length of shoot (cm)		
	2010	2011	P	2010	2011	P	2010	2011	P
June	61.70(51.75)	62.70(52.34)	62.20 (52.04)	43.33	46.33	44.83	50.00	48.24	49.15
July	71.70(57.86)	72.30 (58.29)	72.00(58.07)	33.00	31.00	32.33	44.50	60.16	49.50
August	72.00(58.12	81.30(64.41)	76.70(61.15)	35.00	36.33	35.66	43.66	46.50	45.08
September	62.70(52.34)	62.7(52.34)	62.70 (52.34)	36.66	38.33	37.50	48.50	70.50	59.53
February	50.50(45.28	47.30(43.47)	48.90(44.39	48.6	49.33	49.00	39.86	36.23	38.05
March	55.3048.06)	56.00((48.44)	55.70(48.23)	56.00	57.33	56.66	38.80	39.50	39.15
SE(m)±	1.094	0.842	0.818	1.130	0.962	0.892	-	5.920	3.593
CD@5%	3.381	2.597	2.521	3.483	2.965	2.749	NS	18.245	11.071

Figures within bracket indicate angular transformed value; NS - Non significant; P - Pooled

Table 2: Effect of different months on vegetative growth parameters with air-layering in jackfruit

	Number of leaves			Number of primary root			Number of secondary root		
	2010	2011	P	2010	2011	P	2010	2011	P
June	15.66	19.33	17.50	7.66	9.66	8.66	14.33	9.33	11.83
July	20.00	19.33	20.16	11.33	11.00	11.00	15.00	18.00	14.83
August	23.67	38.66	30.16	10.66	10.33	10.50	14.33	12.33	13.33
September	23.00	19.66	21.33	5.33	5.00	5.16	8.33	8.33	8.33
February	12.33	11.00	11.66	5.33	2.33	3.83	11.33	10.33	10.83
March	16.00	16.33	16.16	10.00	6.66	8.33	12.00	9.66	10.83
SE(m)±	2.260	2.305	1.786	1.367	1.688	1.132	1.420	-	1.036
CD@5%	6.966	7.103	5.500	4.214	5.203	3.489	4.377	NS	3.186

NS - Non significant; P - Pooled

Table 3: Effect of different months on vegetative growth parameters with air-layering in jackfruit

	Root length (cm)			Fresh weight of root (g)			Dry weight of root (g)		
2010		2011	P	2010	2011	P	2010	2011	P
JUNE	9.13	7.80	8.46	1.15	1.19	1.17	0.61	0.58	0.60
JULY	10.90	11.53	9.98	1.26	1.48	1.31	0.62	0.81	0.70
AUG	10.73	10.23	10.48	0.85	0.82	0.84	0.41	0.15	0.28
SEPT	9.50	9.46	9.48	1.06	1.03	1.05	0.57	0.55	0.56
FEB	9.76	9.46	9.61	0.74	0.53	0.63	0.36	0.33	0.35
MAR	6.76	8.56	7.66	0.72	0.61	0.66	0.35	0.34	0.35
SE(m)±	-	-	-	0.066	0.118	0.088	0.038	0.053	0.041
CD@5%	NS	NS	NS	0.204	0.366	0.271	0.119	0.163	0.127

NS - Non significant; P - Pooled

performance, where the root initiation occurred within 35.66 and 37.50 days respectively (Table 1). The earliest rooting during July may be attributed to favorable temperature and humidity. The favorable environment may have increased cell division, and accelerated root formation. In winter the falling temperature might have an adverse effect on the root formation. The results are in line with the findings of Nautiyal (2002) where he reported that root initiation was more in July, compared to other months due to higher temperature. Kumar (2012) also reported that season has pronounced effect in regeneration of roots in air layering.

