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Response of rough lemon types of Assam to different method of propagation

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Abstract

Rough lemon commonly known as 'Gul nemu' in Assam is a very important rootstock in Citrus cultivation. However, it is also popular in the area of its origin, for its nutritious and flavorful fruits. Therefore, standardization of its propagation method among various germplasm available throughout the state, is much needed. As very few research are focused in this direction, a work was undertaken in Assam Agricultural University, Jorhat during 2017-2019, to judge the response of rough lemon types (in 30 germplasm) available across six agroclimatic zones of Assam to seed propagation, cutting and layering method with the objective of finding out the best method suited for selected germplasm type for rootstock raising and quality fruit production. All the germplasm irrespective of location, performed best through layering. While the success through cuttings was less, except in 4 germplasm from four locations, which had 100% successful rooting. The germplasm belonging to Barak valley region performed comparatively well for rootstock raising with good seed germination percentage.

Keywords: Rough lemon types, propagation, germplasm

Introduction

Rough lemon (*C. jambhiri*) is a widely used rootstock around the world. But in North Eastern Indian, particularly in Assam, it is also famous among the localities for its refreshing flavorful fruits. This region being the probable origin of the species, shows great diversity in its types available throughout the citrus growing pockets. Considering it as a highly cross-pollinated crop, it is natural to show variations. However, records on such variations are not available and very minimal work has been done to standardize the propagation of the germplasm of this species, either for the purpose of rootstock or for consumption as table purpose fruits. Considering these problems, an experiment was undertaken during 2017-2019 under Assam Agricultural University, Jorhat to find out best method of propagation of various available germplasm of Rough lemon in six agro-climatic regions of Assam with the objective to generate information regarding which germplasm performs best for rootstock raising (through seeds) or which germplasm has good survival through vegetative methods for maintaining quality fruits.

Materials and Method

This study was performed on thirty Rough lemon germplasm (based unique morphology and biochemical constituents) identified and characterized using the minimal descriptors for citrus by IPGRI, 1999, aged between 8-12 years, selected from six agro-climatic zones through Assam. Each germplasm were given a specific number indicating its location. Five plants from each zones was considered for the investigation and their response to propagation through seeds, cuttings and air layering was evaluated.

A. Seed propagation

Freshly extracted seeds from healthy mature fruits were washed in tap water to remove the mucilaginous substances at the same time the floating seeds were discarded and the healthy bold seed were selected. The seeds were sown in plastic cups with sand as the growing medium. Following observations were recorded:

(a) **Days to seed germination:** Days to seed germination was recorded on five representative seeds with three replications.

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(b) Germination percentage: Germination percentage was calculated by the following formula:

$$\text{Germination (\%)} = \frac{\text{Number of seeds germinated}}{\text{Number of seed sown}} \times 100$$

(c) Extent of polyembryony: The number of polyembryonic seedlings was observed as per the number of seedlings emergence per seed. Extent of polyembryony was calculated by the following formula and expressed in %.

$$\text{Extent of polyembryony (\%)} = \frac{\text{Number of seeds producing nucellar seeding}}{\text{Total number of seeds sown}} \times 100$$

B. Propagation by cuttings: Semi-hard wood cuttings of rough lemon were prepared from one year old non fruiting shoots during the month of May-June (Bhusal *et al.*, 2001) [2] and September (Sabbah, 1991). The cuttings of about 1-2 cm thick and 15-20 cm long with 3-4 buds were collected from all the accessions from different locations packed in moist cloth and were brought to the experimental sites. Before insertion, a basal cut was given just below a node and an upper slanting cut was given at 1 cm above the node. The pots were prepared by filling loose soil to about 20 cm deep, equal proportion of FYM and sand were added to the soil. The basal portions of cuttings, 1/3 of its length was inserted into the pot in slanting position. Cuttings were uprooted after 40 days of leaf emergence to observe rooting. Number of rooted cuttings are recorded. Five numbers of cuttings were taken per tree. Following observations were recorded

Success percentage: Percentage of success was calculated by the following formula:

$$\text{Success (\%)} = \frac{\text{Number of cuttings rooted}}{\text{Number of cuttings inserted}} \times 100$$

C. Propagation by air layering: One year old, healthy and straight shoots of rough lemon accessions from six locations were selected in the month of July and a ring of bark measuring 2.5 cm to 4 cm was removed just below a bud (Singh, 2012) [10]. Coco peat was soaked overnight in water and mixed with soil (2:1). The ringed portion was surrounded by mud ball containing coco peat and soil followed by wrapping with transparent polyethylene strip. Both the ends were tied with rope to make it air tight. Five numbers of air layers were prepared in each accession and root initiation was recorded after three and half weeks of layering. Following observations were recorded.

