



ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(3): 5842-5844
© 2023 TPI

www.thepharmajournal.com

Received: 26-01-2023

Accepted: 28-02-2023

C Rajamanickam

Citrus Research Station,
Vannikonenthal, Sankarankovil,
Tirunelveli, Tamil Nadu, India

K Sundaraiya

Citrus Research Station,
Vannikonenthal, Sankarankovil,
Tirunelveli, Tamil Nadu, India

B Muralidharan

Citrus Research Station,
Vannikonenthal, Sankarankovil,
Tirunelveli, Tamil Nadu, India

A Baskaran

Citrus Research Station,
Vannikonenthal, Sankarankovil,
Tirunelveli, Tamil Nadu, India

T Sumathi

Citrus Research Station,
Vannikonenthal, Sankarankovil,
Tirunelveli, Tamil Nadu, India

Corresponding Author:

C Rajamanickam

Citrus Research Station,
Vannikonenthal, Sankarankovil,
Tirunelveli, Tamil Nadu, India

Evaluation of different citrus rootstocks on growth characters of acid lime (*Citrus aurantifolia* Swingle) var. PKM-1

C Rajamanickam, K Sundaraiya, B Muralidharan, A Baskaran and T Sumathi

Abstract

The present field experiment on the effect of different citrus rootstocks on growth characters of acid lime (*Citrus aurantifolia* Swingle) var. PKM-1 was conducted at Citrus Research Station, Vannikonenthal, Sankarankovil Taluk, Tirunelveli district during 2021-2022. The objective of the present experiment is to evaluate the different types of citrus rootstocks on growth traits of acid lime and to identify the appropriate rootstock for enhancing the growth and yield under Tirunelveli conditions. Seven numbers of rootstocks such as *Citrus macrophylla* (Alemow), *Citrus limonia* (Rangpur lime), *Poncirus trifoliata* (Trifoliolate orange), *Citrus aurantium* (Sour orange), *Citrus jambhiri* (Rough lemon), *Citrus madraspatana* (Kichili) and *Citrus pennivesiculata* (Gajanimma) were used for this study and budded on variety PKM -1. Fifty numbers of rootstocks were used for each treatment. 'T' budding was done during the months of November and December and budded plants were maintained in nursery. In the present study results showed that various rootstocks had significant effect on growth traits of acid lime. PKM-1 acid lime budded on rangpur lime rootstock recorded the highest values in growth traits such as budding success percentage (64.40%), survival percentage (90.0%), plant height (97.50 cm), shoot length (52.25 cm), number of leaves per plant (82.30) and stem thickness (3.50 cm³) followed by rough lemon rootstock (58.20%; 90.00%; 84.10 cm; 48.40 cm; 51.20; 2.80 cm³) whereas the lowest values were found in rootstock kichili (*Citrus madraspadanas*) (28.00%; 30.0%; 47.50 cm; 22.30 cm; 22.60; 2.52 cm³). In the case of main field planting, PKM-1 acid lime registered the highest values for the growth characters such as transplanting successes percentage (100%), tree height (1.60 m), stem girth (24.8 cm), canopy spread (2.10 m E-W; 2.10 m N-S), canopy volume (1.01 m³), number of branches per plant (4.1) and shoot length (1.90 m) whereas the lowest values were noticed in kichili rootstock. Hence the present study it was concluded that Rangpur lime rootstock showed vigorous effect on acid lime var. PKM-1 as compared with rough lemon, sour orange, Kichili, Alemov, Gajanimma, Trifoliolate orange rootstocks.

Keywords: Acid lime, growth traits, rootstocks, scion, budding

Introduction

Citrus is considered as one of the most important fruits widely cultivated different parts of the world. It belongs to the family Rutaceae. In India, citrus industry ranks third amongst the fruit-based industries, succeeding mango and banana. Citrus crops have occupied an area of 10.34 lakh ha with total production of 13.20 lakh tonnes in India and contribute 13 per cent of total fruit production. Acid lime (*Citrus aurantifolia* Swingle) is an important commercial species of citrus considered to be indigenous to India, and is extensively cultivated in many parts of India across tropical and subtropical regions. In India, Maharashtra, Andhra Pradesh, Assam, Tamil Nadu, Gujarat, Rajasthan, and Bihar are the leading states in acid lime cultivation. In Tamil Nadu, it is widely cultivated in Tirunelveli, Tenkasi, Turicorin, Dindigul, Madurai, Theni, Perambalur, Tiruchirapalli, Coimbatore, Vellore and Virudhunagar districts under rainfed and irrigated conditions. Acid lime are cultivated 10000 ha areas under Tamil Nadu conditions especially Tirunelveli, Tenkasi and Thoothukudi districts it is under larger area cultivation. Rootstocks are known to have profound effect on the vigour, precocity, longevity of trees, productivity, internal quality and longevity of the scion varieties grafted on them. They are also known to influence the susceptibility of trees to various diseases and insects (Singh *et al.* 2012) [14]. A wide variety of citrus rootstocks are available each having desirable attributes. Citrus rootstocks differ in compatibility of kinds of soils and manner of root dispersion. Rootstock selection is a vital consideration while planning any orchards Patil, (1987) [10].

