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Assessment of Acid lime (*Citrus aurantifolia* Swangle) Varieties for Yield and Quality traits

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ABSTRACT

The present study on Assessment of acid lime varieties for growth, yield and quality traits suitable for Tirunelveli district of Tamil Nadu was conducted at Citrus Research Station, Vannikonenthal and demonstrated at ten different farmers' field at Vannikonenthal village of Manur block, Tirunelveli district during 2021- 2022. The observation on growth, yield, quality parameters and cost economic traits were recorded. The results revealed that PKM1 variety recorded the highest values for the traits such as plant height (3.63 m), tree spread (3.26 m E-W; 3.58 m N-S), canopy volume (7.583 m^3), fruit girth (3.65 cm), fruit weight (46.70 g), fruit volume (44.20 cc), number of fruits per tree (1006.25), yield per tree (41.60 kg/tree), yield per ha (12.76 t/ha), TSS (7.86 ^{o}Brix), fruit juice content (37.50 ml), acidity (6.501 %) and ascorbic acid content (32.15 mg/100g), followed by Balaji whereas the lowest values was found in farmers' practices (Puliyankudi local) (3.15 m; 2.90 E-W; 3.32 N-S; 4.93 m^3; 3.35 cm; 39.50 g; 37.30 cc; 35.77 kg/ tree; 9.91 t/ha; 6.78 ^{o}Brix; 31.30 ml, 6.35 %; 24.10 mg/100g).Furter, it was found that PKM1 recorded the highest net returns of Rs. 1,40,100/ ha with the B:C ratio of 2.22 followed by Balaji (Rs. 1,17,500/ha; 2.04). However, the farmers' practices registered the lowest net profit (Rs. 82,000/ha) and benefit cost ratio (1.71). The incidence of bacterial canker observed that the lowest incidence was recorded in PKM1 and Balaji whereas the highest incidence was noticed in farmer's practices (23.25 %). PKM1 registered 28.0 per cent increased yield over farmers' practice.

Key Words: Acid lime, Citrus, Fruit, Growth, Yield.

INTRODUCTION

Acid lime (*Citrus aurantifolia* Swangle) is one of the most important fruits in India India is largest producer of acid lime in the world (Chadha, 2002). In India, it is extensively cultivated in Maharashtra, Andhra Pradesh, Telangana, Karnataka, Tamil Nadu, Gujarat and Bihar. Acid lime used for preparation of lime oil, lime peel oil, peel powder are also great demand in soap and cosmetic industry. In Tamil Nadu, it is commercially cultivated at Tirunelveli, Tenkasi, Tuticorin, Perambalur, Madurai, Theni, Dindigul, Virudhunagar, Coimbatore and Vellore districts. In Tirunelveli and Tenkasi districts, acid lime largely cultivated at Manur, Ambasamuthiram, Nanguneri, Cheranmahadevi, Puliyankudi, Vasudevanallur, Sankarankovil, Melanelithanallur, Alankulam, Tenkasi, Kadayam and Kadayanallur blocks. In Tirunelveli district, acid lime fruits can be harvested throughout the year. Farmers are predominantly cultivated local cultivar (Puliyankudi local) and getting low yield and income and susceptible by bacterial wilt as well as die back diseases. Farmers were unaware about new high yielding varieties and new innovative technologies and hence fetching low yield and income. With this background, an assessment of acid lime varieties for growth, yield, quality and higher productivity and its suitability in Tirunelveli and Tenkasi districts was carried out.