Length of Shoot (cm)

With regard to shoot length, the data recorded during the month of September showed maximum value (59.53 cm), while the least value was observed during the month of February (38.05 cm). The values for the month of June (49.15 cm) and July (49.50 cm) were statistically *at par* (Table 1). The higher value during the month of September could be due to rapid growth rate in presence of favorable environmental condition leading to increased cell activity, production of higher amount of photosynthates causing more vegetative growth and coincidence with physiologically active phase of growth. The results are in line with the earlier findings of Sud, 2005 in litchi. However it differed with the finding of Patil *et al*. 2004 in pomegranate.

Number of leaves

Maximum number of leaves was recorded in the month of August (30.16) and minimum in the month of February (11.66). The values for the month of June (19.33), July (19.33) and September (19.66) were statistically *at par* (Table 2). The probable reason for higher values during August may be due to coincidence with favorable environment, leading to higher cell activity and consequent higher vegetative growth. Also availability of sufficient photosynthates may lead to increase vegetative growth during this month. These results are in line with the findings of Kumar *et al*., 2007 and Singh (2002). Tomar (2011) also reported that air layering done on 26-27th July produced maximum number of leaves in jackfruit.

Number of primary root

The maximum number of primary roots was recorded in the month of July (11.00) and the least was observed in the month of February (3.83). The next best performance with regard to number of primary root was observed in the month of August (10.66), followed by June (8.66) (Table 2). The better performance in the month of July could be due to high humidity (75-95 %) and optimum temperature that favors maximum growth as sphagnum moss absorbs humidity while temperature helps in root initiation. Bose *et al*., 1986 also reported that rooting in air layering is encouraged by exclusion of light, availability of oxygen, sufficient moisture and optimum temperature and all the conditions are prevalent during this month. Further, internal hormonal content and cofactors could play an important role. These results are in conformity with the findings of Lavania *et al*. (1995) and Tomar (2016).

Number of secondary roots

The value for number of secondary root was maximum (14.83) during the month of July and minimum (8.33) during the month of September. The layering operation carried during the month of August showed next best performance (13.33), followed by June (11.83) (Table 2). The reason for more root formation in the month of August may be due to better growth of the twigs owing to congenial environment, leading to production of adequate carbohydrates, photosynthates and its subsequent translocation to girdling site that helped in formation of more number of roots. Kumar (2000) also recorded maximum number of roots (18.0) when air layering was done in the month of July in litchi cv. Shahi. Lavania *et al*. (1995) in jackfruit and Singh (2002) in guava also observed similar results with regard to secondary roots.

Root length (cm)

No significant result was obtained with regard to root length, throughout the experimental period. However the maximum root length (10.48 cm) was recorded in the month of August and the least (7.66 cm) during the month of March. Values for the month of July (9.98 cm) and September (7.66 cm) were statistically *at par*.

Fresh weight of root/layer (g)

The value for fresh weight of root was maximum (1.31 g) during July and minimum (0.63 g) during February. The second best performance was recorded during June (1.17 g) (Table-3). The higher values in July could be due to correlation between temperature and humidity besides coincidence with active phase of growth that caused more callus development and hence roots. These results are in comparison to the findings of Singh (2002). A similar finding was also reported by Lavania *et al*. (1995) where they obtained maximum value of 4.0 g by treatment with 10000 ppm IBA in the month of July. These results also corroborate the earlier findings of Kumar *et al*. (2007).

Dry weight of root (g)

The dry weight of roots revealed similar trend with that of fresh weight, where operation carried out during the month of July recorded maximum value (0.70 g) and minimum value (0.28 g) during August (Table-3). While the second best performance (0.60 g) was observed during June. The probable reason for better results in July may be related to health and vigor of the mother plant that could play significant role in root development (Hartman, 2002). The favorable environment and active phase of growth can help in utilization of maximum solar energy and accelerates the dormant adventitious buds in the girdled area to grow into roots and hence, increase the mass. These results corroborates the findings of Tomar (2011) in the same crop, but differed with the findings of Kumar *et al*. (2007) where they obtained higher values through application higher concentration of indole butyric acid ranging from 2000 to 12000ppm.

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