



Effect of air layering time and genotype on success of plum propagation

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Abstract

The experiment was conducted at the Regional Spices Research Center, BARI, Gazipur during April 2015 to October 2016 to evaluate the effect of air layering time on plum propagation. Air layering was done in six times (Mid April, Mid-May, Mid-June, Mid-July, Mid-August and Mid-September) on two plum varieties (BARI Alubokhara-1 and un-fruiting line PD Gaz 004). Significant variations were observed on rooting, establishment and death of layers due to layering time, and variety. The un-fruiting line PD Gaz 004 showed outstanding performance in rooting and survivability of layers over BARI Alubokhara-1. Poor rooting and lower establishment caused very high mortality of layers in BARI Alubokhara-1. Rooting and survivability, number of roots, length of roots and leaf production was acceptable in June to August layering. The maximum (10 out of 10) rooting success of layer with 100% establishment from PD Gaz004 was obtained when layered June Month. In BARI Alubokhara-1, the highest rooting success (6.5), and establishment rate (60%) were recorded in June layering. June to August layering found better for successful air layering for vegetative propagation of plums in Bangladesh.

Keywords: air layering, plum propagation, rooting and survivability.

Introduction

Alubokhara or Plum (*Prunus domestica*), a high valued spice crop in the family Rosaceae is native to Europe and Asia. *Prunus domestica* is believed to have originated in the area of the Caucasus and Asia Minor (Eryomine, 2013). Plums and their juice contain mild laxatives including phenolic compounds, sorbitol, dietary fiber are thus common home remedies for constipation (Mileti *et. al.*, 2012). Plums also have a

high antioxidant content which retards aging (Stacewicz *et. al.*, 2001). In Bangladesh, the demand of plum usually meets up by importing from other countries like India, China, and Thailand (Mozumder *et. al.*, 2013). A number of germplasm collected by Spices Research Center of BARI from different parts of the world and evaluated at different AEZ of Bangladesh. After several years evaluation, one

variety was found superior in respect to adaptability, yield and yield attributes, quality, pest and disease tolerance and released as “BARI Alubokhara-1” from the Spices Research Center of Bangladesh Agricultural Research Institute in 2013 (Anon. 2014). This well adopted variety produce more number of fruits (1221/plant/year) in June-July and the yields 10.29 kg/plant or 6.43 t/ha. Attractive dark red colored, sour sweet taste (TSS 10,6%), medium size(3×2.74 cm, 8.67g), globular fruits having high nutritive and medicinal properties with high value might be grown attention to the growers. The description of BARI Alubokhara-1 is published in the BARI website www.bari.gov.bd and broadcasted several times on BTV in 2014 to 2016. Huge demands of saplings are observed after mass media broadcasting and website publication. To increase Alubokhara production by increasing cultivation area, this variety should be disseminating throughout the country. Vegetative propagation is essential to increase its cultivation maintaining genetic purity of the variety. Air layering and cutting are most used and popular means of Alubokhara propagation (Food & Agriculture Organization, 2011). The rainy season of Bangladesh, many fruit plants showed good shoot and root growth in cuttings and air layering. Moreover, plantation of such a valuable plants increase farmer’s profitability and livelihood. Increasing income through cultivating plum may encourage farmers to disseminate this crop thus will improve environmental condition creating of new vegetation. Therefore, the present study was designed for development of a successful vegetative propagation through air layering of plum with a view to increase its production and profitability through rapid dissemination of BARI Alubokhara-1. Main objectives of the experiment are:

1. Standardization of air layering techniques of Alubokhara (plum) in the environmental condition of Bangladesh.
2. To increase success of layering using appropriate time and variety thus increase cultivated area and production to meet the demand.

Materials and Methods

The experiment was conducted at the Regional Spices Research Center, BARI, Gazipur located in about 40 km North to Dhaka city with 23°59'29" North latitude and 90°24'50" East longitude and an elevation of 8.50m from the sea level during June 2015 to October