MATERIALS AND METHODS

The present assessment was carried out at

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Citrus Research Station, Vannikonenthal, Manur Taluk, Tirunelveli district. PKM1, Balaji and Puliyankudi local (farmer practices) were used for this assessment and cultivated in an area of 2.0 ha. PKM1 and Balaji trees were available at Citrus Research Station farm whereas the Puliyankudi local observations were collected from the farmers' field at Vannikonenthal, Manur Block, Tirunelveli district, Tamil Nadu. Foliar application of IIHR citrus special sprayed during pre flowering stage, flowering stage as well as fruit development stages @ 5 g/l of water. One year old seedlings with the height of 30 cm were planted in the main field at a spacing of 6.0 x 6.0 m. The seeding planted during June – July and October – November. Impart training on improved production technology of acid lime to ATMA farmers regarding cultivation details such as training, pruning, planting of seedlings, application of fertilizers and manures, foliar application of IIHR citrus specials, plant protection measures etc. The present field assessment was laid out in a randomized block design (RBD) with three treatments and ten replications as per the methods suggested by Panse and Sukhatme (1967). The observations *viz.,* plant height (cm), plant spread (N-S; E-W) (m), canopy volume (m^3), number of fruits per tree, fruit weight (g), fruit volume (cc), fruit girth (m), yield per tree (kg), yield per ha (t/ha), quality traits like TSS (^{o}Brix), fruit juice content (ml), acidity (%) and ascorbic acid content (mg/100 g), net profit (Rs.) and B:C ratio were recorded and analysed statistically. The incidence of citrus canker was also observed. Total Soluble Solids (°Brix) was measured by hand refractometer and acidity (%) as well as ascorbic acid content (mg/ 100 g) was estimated using procedures described by Ranganna (1986).

RESULTS AND DISCUSSION

The present experiment results of vegetative and yield traits were presented in Table 1. The present demonstration results revealed that acid lime var. PKM1 recorded the highest values in growth and yield traits as compared to Balaji and local practices (Puliyankudi local). The results revealed that PKM1 recorded the highest values in vegetative traits such as plant height (4.62 m), tree spread (3.26 m East - West; 3.58 m North - South) and canopy volume (7.853 m^3) and it was followed Balaji (3.87 m; 3.08 m E-W; 3.45 m N-S; 5.879 m^3); whereas the lowest values of vegetative traits were observed in farmers' practices (Puliyankudi local) (3.15 m; 2.90 m E-W; 3.32 m N-S; 4.933 m^3). Kumar *et al* (2011) reported that acid lime var. PKM1 registered the highest values in vegetative traits when compared other varieties under Periyakulam condition. Mahantesh (2016) reported that PDKV Seedless lime registered the highest values of vegetative parameters such as plant height (3.50 m), tree spread (10.30 m) and tree volume (42.48 m^3) under Hisar condition.

In the present assessment, PKM1 recorded the highest number of fruits per tree (1006.25) followed by Balaji (951.80) whereas the lowest number of fruits per tree observed in farmer practices (Puliyankudi local) of 854.70. This might be due to genetic nature of the plant. Kumar *et al.,* (2011) reported that PKM1 recorded the more number of fruits per tree under Periyakulam conditions. In the present assessment the same trend was noticed in fruiting traits also. PKM1 had exhibited the highest values of fruiting traits such as fruit weight (38.75 g), fruit girth (3.65 cm) and fruit volume (44.20 cc) followed by Balaji (36.80 g; 3.58 cm; 41.10 cc) whereas the lowest fruiting traits was noticed in Puliyankudi local (34.15 g; 3.35 cm; 37.30 cc). This might be due to throughout year flowering, fruiting, number of flowers, productive branchelets and canopy volume which leads to enhanced number of fruits per tree. This was in accordance with the earlier finding of Jawaharlal *et al,* (1989).

Regarding yield characters, PKM1 recorded the highest yield per tree (46.10 kg/tree) and yield per ha (12.76 t/ha) whereas this was followed by Balaji (41.68 kg/tree; 11.55 t/ha). The lowest yield characters was observed in puliyankudi local (35.77 kg/tree; 9.91 t/ha). This might be due to genetic nature of the plant. Kumar *et al* (2011)

Table 1. Assessment of acid lime varieties for growth and yield traits under Tirunelveli conditions.

