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Effect of pre sowing treatments on seed germination and growth behaviour of acid lime seedlings (*Citrus aurantifolia* Swingle) under shade net condition

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Abstract
The present experiment entitled "Effect of pre sowing treatments on seed germination and growth behaviour of acid lime Seedlings (*Citrus aurantifolia* Swingle) under shade net condition" was conducted during 2024 -25 at Department of Fruit Science, Collage of Horticulture and Research Station Mahatma Gandhi University of Horticulture and Forestry, Durg (C.G.). For statistically analysis, complete randomized design was used, which consisted of nine treatments and three replications. The seeds are trated with GA3 @ 200 ppm and minimum days (18.27) taken to start germination and germination percentage (88.09%) of acid lime seeds was found maximum. Under the same treatment GA3 @ 200 ppm was found the maximum values of growth parameters *viz.* Seedling height (6.03, 11.04 and 16.01 cm), number of leaves per seedling (8.40, 11.27and 18.40), girth of stem (1.23, 1.88 and 2.45 mm), at 30, 60 and 90 DAS respectively.

Keywords: Acid lime, cow dung slurry, cow urine, GA3, NAA

Introduction
Kagzi lime (*Citrus aurantifolia* swingle) belongs to family Rutaceae, originated in India. it is commercially grown in tropical and subtropical place of India. Acid lime is the third most important fruit after mandarin and sweet orange. India ranks fifth amongst main lime generating international locations inside the international (Chadha, 2010) [7]. The lime is called Kagzi in India, which owes its origin to the Indian word Kagaj, that means paper, with which the rind of this fruit is constantly in comparison for its thinness. Important citrus generating states in India are Andhra Pradesh, Maharashtra, Madhya Pradesh, Punjab, Gujarat, Rajasthan, Karnataka, Assam, Odisha, Haryana and others. In India, citrus is the third maximum essential fruit crop, after mango and banana, with an expected manufacturing of 14850 (in '000'MT) of end result and region coverage of 1106 (in '000' ha) in the course of 2021-22. Kagzi lime (*Citrus aurantifolia* Swingle) is commercially propagated via seeds in India (Naik, 1949) [17] as it comes true to type, because of excessive degree (39-60%) of nucellar embryony. the consequent seedlings are known to be unfastened from tristeza virus and as a consequence carry out better (Bose, 2002) [5]. In kagzi lime polyembryony is ninety eight % and ordinarily two seedlings are commonly acquired from single seed (Thakur and Bajwa, 1968) [25]. They stated that the general overall performance of kagzi lime seedlings is higher over budded flora. In seed propagated plants higher and quicker germination of seeds and manufacturing of the most quantity of seedlings are rather crucial to satisfy the growing demand of the cultivars in shortest possible time. Evenary (1949) [12] mentioned that, the seed coat of lime acts as a barrier because it interferes with early germination of seed because of presence of positive inhibitory substance. The increase of acid lime seedling may be very gradual in nursery in addition to inside the subject, In fact many complaints from cultivators for gradual boom of seedlings below area conditions are being reported (Shant and Rao, 1973) [23]. the usage of growth regulators in overcoming the inhibitory action of positive chemical substances that put off the germination has been pronounced with the aid of Abohassan *et al.* (1979) [1] in kagzi lime and apricot additionally Chaudhari and Chakrawar (1981) [8] in Rangpur lime. Gibberellic Acid (GA3), a commonly used hormone in seed

priming, can stimulate the expression of genes involved in germination through selling cell elongation and breaking seed dormancy Zhang *et al.*, (2024) [26]. moreover, hormone remedies may additionally engage with Naphthalene Acetic Acid (NAA) some other vital hormone worried in seed dormancy regulation as well as natural materials handled which include a cow dung slurry and cow urine (Dadhaniya *et al.*, 2020) [11].

Materials and Methods

The present experiment was conducted during the year 2024-25 at Department of Fruit Science, College of Horticulture and Research Station, Sankara, Patan, Durg (C.G.). The experiment was laid out in Completely Randomized Design with nine treatments were *viz.* T_0 Control, T1GA3@100ppm, T_2 GA3@200ppm, T_3 NAA@100ppm, T_4 NAA@200ppm, T5 CowUrine@20%, T_6 CowUrine@40%, T_7 Cowdungslurry@20%, T_8 Cowdungslurry@40% which were replicated three times. Seeds were carefully extracted from uniform size fully ripened and healthy fruits of acid lime. Extracted seeds were washed in running water and dried under shade for 1 hour. Seeds were soaked in different treatments. Treated acid lime seeds were sown in polythene bags of 7" × 5" size were filled with one seed of the acid lime was dibbled at about 2 to 3 cm depth in each polythene bag were irrigated immediately after sowing using a rose-can and subsequently seedlings were watered as and when required. The observations recorded days taken to start germination, germination percentage, seedling height (cm), girth of stem (mm) and number of leaves per seedling.