2016. The experiment was conducted using a complete randomized design (factorial) using two factors comprising six time of layering (Mid April, Mid-May, Mid-June, Mid-July, Mid-August and Mid-September) and two plum varieties/lines (BARI Alubokhara-1 and an un-fruited plum line PD Gaz 004). Soil mixture was prepared with 50% loamy soil and 50% well decomposed cow dung and kept for 2 weeks before use for layering. Treatment wise hormone solution was taken with a dropper bottle and applied 3/4 drops on the cut surface (from where bark was removed) of the shoot. No hormone was applied for control treatment. Each replication of a single treatment was consisting 10 layering shoots and a total of 30 for 3 replications was used and tagged properly. A total of 60 layering were done for each month. The cut portions was surrounded with 150-200 g of moist soil mixture, covered with polythene and tied tightly with jute rope. When a number of roots were established and seen over polythene, the air layering seems suitable to separate from the mother plant. A half cut was given at 2-3 cm below the cut portion of air layering. After one week the layering was separated by final cut from the previous cut place and extra branches and leaves were trimmed off. The trimmed layering shoot was planted in previously prepared 7x10" polythene bag removing the layering polythene and kept one week under shade followed by 2 weeks in partial shade for establishment. When a number of roots and shoots were established, the air layering seems suitable to plant in the field. Data on length and number of roots per layering was counted breaking the stool at 45 days of layering while success of detached layers and number of leaves at 30 days after separation. Data were recorded on days to rooting, days to separation from mother plant at the final cut, success rate was calculated comparing total number of layers, number of roots at final cut and leaf production performances of layers was recorded at 30 days after separation. Length and number of roots per layering was count breaking the stool at cutting days of layering. The sample of 5 layers was broken and the numbers of roots were counted and lengths of roots were measured with a digital slide calipers. After separation from the mother plants, success of detached layers and number of leaves were counted at 30 days of planting in the polythene bag. Recorded data were calculated, compiled properly and analyzed statistically by MSTAT and MS-Excel Program and mean comparison was done following the Duncan's Multiple Range Test (Zaman, *et al.* 1987).

Results and Discussion

Effect of layering time

The time of layering was significantly affected on the success, death of separated layers and establishment of saplings while days to rooting and separation were found similar (Table 1.a). The number of successful layer was significantly higher in August (7.64), June (6.64) and while it was lower (3.93) in September

layering. The lower success rate in September layering is due to fall of temperature and lower humidity in October resulted lower root and shoot initiation. Moreover, plum showed inactive phase of growth in winter including leaf dropping in the winter that got a limited time for rooting and establishment of layers before and after separation. On the other hand, less rainfall and humidity in April and May resulted less success compared to June, July and August.

Table 1.a Effect of air layering time on success of plum propagation

Time of layering	Days to rooting			Days to separation			Successful layers (no)			% Dead layers		
	2015	2016	Mean	2015	2016	Mean	2015	2016	Mean	2015	2016	Mean
April	36.9	39.8	38.35	45.4	51.65	48.53	5.75bc	5.32a	5.54	42.50bc	3.9c	23.20b
May	36.0	38.5	37.25	45.3	54.45	49.98	5.17cd	4.54a	4.855	48.33ab	2.6c	25.46ab
June	35.4	40.4	37.90	44.4	52.40	48.40	6.04bc	6.64a	6.34	39.58bc	5.4bc	22.49b
July	33.2	39.5	36.35	42.6	50.15	46.38	7.04a	6.21a	6.63	29.58d	6.8abc	18.19b
August	34.0	39.5	36.75	42.8	49.85	46.33	6.13b	7.64a	6.89	38.75 c	11.2a	24.98ab
September	36.2	41.3	38.75	44.9	51.55	48.23	4.79d	3.93a	4.36	52.08a	10.7ab	31.39a
Sig. level	NS	NS	NS	NS	NS	NS	**	**		**	*	*
CV%	3.34	4.88	4.11	4.42	5.63	5.03	12.35	12.50	12.43	14.52	14.83	14.68

Means having same letter(s) or without letter are not significantly different by DMRT. 'ns' '**' and '***' means not significant, significant at 5% and 1% probability level, respectively.

A number of successfully rooted layers were died in the polybag after separation from the mother plant. In second year (2016), the death rate was the minimum due to delayed separation and more care for establishment of the separated layers acquiring first year (2015) experience. The death rate was significantly higher in September (31.39%), May

(25.46%) and August (24.98%) compared to other months.

The percentage of establishment, length of roots and leaves per layer showed significant variation but number of roots were similar in April to August layering (Table 1.b). Establishment rate increased in second year than first year in all Months except July.

