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Effect of mechanical treatments on rooting in cuttings of guava, lemon and pomegranate

S. K. Pandey, A. Bisen[1] and N. Patel

Department of Horticulture, College of Agriculture, J.N.K.V.V., Jabalpur -482 004 (M.P.)

[1]Department of Forestry, J.N.K.V.V., Jabalpur -482 004 (M.P.)

Abstract

An attempt was made to determine the most effective mechanical treatments i.e. ringing and girdling in relation to upper & lower portion of shoot of guava, lemon and pomegranate. The results revealed that cuttings obtained from lower end portion of ringed branch (M2) promoted significantly better growth parameters, particularly number of sprout shoots (4.0), shoot length 120 days after planting (28.00 cm), number of leaves (45.66), length and width of leaves (8.03 cm and 3.24 cm), leaf area index (41.24 cm2) as well as better success of rooting percentage (80 %) in lemon followed by pomegranate (78 %). In case of crop response, lemon significantly responsed to cuttings made from lower end portion of ringed branch followed by pomegranate subjected to shoot and root characteristics.

Key words: *Mechanical, Cuttings, Ringing, Guava, Lemon, Pomegranate, Girdling*

Introduction

Cutting is the cheapest, rapid and simplest method of propagation and the new plants develop from cutting are true to type and uniform in growth. Such plants come into bearing, earlier than the seedlings and do not require any special techniques necessary in grafting, budding and layering. The success in stem cutting multiplication of fruits crops depend upon some factors such as condition of the mother plant, age of the tree, part of the tree from where the condition of the mother plant, age of the tree, part of the tree from where the cuttings are made, time of planting, rainfall, humidity, temperature, rooting media, care while planting and after care Frey *et al.* (2006). Besides these factors, mechanical treatment like ringing and girdling play an important role in rooting Biswas (1995). Ringing and girdling interrupt the downward translocation of carbohydrates, hormones and other possible root promoting substances which helps in shoot initiation and formation Evert and Smittle (1990). Using these techniques on shoots prior to their removal for use as cuttings improve the rooting.

Materials and methods

The present investigation was conducted at Fruit Research Station, Imalia Farm, Department of Horticulture, JNKVV, Jabalpur (M.P.) during September 2007 to January 2008. Five treatments viz. control (M_0), cuttings of upper portion of ringed branch (M_1), cuttings of lower portion of ringed branch (M_2), cuttings of upper portion of girdled branch (M_3), cuttings of upper portion of girdled branch (M_4) as main treatments and three crops i.e. guava (C_1), lemon (C_2) and pomegranate (C_3) as sub treatments were taken in Factorial Complete Randomized Design with three replication. Five semi hard wood cuttings of 15 cm length with 4-5 buds and 0.75-1.0 cm thickness were taken for each treatment in each replication. A straight cut was made at the base end just below the bud and slanting cut was made at the apical end just above the bud. The cuttings were planted as per treatments in the pre-watered poly bags containing rooting media in partial shade condition with the help of dibbler to avoid any injury to the cuttings.

Two third part of the treated cuttings were inserted in the rooting media at a slight angle (45°) to the vertical. The observation on days taken for sprouting and days taken for 50% sprouting was recorded at every week interval. The success of rooting percentage, number of roots per cutting, number of shoots per cutting, total number of leaves/cutting, length & width of leaf (cm), leaf area index (cm^2), fresh & dry weight of leaves (g), fresh & dry weight of roots (g), length & diameter of longest root (mm) were recorded after 120 days. The length of shoots (cm) was recorded with the help of centimeter scale at 80, 100 and 120 days interval after planting of cuttings. Fresh and dry weight of five leaves from planted cuttings was taken with the help of electronic balance and oven dry method.

Results and discussion

The success of rooting percentage (57.77%), length of shoot at 80 and l00 days (14.55 cm & 17.11 cm.), total number of leaves per cutting (26.00), number of shoot per cutting (2.77), leaf area index(18.72), fresh weight of five leaves (3.94 gm), dry matter percentage of leaves (30.05%), diameter of longest root(0.49 mm), fresh weight of roots (1.24 gm) and dry matter percentage of roots (28.46) were found significantly surpassed under ringed lower portion of branch (M2) as compared to other mechanical treatments and control. Shoot length at 120 days(18.79 cm), length and width of leaf (6.05 & 2.61 cm), length of longest root (16.12 mm)and number of roots per cutting (25.11) were also found maximum under ringed lower portion of branch (M2) but, it did not differ significantly from girdled lower portion of branch . The increase in root and shoot characters in lower portion of ringed branch might be due to optimum increase in the endogenous auxin level, phenols, carbohydrates and other bio compounds which stimulate cell division and growth. These findings are in close agreement with.the findings of Biricolti *et al.* (1994) in chestnut, Fachinello *et al.* (1988) in apple and Gruddutt *et al* (2004) in guava. Although different mechanical treatments did not influenced earliest sprouting (days taken for sprouting and 50% sprouting) significantly, but the minimum (19.33) and maximum (23.00) days taken for sprouting was noted under ringed lower portion of branch (M_2) and control (Mo) respectively. Earliest sprouting of cuttings may be due to prevention of downward translocation of carbohydrates and accumulation of higher level of endogenous auxin in the ringed, lower portion of cuttings during the period of root initiation which might have resulted earliest completion of physiological process involved in rooting and sprouting. Similar results were also reported by Baghel *et al.* (1993) in lemon cuttings.