Role of rootstocks in citrus is one of the most debatable and discussed issues and its selection is a major consideration under planning of any citrus orchard. Exhaustive study on the suitability of rootstocks for acid lime have been undertaken to determine the most ideal rootstock for commercial cultivation (Shinde *et al.* 1997; Lallanram *et al.* 2002) [13, 6]. The ideal citrus rootstock must be compatible with the scion, the adaptable to the appropriate soil and climatic factors and should be improve one or more desirable characteristics. PKM-1 acid lime is the commercial cultivar under Tamil Nadu especially Tirunelveli and Tenkasi districts and so far no efforts have been made to identify the suitable rootstocks. With this background, the present experiment was conducted to find out a suitable rootstock for acid lime var. PKM -1 under Tirunelveli and Tenkasi condition during 2021 – 2022.

Materials and Methods

The present study on evaluation of different citrus rootstocks on acid lime var. PKM-1 for growth traits was conducted at Citrus Research Station, Vannikonenthal, Sankarankovil during 2021-2022 with the aim to identify the appropriate rootstock for enhancing the growth of acid lime var. PKM-1. Seven numbers of rootstocks such as *Citrus macrophylla* (Alemow), *Citrus limonia* (Rangpur lime), *Poncirus trifoliata* (Trifoliata orange), *Citrus aurantium* (Sour orange), *Citrus jambhiri* (Rough lemon), *Citrus madraspatana* (Kichili) and *Citrus pennivesiculata* (Gajanimma) were used for this study and budded on variety PKM -1 by using 'T' budding method at a height of 20 – 25 cm from the ground consisting of ten rootstocks per treatment with five replications. Fifty numbers of rootstocks were used for each treatment. Budding was done during the months of November and December and budded plants were maintained in nursery. After one year budded plants were planted in the main field with the spacing of 6 x 6 m spacing. In each rootstock 10 plants were planted in the main field. The cultural practices such as irrigation, weeding, pruning, fertilizer with farm yard manure @ 20 kg per plant and recommended dose of NPK and foliar application of micronutrients etc were given to all the plants as per the Crop Production Guide of TNAU (2020) were followed. Pits were taken with the size of 75 x 75 x 75 cm and applied 10 kg farm yard manure along with top soil and pits were filled as well as planting were taken in the centre of the pit. The experiment was laid out in a randomized block design (RBD) and replicated thrice. Observations *viz.*, budding success percentage (%), survival percentage (%), plant height (cm), shoot length (cm), number of leaves per plant, stem thickness (cm) were recorded. After the planting at the main field, observations such as tree height (m), transplanting success percentage (%), stem girth (cm), canopy spread (E-W; N-S m), canopy volume (m³), number of branches per plant and shoot length (m) were recorded after third year. The recorded observations were analysed statistically as per the method was suggested by Panse and Sukhatme (1967) [8].

Results and Discussion

The growth traits of different rootstocks on acid lime var. PKM-1 are presented in Table 1 and observations of all the growth traits are highly significant. The present study results revealed that budding success percentage and survival percentage recorded the highest values in acid lime budded on rangpur lime rootstocks (64.40%; 90.00%) followed by rough lemon rootstocks (58.20 5; 85.00%) whereas the lowest

values were noticed in acid lime budded on kitchili rootstocks (28.00%; 30.00%). This might be due to their ever green nature which resulted in retaining the leaves even during summer months leading to regular movement of photosynthates and thereby superior sap flow during the budding months. It may also account to rapid complete union of xylem and cambium tissue of the scion and rootstock favouring survival of the sprout (Hartmann *et al.* 1997) [4]. Nasir *et al.* (2006) [7] reported that budding success percentage was higher in Kinnow budded with Rangpur lime rootstock. Rajamanickam *et al.* (2002) [11] observed that grafted plants recorded the highest success and survival percentage in aonla under Periyakulam conditions. This is in conformity with the findings of Barman (2006) [1].