(a) Days to root formation: Days to root formation was observed visually through the polyethylene sheet and data was recorded.

(b) Success percentage: Percentage of success was calculated by the following formula:

$$\text{Success (\%)} = \frac{\text{Number of air layers rooted}}{\text{Number of air layers prepared}} \times 100$$

Results and Discussion

A. Seed propagation: Seeds of rough lemon fruits were sown on 15th December, 2017 in plastic cups immediately after extraction. The results are presented in the Table 1. The data revealed that, the average numbers of days required for germination of rough lemon seeds was 32.30 days. The least number of days required for germination was recorded to be 23.67 days in AR04T2 and highest days (41.00 days) for germination were recorded in AR02T5 followed by AR03T3 (40.33 days). The highest germination percentage of 100% was recorded in AR06T2 and the lowest was recorded to be 70.00% in AR01T4. The mean germination percentage of rough lemon accessions was recorded to be 87.67%. Similar finding was reported by Gaikwad *et al.* (2018) [5] in a study on seed germination of rough lemon accessions of Maharashtra and recorded seed germination ranging from 75.14% to 94.38% in freshly sown seed.

The variation in germination percentage might be due to difference in size of the seeds and maturity stages of harvested fruit. Days taken to germination in the present study were longer compared to reports of Ali and Mirza (2006) [1] who observed germination at 10 days of sowing. The delay in germination might be attributed to low temperature effect. Regarding emergence of polyembryonic seedlings, not all rough lemon accessions were observed to bear polyembryonic seedlings. The extent of polyembryonic seedlings ranged from 0 to 20.00% among accessions. This was in fair conformity with the reports of Krezdron and Jackson, 1973. It was observed that cuneiform seed failed to bear polyembryonic seedlings.

B. Air layering

Air layering in rough lemon accession was done from 21st Feb to 10th March in different locations and five layers were prepared per accession. The observations pertaining to air layering is presented the Table 1. The data showed that the maximum numbers of days for rooting was recorded to be 49.33 in AR02T2 and the minimum number of days was recorded to be 35.67 days in AR01T2. Among locations, average days taken for rooting was longer (46.93 days) in location L2 and shortest in location L1 (38.00 days). The average number of days for rooting in air layers of rough lemon was recorded to be 41.97 days. The success percentage ranged from 80% to 100% among the accessions with an average percentage of 92.11%.

However, no earlier reports on performance of air layering in rough lemon can be traced till date. The observed variation in the present study, in days to root formation might be due to plant physiological status and environmental factors *i.e.* rainfall. The faster rooting in accessions of location L1 might be due to high humidity in the locality that might have reduced transpiration which in turn increased cell turgidity and enhanced cell division.

C. Cuttings

Semi hardwood cuttings were inserted during April, 2017 in pots containing growing media. Data on propagation of rough lemon accessions by cutting is presented in the Table 1. The success percentage ranged from 33% to 100% in thirty accessions with a mean success percentage of 79.11%. The low percentage of success might be due to ageing of the plants and physiological status of the tree. The present results is in partial agreement with the previous reports of Faruque

and Mahmood (1973) [3] who recorded that rooting of cuttings from stem and leaf was successful in ealchi lemon, kagzi lime but pink flesh pummelo did not root at all. However, it does not agree completely to the findings of Bhusal *et al.* (2001) [2], who reported 100% rooting in rough lemon cuttings. Heuser (1976) [6] recorded those cuttings taken from plants in juvenile phase root more readily than the plants in the adult

phase of growth. The rooting potential of the soft wood cuttings was found to diminish with the increase in the age of the mother shoots (Sing *et al.*, 1957) [9]. In citrus, considerable differences can exist in the rooting of stem cuttings among genera and species, within species, and even within clones of the same species (Ferguson and Young, 1985) [4].