Table 1.b Effect of air layering time on establishment and growth of plum layers

Time of layering	% Established			No. of roots /layer			Length of root (cm)			Leaves/plant		
	2015	2016	Mean	2015	2016	Mean	2015	2016	Mean	2015	2016	Mean
April	28.75bc	49.29bc	39.02b	3.90	3.89	3.89	4.81ab	5.15a	4.98a	11.45ab	15.1a	13.28ab
May	22.50 c	42.50c	32.50c	3.70	4.61	4.16	4.61ab	5.23a	4.92a	10.93ab	15.5a	13.22ab
June	22.50c	61.07a	41.79b	4.25	4.53	4.39	5.35a	5.49a	5.42a	12.52a	15.7a	14.11a
July	61.67a	55.36ab	58.52a	4.40	4.38	4.39	5.51a	5.34a	5.43a	12.79a	15.7a	14.25a
August	36.67b	64.64a	50.66a	4.50	3.97	4.24	5.27a	4.88ab	5.08a	12.49a	13.7ab	13.09ab
September	28.30bc	28.57d	28.44c	3.45	3.44	3.45	3.81b	3.91b	3.86b	9.63b	11.5b	10.57b
Sig. level	**	**	*	NS	NS	NS	*	*	*	**	*	*
CV%	14.52	15.23	14.88	11.21	5.34	8.27	9.82	4.38	7.10	12.87	5.40	9.14

Means having same letter(s) or without letter are not significantly different by DMRT. 'ns' '**' and '***' means not significant, significant at 5% and 1% probability level, respectively.

Significantly higher mean establishment rate (58.52%) was recorded in July followed by August (50.66%) compared to June (41.79%), April (39.02%), May (32.50%) and it was the lowest September layering (28.44%). Length of roots and number of leaves per

layer were significantly lower in September layering compared to other months. Hot humid weather favors rooting and leaf initiation that caused more rooting and leaves in April to August layering.

Effect of variety on success of air layering

ABARI Alubokhara-1 was significantly reluctant in rooting compared to the line PD Gaz-004 for successful layering (Table 2.a). Significantly delayed rooting (41.2 days) and separation (51.8 days) was observed in BARI Alubokhara-1 while PD Gaz-004 showed prompt rooting (33.9 days) and early

separation (44.2 days). The highest number of successful layers (8.78) was recorded in PD Gaz-004 but it was much lower (2.76) in BARI Alubokhara-1 out of 10 layering. The death rate of BARI Alubokhara-1 was very high (41.7%) while in PD Gaz-004 only 7.01 % layer was died after separation.

Table 2.a. Effect of air layering time on success of plum propagation

Time of layering	Days to rooting			Days to separation			Successful layers (no)			% Dead layers		
	2015	2016	Mean	2015	2016	Mean	2015	2016	Mean	2015	2016	Mean
BARI Alubokhara-1	37.0a	45.3a	41.2a	46.0a	57.6a	51.8a	2.11b	3.40b	2.76b	78.89a	4.5b	41.70
PD GAZ004	33.5b	34.3b	33.9b	42.5b	45.8b	44.2b	9.53a	8.02a	8.78a	4.72b	9.3a	7.01
Sig. level	NS	**	*	*	**	*	**	**	**	**	*	*
CV%	3.34	4.88	4.11	4.43	5.63	5.03	12.35	12.50	12.43	17.19	14.83	16.01

Means having same letter(s) or without letter are not significantly different by DMRT. 'ns' '**' and '***' means not significant, significant at 5% and 1% probability level, respectively.

The establishment rate was significantly higher. Significantly higher establishment (61.38%) was

found in PD Gaz-004 whereas only 22.26% separated layers were established in BARI Alubokhara-1.

Table 2.b Effect of air layering time on establishment and growth of plum layers

Time of layering	% Established			No. of roots /layer			Length of root (cm)			Leaves/plant		
	2015	2016	Mean	2015	2016	Mean	2015	2016	Mean	2015	2016	Mean
BARI Alubokhara-1	15.00b	29.52b	22.26	3.5b	4.01	3.76	4.16b	4.72	4.44b	10.2b	14.0	12.10b
PD GAZ004	51.81a	70.95a	61.38	4.5a	4.26	4.38	5.63a	5.28	5.46a	13.1a	15.0	14.05a
Sig. level	**	**	*	NS	NS	NS	**	NS	*	**	NS	*
CV%	14.52	15.23	14.88	11.21	5.34	8.28	9.82	4.38	7.10	12.87	5.40	9.14

Means having same letter(s) or without letter are not significantly different by DMRT. 'ns' '**' and '***' means not significant, significant at 5% and 1% probability level, respectively.