Sr. No.	Particulars	PKM-1	Balaji	Puliyankudi local	SEd	CD (P= 0.05%)
1.	Plant height (m)	3.63	3.32	3.15	0.138	0.281
2.	Plant spread (m) East– West	3.26	3.08	2.90	NS	
	Plant spread (m) North - South	3.58	3.45	3.32	NS	
3.	Canopy volume (m^3)	7.853	5.879	4.933	0.178	0.324
4.	Number of fruits per tree	1006.25	951.80	905.70	17.825	36.021
5.	Fruit girth (cm)	3.65	3.58	3.35		
6.	Fruit weight (g)	46.70	43.80	39.50	0.031	0.073
7.	Fruit volume (cc)	44.20	41.10	37.30	0.590	1.280
8.	Yield per tree (kg)	46.10	41.68	35.77	0.562	1.234
9.	Yield per ha (t/ha)	12.76	11.55	9.91	0.005	0.009
10.	Fruit harvest	Throughout the year	Throughout the year	Throughout the year		
11.	TSS (^{o}Brix)	7.86	7.54	6.78	0.310	0.582
11.	Fruit juice content (ml)	37.50	36.45	31.30	4.580	10.021
12.	Ascorbic acid content (mg/100 g)	32.15	26.70	24.10	0.362	1.095
13.	Acidity (%)	6.501	6.47	6.35	0.125	0.240
14.	Market preference	Very Good	Very Good	Good		
15.	Bacterial canker incidence	Moderately resistant	Less incidence	Susceptible		

stated that PKM1 registered the higher yield under Periyakulam condition. The incidence of bacterial canker, Balaji observed the less bacterial canker incidence followed by PKM1 whereas the highest incidence was found in Puliyankudi local. Mukundalakshmi *et al* (2023) stated that acid lime var. Balaji recorded the less incidence of bacterial canker under Andhra Pradesh conditions. PKM1 and Balaji acid lime varieties are mostly preferred by the farmers and had good market preference than the Puliyankudi local.

In the case of quality traits, PKM1 registered the highest values for the traits such as acidity (6.501%), ascorbic acid content (32.15 mg/100 g), juice content (37.50 ml) and TSS (7.86 ^{o}Brix) followed by Balaji (6.47 %; 26.70 mg/100 g; 36.45 ml; 7.54 ^{o}Brix) whereas the lowest quality traits were noticed in Puliyankudi local (6.35 %; 24.10

Table 2. Cost economics of different acid lime varieties under Tirunelveli district conditions.

Sl. No.	Acid lime varieties	Yield per ha (t/ha)	Gross income (Rs.)	Gross cost (Rs.)	Net profit (Rs.)	B:C ratio
1.	PKM -1	12.76	255200	115100	140100	2.22
2.	Balaji	11.55	231000	113500	117500	2.04
3.	Puliyankudi local (Farmers practice)	9.91	198200	116200	82000	1.71

mg/100 g; 31.30 ml; 6.78 °Brix). This might be due to genetic behaviour of the cultivars.

ECONOMICS

The data on the cost economics traits of different varieties are depicted in Table 2. Among the varieties, PKM-1 exhibited the highest yield with a net profit of Rs. 1,40,100 per ha and benefit to cost ratio of 2.22 followed by Balaji (Rs.1,17,500/ ha; 2.04). However, Puliyankudi local recorded the lowest net profit of Rs. 82,000 per ha with benefit cost ratio of 1.71. Rajamanickam (2019) reported that the demonstrated plot registered the highest yield, net profit with benefit cost ratio than the local check. Similar earlier findings were also reported by Rajamanickam (2020) in chilli and Rajamanickam and Arokiamary (2022) in Moringa. PKM1 recorded the 28 per cent yield enhancement along with good market preference than Puliyankudi local (farmer's practices). Hence, farmers realized that acid lime cv. PKM1was in terms of yield, quality and good market preference under Tirunelveli and Tenkasi districts condition.

CONCLUSION

It was concluded that cultivating acid lime var. PKM1 recorded the highest values of the traits such as yield per plant, yield per ha, net profit with the benefit cost ratio and less incidence of bacterial canker disease over the farmers practice. Besides this, 28 per cent yield enhancement over farmers practices (Puliyankudi local). Farmers realized that acid lime var. PKM1 was better choice in terms of yield and market price.

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