Results and Discussion

Days taken to start germination

Theseeds treated with GA3 at 200ppm (T_2) germinated the earliest of all the treatments, starting in 18.27 days followed by GA3 at 100 ppm (T_1) with 20.20 days. The maximum number of days taken to start germination was recorded under control (T_0) with 26.12. The early germination is probably due to involvement of GA3 inside the activation of cytological enzymes resulted into the production of power and substrates, which in flip offer the structural additives, crucial for growth and emergence of the embryo alongside boom in cellular wall plasticity and higher water absorption. The findings are supported with the aid of Archana *et al.* (2018) [3] in Kagzi Lime, by Burns and Coggnies (1969) who said that the boom and uniformity of seedling of candy orange have been also greater through seed treatment with GA3.

Germination percentage

According to the current study findings, germination was significantly improved the GA_3 at 200 ppm (T_2) had the highest germination rate 88.09% followed by GA_3 at 100 ppm (T_1) 83.57%. The minimum germination were recorded 66.00% under the control (T_0). The higher germination rate of Acid lime seedlings might be due to the fact that GA3 involvement in alpha amylase activity, which catalyzes the conversion of starch to simple carbohydrates and releases chemical energy that is utilized to activate the embryo and the shoot apex which promoted cell division and cell growth rently leading to increased development of young leaves Salisbury (1988) [24]. This results are closely matches the findings of studies conducted on papaya by Babu *et al.* (2010) [4], Barche *et al.* (2008) [6], Deb *et al.* (2010) [10] and Chaudari *et al.* (2019) [9] in Kagzi Lime.

Seedling height (cm)

Acid lime seeds were treated of at 200 ppm of GA3 (T_2) resulted in the highest height of seedlings at 30, 60 and 90 DAS with 6.03, 11.04 and 16.01 cm followed by the NAA at 200 ppm (T_4), 4.63, 9.56 and 13.13 cm at 30, 60 and 90 DAS respectively. The minimum seedlings height was measured at 30, 60 and 90 DAS with 2.25, 4.12 and 6.13 cm respectively. The seedling notable maximum height was observed at 200 ppm of GA3 might be due to the fact that GA3 increases osmotic uptake of nutrients, which results in cell elongation and raises the seedling height. The application of growth regulator increases the seedling height and such effect might be due to increase in photosynthetic activity and also enhancement in the mobilization of photosynthates and change in membrane permeability (Shukla *et al.*, 1997). Similar findings were also reported by Meena and Jain (2005) [16] in papaya, Kumar *et al.* (2008) and Naguri (2013) [18] in mango, Hore and Sen (1985) [14] in bael, Prajapati *et al.* (2014) [20] in jackfruit, Nimbalkar *et al.* (2012) [19] in karonda, Rajput *et al.* (2020) [21], Singh *et al.* (2023) [22] and Archana *et al.* (2018) [3] during in Kagzi Lime.

Number of leaves per seedling

The acid lime seeds were treated with GA3 at 200 ppm (T2), the greatest number of leaves at 30, 60 and 90 DAS with 8.40, 11.27 and 18.40 were observed followed by the NAA at 200 ppm (T4) 6.47, 9.33 and 16.80 at 30, 60 and 90 days. At 30, 60 and 90 DAS, the control (T0) group had the fewest leaves with 2.40, 4.07 and 7.40 respectively GA3 at 200 ppm recorded the highest number of leaves per seedling was observed might be due to the fact that both increased seedling growth and GA3 activity at the apical meristem, which increases the synthesis of the nucleoprotein that causes leaf initiation similar findings were also found by Prajapati *et al.* (2014) [20] in jackfruit, Nimbalkar *et al.* (2012) [19] in karonda, Kumar *et al.* (2008) [15], Naguri Ashiya (2013) [18] in mango, Meena and Jain (2005) [16] in papaya and Chaudari *et al.* (2019) [9] in Kagzi Lime.

Girth of stem (mm)

The best results came from using GA_3 at 200 ppm (T_2) with 1.94, 2.63 and 3.37 mm at 30, 60 and 90 DAS followed by the NAA at 200 ppm (T_4) with significant improvements of 1.23, 1.88 and 2.45 mm at 30, 60 and 90 DAS respectively. The minimum girth of stem were recorded 0.63, 1.17 and 1.86 mm at 30, 60 and 90 days under the control. The seedlings notable maximum diameter was observed at 200 ppm of GA3 might be due to the fact that GA3 increases osmotic uptake of nutrients, which results in cell elongation and an increase in stem diameter. More cell division and elongation at the stem section also contributed to its expansion Sen *et al.*, (1990). Comparable outcomes were also observed by Meena and Jain (2005) [16] in papaya, Kumar *et al.*, (2008) [15] in mango and Naguri Ashi (2013) in mango, Nimbalkar *et al.*, (2012) [19] in karonda and Prajapati *et al.*, (2014) [20] in jackfruit.

