

Evaluation of acid lime (*Citrus aurantifolia*) clones for pickling

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ABSTRACT

An experiment was conducted to evaluate acid lime (*Citrus aurantifolia* Swingle) clones for pickle making at Citrus Research Station, Tirupati, during 2021 and 2022 with two replications in a completely randomized design with fifteen acid lime clones. The mean performance of pickle recovery was 49.26%, highest in TAL 94/14 (56.00%) and least in Phule Sharbati (42.00%). There was good texture (8.20), taste (8.50) and overall acceptability (8.40) in TAL94/14, whereas, best colour (8.20) and flavour (8.30) were observed in Local Kagzi lime and Balaji clones. The total bacterial population (CFU/g) was counted for four months period from the 0th day to 120th day at monthly interval. The least bacterial count was observed in clone TAL 94/14 on the 0th, 30th and 90th day. However, Balaji recorded least bacterial population on 60th and 120th day.

Key Words: Pickle, Total bacterial population, Sensory evaluation, Drying.

Acid lime (*Citrus aurantifolia* Swingle) can be used to make pickles and seasonal cuisine diced, quartered, halved, or whole, limes are pickled with salt and occasionally spices are included as well. In India, limes and lemon are used in Indian traditional medicines Siddha Medicine and Ayurveda (Mohanapriya *et al.*, 2013). Pickling is a traditional method for preserving and restoring the inherent bioactive substances and antioxidant properties of fruits and vegetables (Sayin and Alkan, 2015). To identify the fermentation of lime pickle under ambient room temperature which would affect the physicochemical, microbiological, and organoleptic qualities of pickle during storage. This helps to preserve lime pickle for long term with its acidity and vitamin C. Therefore an, experiment was conducted.

MATERIALS AND METHODS

The experiment was conducted at Citrus Research Station, Dr YSR Horticultural University, Tirupati, during 2021-2022 with two replications in a completely randomized design. Fifteen acid lime clones were evaluated for pickle making. The pickle recovery (per cent dry weight) was calculated by known weight of pickle (100 g) after four months and

strained to separate solids and liquids. The weight of solids separated was taken and made to its percent. The ingredients were lime 250 g, salt 25 g, red chilli powder 25 g, turmeric 1 g, cumin, fenugreek, dry chilli, asafoetida and mustard. The entire bacterial population per gram of sample was enumerated through repeated dilutions with distilled water, followed by pour plate method through nutrient agar media.

The colonies were counted after 24 hours. Total bacterial population (CFU/g) at serial dilutions of 10⁻⁶ starting from 0th day to 120 days for 4 months period at monthly intervals were carried out. The data were analyzed in CRD design. Nine-point hedonic scale method was followed for conducting the sensory evaluation of pickle. The overall acceptability was recorded based on colour, flavor, texture and taste of the pickle. Randomized Block Design (RBD) is used for sensory evaluation with ten evaluators.

RESULTS AND DISCUSSION

The maximum pickle recovery was observed in TAL 94/14 (56.00 %), followed by Pramalini and NRCC Nimboo-2 (54.00 %) and Balaji (53.00 %), which were identical to each other and significantly superior among other clones. However, least pickle recovery was noticed in Phule Sharbati (42.00%). Sensory evaluation at ambient conditions for colour, flavour, taste, texture and overall acceptability was

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observed through 0-9 point hedonic scale. A good quality colour was observed in Local Kagzi lime (8.20), followed by TAL 94/14, Balaji, Phule Sharbati and Akola lime (8.00). The quality of pickle colour was not attractive in Pramalini, Petlur Pulusunimma (7.00), followed by NRCC Nimboo 3 (7.20). The pickle made from Balaji has best flavour (8.30), followed by TAL 94/14 (8.00), Sai Sharbati (7.80) and Petlur Pulusunimma (7.70). The flavour quality in Vikram (6.70) scored least, followed by NRCC Nimboo-3 (7.10). The texture of TAL 94/14 (8.20) pickle was best, followed by TAL 94/13 (8.10), NRCC Nimboo-4 (8.00), and Balaji (7.90), which are similar to each other and significantly superior among other clones. NRCC Nimboo-3 (6.60) has lowest pickle texture quality.

