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Performance of different poly wrappers for shoot development on air layering in pomegranate (*Punica granatum* L.) Cv. Bhagwa

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Abstract
The present investigation entitled "Performance of different poly wrappers for shoot development on air layering in pomegranate (*Punica granatum* L.) Cv. Bhagwa." was carried out on progressive farmer's field at Warudi, Taluka Badnapur during 2014-15. The objective was to study the effect of different polywrapper on survival of air layers of Pomegranate. Experiment was laid out in Randomized Block Design (RBD) with eight treatments replicated thrice. The treatments were T1 (Red polywrapper) T2 (Black polywrapper), T3 (Blue polywrapper), T4 (Yellow polywrapper), T5 (Green polywrapper), T6 (Orange polywrapper), T7 (Pink polywrapper), T8 control (white polywrapper). The result indicated that the Black polywrapper was best in respect of survival. The air layers made with black polywrapper showed superior result in respect shoot observation. The minimum days required for shoot spouting (15.66), while maximum survival per cent (96.67 %), number of sprout at 60 days (12.25), length of sprout at 60 days (23.49 cm), seedling height at 60 days (82.13 cm) and number of leaves at 60 days (81.91) was observed in treatment T2 (Black polywrapper). The observations in respect of diameter of sprout/stem girth showed non-significant differences. Based on this investigation use of black polywrapper may be recommended for better survival of air layers in pomegranate (*Punica granatum* L.) cv. Bhagwa.

Keywords: polywrappers, survival, pomegranate

Introduction
Pomegranate (*Punica granatum* L.) is an important fruit crop, belongs to family Punicaceae having a chromosome number 2n=16, 18, native of Iran. Pomegranate is grown in tropical and subtropical regions of the world. In India total area under pomegranate cultivation is 131 thousand ha, production is around 1346 MT and productivity is around 10.3 MT/ ha. In Maharashtra area is about 90.00 thousand ha and production is around 945.00 MT (Anonymous 2014). Horticulture contributes nearly 28 per cent of GDP in agriculture and 54 per cent of export share in agriculture. India is the largest producer of pomegranate in the world, but it has only 7% share of total world exports. In Maharashtra, pomegranate is commercially cultivated in Solapur, Sangli, Nashik, Ahmednagar, Pune, Dhule, Aurangabad, Satara, Osmanabad, Latur and Beed districts of Marathwada. Solapur is famous for juicy pomegranate fruit which is locally known as Anar. Ganesh, Bhagwa, Ruby, Arakta and Mridula are the varieties of pomegranate cultivated in Maharashtra. The variety Ganesh and Bhagwa cultivated on large scale and suitable for export purpose.

Extensive survey work on pomegranate orchards indicated that the 'Bhagwa' variety of pomegranate is heavy yielder and possesses desirable fruit characters making it suitable for export. This variety matures in 180-190 days with an average fruits yield of 147.90 fruits/ tree. High yield in bhagwa may be due to the hybrid vigour. It is the multiple hybrids developed with cross combination of local variety Ganesh and Afghanistan varieties. It also possess maximum length of shoots (30.93 cm) as well as maximum leaf area/ shoot were noticed (630.97 cm2) (Shiva *et al*., 2012). In this regard the 'Bhagwa' variety was selected for present study.

Propagation by seed is easy and seedling plantation appears hardier, drought resistant due to deep tap root system. Seed propagation brings genetic variability and leads to low yield and poor quality of fruits. Hence, it is advisable to follow asexual propagation i.e. cutting and layering. The advantages of layering over cutting are that, it can be practiced throughout the year with better frequency of rooting, overall rooting and survival success is more.

Plant growth regulator and wrapping materials plays important role in rooting and subsequent survival and success of air layers. The exogenous application of IBA induced rooting's in stem cuttings and air layering due to their ability to activate cambium regeneration, cell division and cell multiplication (Rymbai and Reddy, 2010) [7]. Similarly different coloured polywrappers affects the accumulation of endogenous auxins synthesized due to perfect etiolation condition. It also increases physiological activities essential for cell division or cell enlargement or both. Polythene sheet provides a cheap, simple and very effective close environment for the propagation of plant (Baghel 1999) [1]. In blue fraction of visible radiation (light) favours higher synthesis and accumulation of protein and development of rooting primordia (Chattopadhyay, 1994) [5] and black polythene paper encourages the accumulation of carbohydrates and auxins and which in turn promotes the rooting in layerage (Bhingarde *et al*., 2010) [2]. Therefore, it is felt necessary to undertake "Studies on effect of different polywrappers on success and survival of air layering in pomegranate (*Punica granatum* L.) Cv. Bhagwa under Badnapur condition.