In the case of growth traits, acid lime PKM-1 budded on rangpur lime rootstocks registered the highest values in plant height (97.50 cm), shoot length (52.25 cm), number of leaves per plant (62.30) and rootstock thickness (3.50 cm) followed by rough lemon rootstock (84.10 cm; 48.40 cm; 51.20; 2.80 cm) whereas the growth traits exhibited the lowest values in acid lime budded on kichili rootstock (43.20 cm; 12.30 cm; 22.60; 1.52 cm). This might be due to the genetic nature of the rootstocks. Rangpur lime rootstock is a vigorous, hardy rootstock with good adaptability to a wide range of soil particularly heavy soil, tolerant to tristeza and salt and produced larger number of roots (Rajamanickam *et al.* 2021) [12]. Rough lemon rootstock also produced larger trees and more number of vertical root developments. Singh *et al.* (2012) [15] reported that the maximum plant height registered in rough lemon rootstock may be due to its vigorous nature facilitating greater absorption of nutrients and water in the soil. Srivastav *et al.* (2005) [17] reported that the maximum plant height was noticed in Mosambi budded on Karna Khatta rootstock. Similar findings also reported by Ingle *et al.* (2004) [5] in Kagzi lime.

The main field growth traits of acid lime var. PKM-1 budded on different citrus rootstocks is presented in Table 2. Acid lime budded on Rangpur lime rootstocks exhibited the highest plant height of 1.60 m followed by rough lemon rootstock (1.52 m) whereas the lowest plant height was noticed in Kichili rootstock (0.98 m). This might be due to more vigorous roots and leaves as well as adaptable to different soil condition. Parameshwar *et al.* (2018) [9] stated that plant height was found highest on Valentia late sweet orange budded on Rangpur lime rootstock. Regarding transplanting success in the main field, acid lime budded on rangpur lime rootstocks registered the highest success percentage (100.00%) where as the lowest percentage was noticed in kichili rootstock (55.20%). Singh *et al.* (2019) [16] stated that transplanting success registered the highest in exotic rootstocks under Punjab condition. In the case of growth traits, acid lime var. PKM-1 budded on Rangpur lime rootstock recorded the highest values for growth traits such as stem girth (24.8 cm), plant spread (2.10 m E-W; 1.82 m N-S), canopy volume (1.01 m³), number of branches per plant (4.1) and shoot length (1.90 m) followed by rough lemon rootstock (22.50 cm; 1.85 m E-W; 1.63 m N-S; 0.762 m³; 3.50; 1.82 m). While the lowest values were observed in acid lime budded on kichili rootstock (17.20 cm; 1.41 m E-W; 1.05 m N-S; 0.241 m³; 2.15; 1.05. Differences among different rootstocks with regards to tree height, canopy spread, canopy volume, stem girth were also reported by Dubey and Singh (2003) [3] in mandarin, Cedeno *et al.* (1994) [2] in Valencia orange.

Table 1: Growth characters of different citrus rootstocks on acid lime var. PKM-1

Treatment details	Success percentage (%)	Budding Survival percentage (%)	Plant height (cm)	Shoot length (cm)	Number of leaves per plant	Rootstock thickness (cm)
<i>Citrus macrophylla</i> (Allemow)	33.70	40.00	48.20	13.50	29.40	2.32
<i>Citrus limonia</i> (Rangpur lime)	64.40	90.00	97.50	52.25	62.30	3.50
<i>Poncirus trifoliata</i> (Trifoliata orange)	35.60	50.00	55.60	24.20	26.25	2.05
<i>Citrus aurantium</i> (Sour orange)	43.80	70.00	79.20	35.10	28.50	2.20
<i>Citrus jambhiri</i> (Rough lemon)	58.20	85.00	84.10	48.40	51.20	2.80
<i>Citrus madraspatana</i> (Kichili)	28.00	30.00	43.20	12.30	22.60	1.52
<i>Citrus pennivesiculata</i> (Gajanimma)	39.50	70.00	51.60	32.60	38.10	2.60
SEd	4.04	4.80	3.81	3.36	2.75	0.28
CD (P=0.05%)	8.32	9.58	7.93	6.90	6.26	0.60