PD Gaz 004 also showed significantly better rooting (4.38/layer), longer roots(5.46 cm) and leaf initiation (14.05) compared to BARI Alubokhara -1(3.76, 4.44 cm and 12.1/layer, respectively). Better root growth resulted higher success rate in PD Gaz-004 might be due to the varietal characters and cumulative deposited energy compared to BARI Alubokhara-1 which lost some photosynthetic energy and food materials during fruit production. Saplings produced from layering of the un-fruited line PD Gaz-004 is kept for cleft grafting of BARI Alubokhara-1 scions in next season for the production of grafted saplings of BARI Alubokhara-1.

Combined effect of layering time and variety

Plum genotype (Variety/line) and layering time showed significant effect on number of successful layers (Table 3.a). The un-fruited plum line PD Gaz004 showed better performance in every layering times in respect to early rooting and separation, success and survivability. BARI Alubokhara-1 took more days in April, May and September layering compared to June, July and August month's layering for root initiation and separation of layers from the mother plant.

Early rooting (32.9 days) was found in May layering in PD Gaz-004 line which delayed in April layering (42.7 days) in BARI Alubokhara-1. Early separation was observed in PD Gaz-004 in April but delayed separation was recorded in the same month in BARI Alubokhara-1 variety. The line PD Gaz-004 showed

higher number of successful layer (>8), less death rate of separated layers and notable establishment of layers in all times but the success was very poor in BARI Alubokhara-1 in April, May and September layering.

Table 3a. Combined effect of air layering time and variety on success of plum propagation

Month	Time of layering	Days to rooting *	Days to separation *	Successful layers (no)			% Dead layers		
				2015	2016	Mean	2015	2016	Mean
April	BARI Alubokhara-1 PD GAZ004	42.7	54.0	2.00cd	2.14e	2.07	80.00bc	0.7f	40.35
		34.0	43.1	9.50a	8.50ab	9.00	5.00e	7.1b-e	6.05
May	BARI Alubokhara-1 PD GAZ004	41.6	54.8	0.83de	1.21e	1.02	91.70ab	1.4ef	46.55
		32.9	45.0	9.50a	7.86ab	8.68	5.00e	4.3def	4.65
June	BARI Alubokhara-1 PD GAZ004	41.8	51.6	2.67c	4.57d	3.62	73.33c	5.0def	39.17
		34.1	45.3	9.41a	8.71a	9.06	5.83e	5.7c-f	5.77
July	BARI Alubokhara-1 PD GAZ004	39.1	49.5	4.41b	3.86d	4.19	55.83d	4.3def	28.07
		33.6	43.3	9.67a	8.57ab	9.11	3.33e	9.3bcd	6.32
Aug	BARI Alubokhara-1 PD GAZ004	39.6	49.2	2.33c	7.07bc	4.70	76.67c	12.1b	44.39
		33.9	43.5	9.92a	8.21ab	9.07	0.83e	11.4bc	6.12
Sept	BARI Alubokhara-1 PD GAZ004	42.5	51.9	0.42e	1.57e	1.00	95.83a	3.6def	49.77
		34.9	44.6	9.17a	6.29c	7.77	8.33e	17.9a	13.07
Sig. level		NS	NS	**	**	**	**	*	*
CV%		4.11	5.03	12.35	12.50	12.43	17.19	14.83	16.01

Means having same letter(s) or without letter are not significantly different by DMRT. 'ns' '**' and '***' means not significant, significant at 5% and 1% probability level, respectively.

The highest number of successful layers was recorded in PD Gaz-004 (9.07) from August layering and it was the lowest (1.00) in BARI Alubokhara-1 from September layering out of 10 layers mean of two years three replications. The maximum percentage of dead layers after separation was counted in BARI Alubokhara-1 from September layering but it was very less (4.65%) in PD Gaz-004 from May layering.

The number and length of root, number of leaves varied significantly in 2015 but in 2016 length of roots

and number of leaves per layer did not differ with the time of layering and variety (Table 3.b). The highest rate of establishment (83.63%) was recorded in case of PD Gaz-004 from July layering while it was the lowest in BARI Alubokhara -1 (7.72%) from September layering. More number of leaves at 30 days after separation (DAS) was counted in June, July and August layering while it was lower in May and September Layering in BARI Alubokhara-1.