Material and Methods

The experiment conducted during the year 2014-15, to find out "Studies on effect of different polywrappers on survival of air layering in pomegranate (*Punica granatum* L.) Cv. Bhagwa" The experiment was conducted on progressive farmer's field at Warudi, Taluka Badnapur District Jalna. The experiment was laid down in Randomized Block design (RBD) with eight treatments Viz., T_1 (Red polywrapper), T_2 (Black polywrapper), T_3 (Blue polywrapper), T_4 (Yellow polywrapper), T_5 (Green polywrapper), T_6 (Orange polywrapper), T_7 (Pink polywrapper), T_8 (White transparent polywrapper (control)) and replicated thrice.

The healthy and vigorous shrubs of pomegranate Cv. Bhagwa four year old aged were selected, planted at distance 10 ft x 12 ft. Twenty four uniform plants were randomly selected for the experiment. The uniform branches having pencil thickness were selected for air layering in the month of Jully. A ring of bark of 2.5 cm long was removed with sharp knife at proximal end away from apex bud. The upper cut portion was treated with the paste of IBA 3000 ppm. Later on slightly moisten sphagnum moss was placed to enclose the cut surface. Thereafter, as per treatments a piece of coloured polythene of 200 µ (Guage) was wrapped and tied with Sutali.

Number, Length and Stem girth of sprout were recorded at 30, 45 and 60 days after transplanting. Length of longest sprout was recorded with the help of ruler at 60 days. The number of leaves was measured at 30, 45 and 60 days after transplanting of air layers. The survival percentage was recorded at 60 days after transplanting as by calculating the number of air layers survived out of the total number of air layers transplanted in the poly bags. The experiment was carried in Randomized Block Design as described by Panse and Sukhatme (1967) [6].

Result and Discussion

Shoot Observation

1. Days required for shoot sprouting after scion detachment

The data pertaining in respect of shoot sprouting were significantly influenced different coloured polywrapper as presented in Table 1.

Table 1: Effect of different polywrappers on shoot sprouting after scion detachment

Treatments	Treatment Details	Required days
T_1	Red polywrapper	16.37
T_2	Black polywrapper	15.66
T_3	Blue polywrapper	16.39
T_4	Yellow polywrapper	21.00
T_5	Green polywrapper	17.61
T_6	Orange polywrapper	21.96
T_7	Pink polywrapper	22.07
T_8	White polywrapper (Control)	23.91
C.D. at 5 %		1.73

The Minimum days required for shoot sprouting (15.66) was observed in treatment T_2 (Black polywrapper) followed by treatment T_1 (16.37) and T_3 (16.39) which were at par with each other. The maximum days required for shoot sprouting (23.91) was observed in treatment control T_8 (White polywrapper).

2. Number of sprouts at 30, 45 and 60 DAT

The total number of sprouts per layer under each treatment was counted and mean number of sprouts were calculated and presented in Table 2.

30th day

The maximum sprouts (4.8) were observed in treatment T_2 (Black polywrapper) followed by T_3 (4.6), T_1 (4.5), T_5 (4.4) which were at par with each other. Minimum number of sprouts (3.6) was observed in treatment control T_8 (White polywrapper).

45th day

The highest number of sprouts (10.19) were found in T_2 (Black polywrapper) followed by treatment T_3 (9.17) which were at par with each other. Next best treatments were T_1, T_5, T_4, T_6, and T_7 which were at par with each other. Significantly lowest number of sprouts (6.58) was found in treatment control T_8 (white polywrapper).

Table 2: Effect of different polywrapper on no. of sprouts at 30, 45 and 60 DAT

Treatments	Treatments Details	Avg. no. of sprouts/ Air layer		
		30 DAT	45 DAT	60 DAT
T_1	Red polywrapper	4.5	8.30	10.34
T_2	Black polywrapper	4.8	10.19	12.25
T_3	Blue polywrapper	4.6	9.17	11.69
T_4	Yellow polywrapper	4.3	7.63	9.42
T_5	Green polywrapper	4.4	8.19	9.99
T_6	Orange polywrapper	4.2	7.54	9.47
T_7	Pink polywrapper	4.2	7.32	8.90
T_8	White polywrapper (Control)	3.6	6.58	8.16
C.D. at 5 %		0.46	1.30	1.73

60th day

The highest number of sprouts (12.25) were recorded in treatment T_2 (Black polywrapper) followed by treatment T_3 (11.69) which were at par. Minimum number of sprouts (8.16) was recorded in treatment control T_8 (white polywrapper).