The best taste was noticed in TAL 94/14 (8.50),

followed by Sai Sharbati (8.00), Phule Sharbati and Balaji (7.90). The overall acceptability of pickle was good in TAL 94/14 (8.40), followed by Balaji (7.90), Local Kagzi lime (7.50), NRCC Nimboo-3 (6.60) and KL-12 (6.70). Vasugi *et al.* (2008) of unique mango accessions for whole-fruit pickle. Sivakumar *et al.* (2010) informed that appearance refers to physical appearance. Aneena *et al.* (2015) on Indian gooseberry, Zeenath *et al.* (2016) for accessions of pickling mangoes for tender mango pickling, Gahane *et al.* (2019) and Madhumati and Reddy (2020) on local mango genotypes. Thus, overall acceptability was observed high in TAL 94/14 (8.40), and minimum was found in NRCC Nimboo-3 (6.60), which was identical to those of Banana genotype Kadali (8.18), and Namarai (6.26) (Suhasini *et al.*, 2021).

Table 1. Pickle making for sensory evaluation and total bacterial population (CFU/g) under ambient storage conditions from different acid lime clones

Clone	Pickle recovery (% dry weight)	Colour	Flavour	Texture	Taste	Overall acceptability	Storage period(days)				
							0	30	60	90	120
Balaji	53.00	8.00	8.30	7.90	7.90	7.90	3.50 x 10 ⁶	10.00 x 10 ⁶	43.50 x 10 ⁶	74.00 x 10 ⁶	291.00 x 10 ⁶
Vikram	43.00	7.30	6.70	6.80	6.80	6.80	5.50 x 10 ⁶	11.50 x 10 ⁶	53.00 x 10 ⁶	83.00 x 10 ⁶	302.00 x 10 ⁶
Pramalini	54.00	7.00	7.30	6.90	6.70	6.90	6.50 x 10 ⁶	12.00 x 10 ⁶	51.50 x 10 ⁶	82.00 x 10 ⁶	306.00 x 10 ⁶
Jai Devi	48.50	7.90	7.40	7.70	7.60	7.40	5.00 x 10 ⁶	10.50 x 10 ⁶	47.00 x 10 ⁶	75.00 x 10 ⁶	293.50 x 10 ⁶
Sai Sharbati	48.50	7.80	7.80	7.70	8.00	7.40	4.00 x 10 ⁶	10.50 x 10 ⁶	46.00 x 10 ⁶	76.00 x 10 ⁶	293.00 x 10 ⁶
Phule Sharbati	42.00	8.00	7.50	7.60	7.90	7.00	4.50 x 10 ⁶	9.50 x 10 ⁶	45.50 x 10 ⁶	75.50 x 10 ⁶	293.00 x 10 ⁶
Petlur Pulusunimma	46.50	7.00	7.70	7.70	7.10	7.30	4.00 x 10 ⁶	10.50 x 10 ⁶	44.00 x 10 ⁶	77.00 x 10 ⁶	291.00 x 10 ⁶
TAL 94/14	56.00	8.10	8.00	8.20	8.50	8.40	3.00 x 10 ⁶	9.00 x 10 ⁶	45.00 x 10 ⁶	73.50 x 10 ⁶	292.00 x 10 ⁶
TAL 94/13	47.50	7.70	7.60	8.10	7.50	7.20	5.00 x 10 ⁶	10.50 x 10 ⁶	46.50 x 10 ⁶	76.50 x 10 ⁶	297.00 x 10 ⁶
NRCC Nimboo-2	54.00	7.50	7.40	6.90	6.60	6.90	4.00 x 10 ⁶	10.00 x 10 ⁶	47.50 x 10 ⁶	77.50 x 10 ⁶	298.00 x 10 ⁶
NRCC Nimboo-3	44.00	7.20	7.10	6.60	7.10	6.60	6.00 x 10 ⁶	12.50 x 10 ⁶	52.00 x 10 ⁶	82.00 x 10 ⁶	306.50 x 10 ⁶
NRCC Nimboo-4	50.00	7.70	7.30	8.00	7.60	7.40	4.00 x 10 ⁶	10.00 x 10 ⁶	44.50 x 10 ⁶	74.50 x 10 ⁶	291.50 x 10 ⁶
Akola lime	49.50	8.00	7.40	6.90	7.30	6.90	5.50 x 10 ⁶	10.50 x 10 ⁶	48.00 x 10 ⁶	78.00 x 10 ⁶	298.50 x 10 ⁶
KL-12	52.50	7.50	7.30	7.10	7.40	6.70	5.00 x 10 ⁶	11.50 x 10 ⁶	49.50 x 10 ⁶	79.50 x 10 ⁶	305.50 x 10 ⁶
Local Kagzi lime	50.00	8.20	7.60	7.10	7.70	7.50	4.00 x 10 ⁶	10.50 x 10 ⁶	45.00 x 10 ⁶	75.00 x 10 ⁶	292.50 x 10 ⁶
SEm±	2.35	0.24	0.25	0.22	0.22	0.20	0.54	0.42	1.64	1.68	3.11
CD @5%	7.17	0.68	0.71	0.62	0.61	0.56	1.66	1.30	5.01	5.12	9.48
CV (%)	6.77	10.02	10.67	9.51	9.29	8.70	16.59	5.69	4.93	3.08	1.48