Table 3b. Combined effect of air layering time and variety on establishment and growth of plum layers

Month	Time of layering	% Established			No. of roots /layer	Length of root (cm)	Leaves /plant		
		2015	2016	Mean			2015	2016	Mean
April	BARI Alubokhara-1 PD GAZ004	14.20gh	20.71ef	17.46e	3.53ab	4.54	10.0bcd	14.2	12.1ab
		43.30cd	77.86a	60.58b	4.29a	5.42	12.91ab	15.9	14.41a
May	BARI Alubokhara-1 PD GAZ004	6.67gh	10.71f	8.69f	3.92ab	4.24	8.292cd	14.8	11.55 ab
		38.33de	74.29a	56.31b	4.47a	5.60	13.57a	16.1	14.84a
June	BARI Alubokhara-1 PD GAZ004	17.50fg	40.71d	29.11d	4.14a	5.02	11.83ab	15.1	13.47ab
		27.50ef	81.43a	54.47bc	4.59a	5.82	13.22ab	16.2	14.70 a
July	BARI Alubokhara-1 PD GAZ004	32.50de	34.29d	33.39d	4.34a	5.23	12.33ab	15.0	13.67
		90.83a	e	83.63a	4.46a	5.63	13.25ab	16.3	14.78a
Aug	BARI Alubokhara-1 PD GAZ004	5.80fgh	58.57b	32.19d	4.06a	4.67	11.27abc	13.9	12.89
		57.50b	c	64.11b	4.43a	5.49	13.72a	13.4	13.56
Sept	BARI Alubokhara-1 PD GAZ004	3.30h	12.14f	7.72f	2.72b	2.95	7.167d	10.9	9.03b
		53.30bc	45.00c	49.15c	4.15a	4.77	12.08ab	12.0	12.04
Sig. level		**	**	**	*	NS	**	NS	*
CV%		14.52	15.23	14.88	8.28	7.10	12.87	5.40	9.14

Means having same letter(s) or without letter are not significantly different by DMRT. 'ns' '**' and '***' means not significant, significant at 5% and 1% probability level, respectively.

BARI Alubokhara-1 showed shy rooting tendency than the line PD Gaz004 and less success in April, and May layering due to dry weather while poor performance in layering in September due to shorter active growth period of plums that ended in October because most of the plum growth almost stopped during winter season in Bangladesh.

Conclusion

Combination of variety and layering time significantly influence on the success and rooting of layers under Bangladesh condition. Rooting and establishment in BARI Alubokhara-1 layers showed weaker performance. June to August layering found better for successful air layering for vegetative propagation of plums in Bangladesh. From two years results, June to August layering can be suggested for successful propagation of Alubokhara (Plum) in Bangladesh.

References

- Anonymous. 2014. Annual Report 2013-14. Spices Research Center, BARI, Shibganj, Bogra.
- Eryomine, G.V. 2013. New data on origin of *Prunus domestica* L. International Symposium on Plum and Prune Genetics, Breeding and Pomology. ISHS Acta Horticulturae. 283: IV.
- Food & Agriculture Organization. 2011. Rome, Italy.
- Mileti N., B. Popovi, O. Mitrovi, M. Kandi. 2012. Phenolic content and antioxidant capacity of fruits of plum cv. 'Stanley' (*Prunus domestica* L.) as influenced by maturity stage and on-tree ripening. AJCS 6(4):681-687.
- Mozumder, S. N., M. I. Hoque, S. Akter and B. R. Banik. 2014. Bangladeshe Alubokhara chash (Booklet in Bengali Cultivation of plum in Bangladesh). BARI Agro.techbklt no. 04/2014. Pp 1-14.

- Stacewicz, S. M., P. E. Bowen, E. A. Hussain, B. I. D. Wood and N. R. Farnsworth. 2001. Chemical composition and potential health effects of prunes: a functional food. *Critical reviews in food science and nutrition*. 41(4): 251–86.
- Zaman, S. M. H., Rahim, K. and Hawlader, M. 1987. *Simple Lessons from Biometry*. Bangladesh Rice Research Institute. Gazipur. *Pp*: 29-34.

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