3. Length of sprouts (cm) at 30, 45 and 60 DAT

The length of all sprouts in each layer was measured in cm and mean length of sprout per layer was worked out and presented in Table 3 at 30, 45 and 60 DAT.

Table 3: Effect of different polywrappers on length of sprout (cm)

Treatments	Treatments Details	Avg. length of sprout / Air layer (cm)		
		30 DAT	45 DAT	60 DAT
T_1	Red polywrapper	7.09	11.09	19.58
T_2	Black polywrapper	9.49	13.98	23.49
T_3	Blue polywrapper	7.38	10.48	19.22
T_4	Yellow polywrapper	5.86	9.37	17.77
T_5	Green polywrapper	6.01	9.61	18.12
T_6	Orange polywrapper	5.52	8.72	16.92
T_7	Pink polywrapper	5.15	8.14	16.20
T_8	White polywrapper (Control)	5.09	7.05	14.58
C.D. at 5 %		1.66	1.99	1.95

30th day

The maximum length of sprout (9.49) was recorded in treatment T_2 (Black polywrapper) which were significantly superior over the rest of the treatments. Next best treatment were T_3 (7.38), T_1 (7.09), T_5 (6.01) and T_4 (5.86) which were at par with each other. The minimum length of sprout (5.09) was recorded in treatment control T_8 (white polywrapper) followed by T_7 (5.15) and T_6 (5.52) which were statistically at par with each other.

45th day

The maximum length of sprout (13.98) was found in T_2 (Black polywrapper) which were superior over rest of the treatments. Next best treatments were T_1 (11.09), T_3 (10.48), T_5 (9.61) and T_4 (9.37) which were at par with each other. The minimum length of sprout (7.05) was found in T_8 control (white polywrapper) followed by T_7 (8.14) and T_6 (8.72) which were statistically at par with each other.

60th day

Significantly maximum length of sprout (23.49) was observed in treatment T_2 (black polywrapper) which were superior over rest of the treatments. The next best treatment were T_1 (19.58), T_3 (19.22), T_5 (18.12) and T_4 (17.77) which were at par with each other. The significantly minimum length of sprout (14.58) was observed in treatment control T_8 (white polywrapper) followed by T_7 (16.20) and T_6 (16.92) which were statistically at par with each other.

4. Diameter of sprout/stem girth (mm)

The data pertaining in respect of diameter of sprout per air layer at 30, 45, 60 days presented in Table 4 revealed that there was non-significant effect of different treatments under study.

Table 4: Effect of different polywrappers on diameter of sprout/stem girth

Treatment	Treatment Details	Avg. diameter of sprout/ Air layer (mm)		
		30 DAT	45 DAT	60 DAT
T_1	Red polywrapper	1.29	1.64	1.86
T_2	Black polywrapper	1.32	1.75	1.95
T_3	Blue polywrapper	1.30	1.72	1.87
T_4	Yellow polywrapper	1.28	1.54	1.82
T_5	Green polywrapper	1.29	1.62	1.85
T_6	Orange polywrapper	1.28	1.54	1.77
T_7	Pink polywrapper	1.27	1.50	1.74
T_8	White polywrapper (Control)	1.23	1.48	1.58
C.D. at 5 %		NS	NS	NS

5. Seedling height (cm) at 60 DAT

Perusal of data regarding with seedling height at 60 days were presented in Table 5. The seedling height was significantly influenced by different coloured polywrapper.

Table 5: Effect of different polywrappers on seedling height (cm).

Treatment	Treatment Details	Seedling height (cm)
T_1	Red polywrapper	77.56
T_2	Black polywrapper	82.13
T_3	Blue polywrapper	80.59
T_4	Yellow polywrapper	74.59
T_5	Green polywrapper	76.61
T_6	Orange polywrapper	74.45
T_7	Pink polywrapper	71.12
T_8	White polywrapper (Control)	63.76
C.D. at 5 %		6.89

The maximum seedling height (82.13) was recorded in treatment T_2 (Black polywrapper) followed by T_3 (80.59), T_1 (77.56) and T_5 (76.61) which were at par with each other. Treatment T_4, T_6, and T_7, were intermediate and at par with each other. The minimum seedling height (63.76) was found in treatment T_8 control (white polywrapper).