Table 2: Effect of growth traits of budded acid lime var. PKM-1 at main field

Treatment details	Tree height (m)	Transplanting success percentage (%)	Stem girth (cm)	Canopy spread (m)		Canopy volume (m ³)	No. of branches per plant	Shoot length (m)
				E-W	N-S			
<i>Citrus macrophylla</i> (Allemow)	1.12	63.80	18.50	1.52	1.28	0.544	2.90	1.25
<i>Citrus limonia</i> (Rangpur lime)	1.60	100.0	24.8	2.10	1.82	1.01	4.1	1.90
<i>Poncirus trifoliata</i> (Trifoliata orange)	1.36	73.50	18.90	1.70	1.54	0.591	3.0	1.51
<i>Citrus aurantium</i> (Sour orange)	1.46	75.80	20.60	1.79	1.60	0.696	3.20	1.62
<i>Citrus jambhiri</i> (Rough lemon)	1.52	89.30	22.50	1.85	1.63	0.762	3.50	1.82
<i>Citrus madraspatana</i> (Kichili)	0.98	55.20	17.20	1.41	1.05	0.241	2.65	1.05
<i>Citrus pennivesiculata</i> (Gajanimma)	1.23	79.50	19.40	1.55	1.30	0.412	3.20	1.50
SEd	0.245	3.98	2.390	0.098	0.085	0.0140	0.184	0.0052
CD (P=0.05%)	0.530	8.52	3.020	0.215	0.195	0.0210	0.480	0.0120

References

- Barman P. Exploitation of rangpur lime for softwood grafting in citrus. M.Sc. (Hort.) Thesis submitted to Kitturrani Channamma College of Horticulture, UHS, Arabhavi, 2006, 229.
- Cedeno MA, Perez LA, Boneta E, Torres CJ. Effect of rootstocks on tree size and yield of six Valencia orange clones. Journal of Agriculture of the University of Puerto Rico. 1994;78(3-4):123-129.
- Dubey AK, Singh AK. Evaluation of different mandarin (*Citrus reticulata*) under foot hills conditions of Arunachal Pradesh. Indian Journal of Agricultural Sciences. 2003;73(10):527-529.
- Hartmann HP, Kesar DE, Davies FT, Geneve R.L. Plant propagation – Principles and Practices (6th Ed.) Prentice Hall of India Pvt. Limited, New Delhi; c1997.
- Ingle H, Gode VP, Banbote BG, Giri GK. Release proposal of PDKV lime submitted to State Varietal Release Committee; c2004.
- Lallanram S, Singh and Marathe RA. Performance of bearing Nagpur mandarin (*Citrus reticulata* Blanco) on various exotic and indigenous rootstocks. Indian Journal of Citriculture. 2002;1(1):14-20.
- Nasir MA, Mohar TA, Aziz A, Ahmad S, Rehman A. Nursery performance of rootstocks of different citrus fruits under Sargodha climatic conditions. Agric. Research. 2006;44:161-165.
- Panse VG, Sukhatme PV. Statistical methods for agricultural workers. 2nd edition, ICAR, New Delhi; c1985.
- Parameshwar P, Joshi PS, Nagre PK. Effect of rootstock on plant growth and fruit quality of sweet orange (*Citrus sinensis*) var. Valencia late. Int. J. Curr. Microbiol. App. Science. 2018;7(4):1685-1689.
- Patil VK. High density planting and dwarfing rootstocks in citrus. A review. J. Maharashtra Agricultural University. 1987;12:189-194.
- Rajamanickam C, Anbu S Balakrishnan K, Rajangam J. Studies on propagation techniques in aonla. South Indian Horticulture. 2002;50(1/6):220-222.
- Rajamanickam C, Subbiah A, Rajangam J, Muthuvel I, Tamilselvan M, Vijayselvaraj KS, et al. Principle and practices of plant propagation and nursery management. Satish Serial Publishing House, New Delhi, 2022, 470.
- Shinde BN, Patil VK, Wankhede SD, Kulkarni RM, Shinde NN. Studies on behaviour of sweet orange (*Citrus sinensis*) variety in relation to bud break, height and spread on different rootstocks. In Proceedings of National Seminar on Citriculture, held during 17 – 19 November at Nagpur, India; c1997. p. 177-179.
- Singh S, Rattanpal HS, Aulakh PS, Sharma DR, Sangwan AK, Arora A, et al. Citrus rootstock in India: Problems and Prospects (Chapter 3). In: Green Agriculture, Newer Technologies. New India Publishing Agency; c2012. p. 27-71.
- Singh J, Yadav A, Bhatnagar P, Arya CK, Jain MC, Sharma MK, et al. Budding performance of Nagpur mandarin of different rootstocks under Hadoti region of Rajasthan. Indian Journal of Horticulture. 2012;69(1): 20-26.
- Singh S, Chahal TS, Singh H. Nursery performance of exotic citrus rootstocks under protected conditions. Agric Research Journal. 2019;56(4):757-761.
- Srivastav M, Dubey AK, Sharma RR. Effect of rootstocks on leaf nutrients, tree growth, yield and fruit quality of 'Mosambi' sweet orange (*Citrus sinensis*) under Delhi conditions. Indian Journal of Agricultural Sciences. 2005;75(6):333-335.