As regards the response of different crops percentage of success (68%), number of shoot per cutting (3.13), shoot length at 80 and 100 and 120 days after planting(20.39,21.98 and 23.90 cm), number of leaves per cutting (9.80), leaf length (6.43 cm), leaf width (2.74 cm), fresh weight of leaves (6.02 g), leaf area index (22.77 cm^2), dry matter percentage of leaves (31.71%), length of longest root (23.09 mm), diameter of longest root (1.01 mm), number of roots per cutting (40.13), fresh weight of roots (2.13 g) and dry matter percentage of roots (26.67 %) were significantly influenced and recorded maximum in lemon crop (C_2). Whereas, earliest sprouting (days taken for sprouting (14.20) and 50% sprouting (14.73) and maximum number of leaves per cutting (11.00) were observed in cuttings of pomegranate (C_3). The maximum rooting as well as vegetative growth characters except maximum number of leaves per shoot (9.80) in lemon crop (C_2) might be due to the fact that lemon crop uptake maximum nutrients as compare to other crop and use these nutrients for their vegetative growth and survival. Similar findings are also supported by Subramanyam and Dinesh (1993), Urban and Leachaudel (2005) in mango and Sharda (2008). The earliest sprouting in pomegranate may be due to higher level of nitrogen in the cuttings of pomegranate which stimulated the faster sprouting.

In case of different combination of mechanical treatments and fruit crops the percentage of success (80%), number of leaves per cutting (13.33%), leaf area index (41.24), fresh weight of leaves (7.89 g), dry matter percentage of leaves (35.82%), total number of leaves per cutting (45.66), fresh weight of roots (2.30) and dry matter percentage of roots (30.08 %) were found significantly superior under treatment combination of lower portion cutting of ringed branch of lemon (M_2C_2). Similarly shoot length after 120 days (28.00 cm), width of leaves (3.24 cm) and length of longest root (50.00 mm) were also found maximum under the same treatment (M_2C_2) which did not differ significantly from M_4C_2 and M_1C_2. The maximum number of leaves per shoot was recorded under treatment combination of lower portion cutting of ringed branch of lemon which did not differ significantly from M_2C_3 and M_4C_2. The maximum diameter of longest root was noted under treatment combination of upper portion of cutting of ringed branch with lemon which did not differ significantly. Although different combinations could not affect the sprouting of cuttings, number of shoot per cutting, shoot length at 80 and l00 days and length of leaf significantly, but the maximum (34.66 days) and minimum (12.00 days) days taken for bud sprouting was found under treatment combination of M_0C_2 and M_2C_3 respectively. The earliest (12.33 days) and latest 50% (47.00 days) sprouting was observed under M_4C_3 and M_0C_2 respectively. The maximum (4.00) and minimum (1.00) number of shoots per cutting were founding the treatment combination of M_2C_2 and M_2C_1 respectively. The maximum (24.13 and 26.08 cm) shoot length at 80 and l00 days and maximum length of leaf (8.03 cm) were recorded in treatment combination of M_2C_2 respectively.

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Table 1: Effect of mechanical treatments on rooting in cuttings of guava, lemon and pomegranate