6. Number of leaves at 30, 45 and 60 DAT

The number of leaves per layer under each treatment was counted and mean number of leaves was calculated and presented in Table 6.

Table 6: Effect of different polywrappers on number of leaves

Treatment	Treatment Details	Number of leaves / layer		
		30 DAT	45 DAT	60 DAT
T_1	Red polywrapper	28.89	58.16	77.37
T_2	Black polywrapper	30.72	65.80	81.91
T_3	Blue polywrapper	29.47	59.87	79.59
T_4	Yellow polywrapper	26.03	53.59	72.77
T_5	Green polywrapper	26.51	55.59	73.40
T_6	Orange polywrapper	25.42	47.88	66.05
T_7	Pink polywrapper	23.88	46.23	60.12
T_8	White polywrapper (Control)	23.75	42.56	53.49
C.D. at 5 %		3.63	4.79	6.37

30th day

Perusal of data in Table. 6 revealed that there were significant differences in number of leaves by different treatment. The maximum number of leaves (30.72) was found in treatment T_2 (Black polywrapper) which were at par with treatment T_3 (29.47) and T_1 (28.89). The minimum number of leaves (23.75) was found in treatment control T_8 (white polywrapper) which was statistically at par with treatments T_7, T_6, T_4, and T_5.

45th day

The maximum number of leaves (65.80) was found in treatment T_2 (Black polywrapper) which were superior over the rest of treatments. Next best treatment were T_3 (59.87), T_1 (58.16) and T_5 (55.59) which were at par with each other. The minimum number of leaves (42.56) was found in treatment T_8 (white polywrapper) which was statistically at par with treatments T_7, T_6 and T_4.

60th day

The maximum number of leaves (81.91) was found in treatment T_2 (Black polywrapper) which was at par with treatment T_3 (79.59). Next best treatments were T_1 (77.37), T_5 (73.40) and T_4 (72.77) which were at par with each other. The

treatment T_6 (66.05) and T_7 (60.12) were intermediate. The minimum number of leaves (53.49) was found in treatment control T_8 (white polywrapper).

7. Survival of layers (%) at 60 DAT

The success obtained in the number of layers surviving in various treatments was recorded at 60 days after the detachment of layers from mother plants has been converted in to percentage and presented in Table 7.

Table 7: Effect of different polywrappers on survival of layers (%)

Treatment	Treatment Details	Survival (%)
T_1	Red polywrapper	47.00 (94.00)
T_2	Black polywrapper	48.33 (96.67)
T_3	Blue polywrapper	47.33 (94.67)
T_4	Yellow polywrapper	45.33 (90.66)
T_5	Green polywrapper	46.00 (92.00)
T_6	Orange polywrapper	43.66 (87.33)
T_7	Pink polywrapper	42.66 (85.33)
T_8	White polywrapper (Control)	42.33 (84.67)
C.D. at 5 %		6.55

Perusal of the data in respect of survival of layers was significantly influence by different coloured polywrapper and presented in Table 7. The maximum number of survival (96.67) was observed under the treatment T_2 (Black polywrapper) which was at pat with T_3 (94.67), T_1 (94.00), T_5 (92.00) and T_4 (90.66). The minimum survival (84.67) was observed under the treatment control T_8 (white polywrapper) which was statistically at par with treatments T_7, T_6.

These results are in confirmation with finding of Singh and Baghel (2001) [9]. They found that maximum number of spouts, leaves, and survival of air layers of mango with black polywrapper. Sarkar and Ghosh (2006) also found best results in terms of survival per cent of guava air layers with black polywrapper.

Conclusion

From the over-all assessment of results on the present research work on studies on effect of different polywrappers on survival of air layering in pomegranate (*Punica granatum* L.) Cv. Bhagwa. Black polywrapper was superior in all shoot observation as well as survival percent over rest of the treatments.

Finally, it is concluded that Black polywrapper was significantly superior in respect of shoot observations, as well as survival of air layers over white polywrapper (Control). This might be due to black polywrapper encourage the accumulation of carbohydrates and auxins which in turn promotes rooting in layerage. Early and established rooting, more root biomass translocate food material to different part of shoot, which ultimately resulted in maximum per cent survival of air layers in pomegranate.

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