Table 1: Seed propagation of rough lemon accessions

Location/ District	Plant No.	Accession No.	Days to seed germination	Germination (%)	Extent of polyembryony (%)	Air Layering		Success (%)	Cuttings	
						Days to root formation	Av. Days /Zone		No. of rooted cuttings	Av. Days /Zone
Jorhat (L1)	1	AR01T1	33.00	83.33	10.00	36.33	38.00	100.00	3.67	73.33
	2	AR01T2	32.33	90.00	16.67	35.67		96.67	4.67	93.33
	3	AR01T3	38.00	86.67	10.00	37.67		100.00	4.33	86.67
	4	AR01T4	30.00	70.00	0.00	41.33		96.67	5.00	100.00
Nagaon (L2)	5	AR01T5	27.67	86.67	10.00	39.00	46.93	100.00	4.00	80.00
	6	AR02T1	30.67	93.33	0.00	47.67		80.00	3.33	66.67
	7	AR02T2	30.67	93.33	16.67	49.33		80.00	4.33	86.67
	8	AR02T3	33.00	93.33	20.00	47.33		80.00	5.00	100.00
	9	AR02T4	33.67	90.00	13.33	44.67		90.00	3.67	73.33
Kokrajhar (L3)	10	AR02T5	41.00	86.67	10.00	45.67	40.93	90.00	3.67	73.33
	11	AR03T1	32.00	90.00	10.00	45.00		100.00	4.00	80.00
	12	AR03T2	33.00	76.67	0.00	46.00		96.67	4.33	86.67
	13	AR03T3	40.33	90.00	3.33	36.33		100.00	4.33	86.67
Sonitpur (L4)	14	AR03T4	28.00	96.67	20.00	39.00	42.47	93.33	3.67	73.33
	15	AR03T5	33.67	93.33	13.33	38.33		96.67	2.33	46.67
	16	AR04T1	27.67	96.67	6.67	40.00		90.00	4.00	80.00
	17	AR04T2	23.67	73.33	0.00	41.00		86.67	5.00	100.00
Karbi Anglong (L5)	18	AR04T3	39.00	80.00	6.67	41.67	42.40	83.33	4.33	86.67
	19	AR04T4	29.67	93.33	13.33	43.67		90.00	4.67	93.33
	20	AR04T5	27.67	76.67	0.00	46.00		86.67	3.67	73.33
	21	AR05T1	31.00	86.67	0.00	44.67		93.33	4.00	80.00
	22	AR05T2	38.00	76.67	0.00	41.67		83.33	3.00	60.00
Cachar (L6)	23	AR05T3	34.00	96.67	3.33	42.67	41.07	93.33	1.67	33.33
	24	AR05T4	26.33	93.33	10.00	39.00		93.33	3.00	60.00
	25	AR05T5	31.67	80.00	0.00	44.00		93.33	5.00	100.00
	26	AP06T1	31.00	96.67	13.33	41.00		90.00	3.67	73.33
Mean	27	AR06T2	29.67	100.00	13.33	43.67	41.56	96.67	4.33	86.67
	28	AR06T3	32.33	76.67	0.00	36.67		90.00	4.00	80.00
	29	AR06T4	33.67	90.00	3.33	38.67		96.67	4.00	80.00
	30	AR06T5	36.67	93.33	6.67	45.33		96.67	4.00	80.00
S.Ed. (±)			0.94	5.16	5.24	0.55		5.02	0.61	12.17
CD (0.05)			1.88	10.33	10.47	1.10		10.04	1.22	24.35
GCV (%)			12.70	8.16	70.63	8.95		5.63	15.89	15.89
PCV (%)			13.19	10.89	109.47	9.10		8.73	24.65	24.65
h ² (%)			92.71	56.12	41.63	96.87		41.55	41.56	41.56

Conclusion

Present study on propagation of rough revealed that, rough lemons can be easily propagated through seeds and air layering. Seed showed an average germination percentage of 87.67% and air layering recorded a success percentage of 92.11%. However, propagation through stem cutting was found to be comparatively difficult with moderate success percentage (79.11%).

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