At 0-day bacterial population, least bacterial plate count was ascertained in TAL 94/14 (3.00×10^6), followed by Balaji (3.50×10^6), and more in Pramalini (6.50×10^6). At 30th day the least bacterial plate count was in TAL 94/14 (9.00×10^6), followed by Phule Sharbati (9.50×10^6), Balaji, NRCC Nimboo- 2 and NRCC Nimboo-4 (10.00×10^6), which were on a par with each other and significantly superior, whereas, NRCC Nimboo-3 (12.50×10^6) clone recorded highest bacterial plate count, followed by Pramalini (12.00×10^6).

During 60th day, plate count of bacteria was least in Balaji (43.50×10^6), followed by Petlur Pulusunimma (44.00×10^6), NRCC Nimboo-4 (44.50×10^6), TAL 94/14 (45.00×10^6) and maximum count in Vikram (53.00×10^6), followed by NRCC Nimboo-3 (52.00×10^6). On 90th day, plate count was least in TAL 94/14 (73.50×10^6), followed by Balaji (74.00×10^6), NRCC Nimboo-4 (74.50×10^6), Jai Devi and Local Kagzi lime (75.00×10^6) and maximum in Vikram (83.00×10^6), followed by NRCC Nimboo-3 (82.00×10^6). During 120th day, least bacterial population was observed in Balaji, Petlur Pulusunimma (291.00×10^6), followed by NRCC Nimboo-4 (291.50×10^6), TAL 94/14 (292.00×10^6), Local Kagzi Lime (292.50×10^6). However, NRCC Nimboo-3 recorded the highest plate count (306.50×10^6), followed by Pramalini (306.00×10^6).

Under ambient storage conditions from 0 day to 120th day, total plate count increased, whereas fungal growth also increased and the pickle got spoiled in a few clones and while in some pickles it became slimy due to excessive growth of lactic acid bacteria, These are also in line with Mani *et al.* (2017) reported effect of sodium substitution on lactic acid bacteria and total bacterial population.

CONCLUSION

The TAL 94/14 recorded best for pickle recovery (56.00 %), texture, taste and overall acceptability with the least bacterial count on 0th, 30th day, 90th day. However, Balaji recorded best for flavour, least bacterial population for 60th and 120th day.

Thus Local Kagzi lime is best for pickle colour, whereas Pramalini, Phule Sharbati, Petlur Pulusunimma, and NRCC Nimboo -4 are promising clones for pickle making.

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