Treatments	Days taken for sprouting	Days taken for 50% sprouting	Success of rooting percentage (%)	No. of shoots per cutting	Shoot length (cm) Days after planting 80	100	120	Total No.of leaves/ cutting	Length of Leaf (cm)	Width of leaf (cm)	Leaf Area Index (cm^2)	Fresh WL of leaves (g)	Dry matter of leaves (%)	No. of roots/ cutting	Length of longest root (mm)	Fresh WL of roots (%)	Diameter of longest root (mm)	Dry matter of roots (%)
(A) MECHANICAL TREATMENTS																		
Mo	23.00	27.77	35.55	1.33	7.81	9.10	10.18	11.33	3.49	1.27	4.32	2,15	15.53	13.11	8.88	0.75	0.33	14.76
M_1	21.33	25.00	42.22	1.66	9.47	10.99	12.78	15.22	3.88	1.65	8.38	3.18	17.30	14.44	10.24	0.82	0.37	17.54
M_2	19.33	22.88	57.77	2.77	14.55	17.11	18.79	26.00	6.05	2.61	18.72	3.94	30.05	25.11	16.12	1.24	0.49	28.46
M_3	21.22	24.77	37.77	1.77	8.85	10.22	11.87	14.55	3.55	1.58	6.95	2.23	16.22	13.88	9.81	0.78	0.34	16.65
M_4	20.11	23.22	49.11	2.55	13.81	16.51	18.62	22.00	5.42	2.45	13.63	3.18	28.50	20.88	15.75	1.15	0.49	27.54
S Em±	1.26	1.46	1.01	0.27	0.81	0.81	0.18	1.28	0.41	0.15	0.10	0.22	0.29	1.77	0.55	0.01	0.02	0.29
CD(5%)	NS	NS	2.93	0.79	2.34	2.34	2.35	3.71	1.18	0.45	0.30	0.64	0.86	5.13	1.60	0.04	0.06	0.86
(B) CROPS																		
C_1	17.33	19.26	4.00	0.53	2.97	3.53	4.47	3.80	1.36	0.98	2.02	0.56	11.48	7.13	4.60	0.37	0.15	10.78
C_2	31.06	40.26	68.00	3.13	20.39	21.98	23.90	29.66	6.43	2.74	22.77	6.02	31.71	40.13	23.09	2.13	1.01	26.67
C_3	14.20	14.73	61.46	2.40	9.33	12.85	14.98	20.00	5.64	2.02	6.40	2.23	21.38	5.20	8.79	0.34	0.05	25.53
S Em ±	0.97	1.13	0.78	0.21	0.62	0.62	0.63	0.99	0.31	0.12	0.08	0.17	0.23	1.37	0.42	0.01	0.01	0.23
CD (5%)	2.81	3.27	2.27	0.61	NS	1.81	1.82	2.87	0.91	0.35	0.23	0.50	0.66	3.97	1.24	0.03	0.04	0.66
(C) INTERACTION (MECHANICAL TREATMENTS X CROPS)																		
M_0C_1	18.33	19.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
M_0C_2	34.66	47.00	60.00	2.33	16.00	17.16	18.16	18.00	5.75	2.22	9.33	4.66	28.66	35.33	19.66	1.97	0.95	22.08
M_0C_3	16.00	16.66	46.66	1.66	7.45	10.15	12.38	16.00	4.73	1.32	3.36	1.78	18.00	4.00	7.00	0.27	0.04	22.22
M_1C_1	17.66	19.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
M_1C_2	30.66	39.33	66.66	3.00	19.65	21.41	24.00	28.00	6.38	2.88	19.91	7.58	31.08	38.66	23.36	2.16	1.06	26.85
M_1C_3	15.66	16.00	6.00	2.00	8.76	11.58	14.35	17.66	5.26	2.06	5.24	1.97	20.82	4.66	7.36	0.31	0.05	25.78
M_2C_1	17.00	18.66	13.33	1.00	7.78	9.06	11.43	8.33	3.53	2.36	5.05	1.26	29.33	18.66	11.63	0.98	0.39	27.03
M_2C_2	29.00	36.00	80.00	4.00	24.13	26.08	28.00	45.66	8.03	3.24	41.24	7.89	35.82	50.00	25.46	2.30	1.03	30.08
M_2C_3	12.00	14.00	78.00	3.33	11.74	16.20	16.95	24.00	6.60	2.23	9.89	2.68	25.00	6.66	11.26	0.43	0.06	28.28
M_3C_1	18.33	19.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
M_3C_2	31.33	40.33	60.00	3.00	18.24	19.43	21.33	25.00	5.56	2.71	16.27	4.62	29.33	37.33	22.26	2.05	0.97	25.52
M_3C_3	14.00	14.66	53.33	2.33	8.31	11.23	14.30	18.66	5.10	2.03	4.59	2.08	19.33	4.33	7.16	0.30	0.05	24.45
M_4C_1	17.33	19.00	6.66	1.66	7.10	8.61	10.93	10.66	3.30	2.53	5.09	1.54	28.09	17.00	11.40	0.87	0.38	26.88
M_4C_1	29.66	38.33	73.33	3.33	23.95	25.85	28.00	31.66	6.43	2.67	27.13	5.37	33.66	39.33	24.70	2.19	1.05	28.82
M_4C_3	13.33	12.33	67.33	2.66	10.38	15.08	16.94	23.66	6.53	2.16	8.69	2.64	23.77	6.33	11.16	0.39	0.05	26.92
S Em+	2.18	2.53	1.75	0.47	1.40	1.04	1.41	2.22	0.71	0.27	0.18	0.38	0.51	3.07	0.96	0.02	0.03	0.51
CD(5%)	NS	NS	5.08	NS	NS	NS	4.07	6.43	NS	0.79	0.53	1.12	1.49	8.88	2.77	0.06	0.10	1.49

Abbreviations: M_0: Control M_1: Upper portion of the ringed branch M2: Lower portion of the ringed branch M3: Upper portion of the girdled branch
M_4: Lower portion of the girdled branch C_1: Guava C_2: Lemon C_3: Pomegranate

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