Table 1: Effect of pre sowing treatments on seed germination parameters of acid lime

Treatment Notations	Treatments	Days Taken to Start Germination	Germination Percentage (%)
T_0	Control	26.12	66.00
T_1	GA_3 @ 100 ppm	20.20	83.57
T_2	GA_3 @ 200 ppm	18.27	88.09
T_3	NAA @ 100 ppm	22.20	76.93
T_4	NAA @ 200 ppm	21.27	79.20
T_5	Cow urine @ 20%	23.02	73.62
T_6	Cow urine @ 40%	22.76	75.93
T_7	Cow dung slurry @ 20%	24.47	71.73
T_8	Cow dung slurry @ 40%	23.18	73.13
S.Em ±		0.58	0.93
C.D. at 5%		1.73	2.80

Table 2: Effect of pre sowing treatments on growth parameters of acid lime seedlings

Treatment Notations	Treatments	Seedling Height (cm)			Number of Leaves per Seedling			Girth of Stem (mm)		
		30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS
T_0	Control	2.25	4.12	6.13	2.40	4.07	7.40	0.63	1.17	1.86
T_1	GA_3 @ 100 ppm	4.26	8.90	11.69	5.40	8.20	14.37	1.18	1.74	2.53
T_2	GA_3 @ 200 ppm	6.03	11.04	16.01	8.40	11.27	18.40	1.94	2.63	3.37
T_3	NAA @ 100 ppm	3.28	7.88	10.89	4.73	6.70	13.47	1.14	1.65	2.45
T_4	NAA @ 200 ppm	4.63	9.56	13.13	6.47	9.33	16.80	1.23	1.88	2.71
T_5	Cow urine @ 20%	3.11	7.02	9.22	4.47	5.80	10.73	1.06	1.43	2.11
T_6	Cow urine @ 40%	4.13	8.30	9.93	5.20	6.20	12.33	1.12	1.58	2.34
T_7	Cow dung slurry @ 20%	2.47	5.29	7.19	3.13	4.67	8.53	0.84	1.23	1.97
T_8	Cow dung slurry @ 40%	2.86	6.15	8.16	3.87	5.33	9.33	0.98	1.34	2.08
S.Em ±		0.10	0.26	0.39	0.17	0.21	0.42	0.03	0.04	0.07
C.D. at 5%		0.30	0.79	1.16	0.51	0.64	1.27	0.10	0.12	0.23

References

1. Abohassan AA, El-Hamady AAM, Hamouda MA. Effect of gibberellic acid and kinetin on germination of apricot and lime seeds and subsequent seedling growth. 1979.
2. Anonymous. Area and production of horticultural crops All India. Gurugram: National Horticulture Board, Government of India; 2022.
3. Archana P, Ajay Kumar K, Sinha K. Effect of gibberellic (GA_3) acid on seed germination and growth of Kagzi lime (*Citrus aurantifolia* Swingle). Int J Chem Stud. 2018;6(5):2803-2805.
4. Babu K, Patel RK, Singh A, Yadav DS, De IC, Deka BC. Seed germination, seedling growth and vigour of papaya (*Carica papaya* L.) under North East Indian condition. Acta Hortic. 2010;851:299-306.
5. Bose TK, Mitra SK, Sanyal D. Fruits: Tropical and subtropical. Kolkata: Naya Udyog; c2002. p. 229-260.
6. Barche S, Kirad KS, Singh DB. Response of seed treatment on germination, growth, survivability and economics of different cultivars of papaya (*Carica papaya* L.). In: II International Symposium on Papaya. 2008;851:279-284.
7. Chadha KL. Handbook of horticulture. New Delhi: Indian Council of Agricultural Research; 2010.
8. Choudhuri BK, Chakrawar VK. The effect of some chemicals on the germination of Rangpur lime seeds. Indian J Agric Sci. 1981;51
9. Chaudhary A, Ahlawat TR, Kumar S, Jena S, Patel D. Effect of gibberellic acid on germination and vigour of Kagzi lime seedlings. Curr J Appl Sci Technol. 2019;38(6):1-8.
10. Deb P, Das A, Ghosh SK, Suresh CP. Improvement of seed germination and seedling growth of papaya (*Carica papaya* L.) through different pre-sowing seed treatments. Acta Hortic. 2010;581:313-316.
11. Dadhaniya DB, Kanzaria DR, Sejal B, Dhara T, Varuti. Effect of time of sowing and chemical treatments on seedling growth of custard apple (*Annona squamosa* L.) cv. Sindhan. Chem Sci Rev Lett. 2020;9(33):19-23.
12. Evenari M. Germination inhibitors. Bot Rev. 1949;15:153-194.
13. Gurung N, Swamy GSK, Sarkar SK, Ubale NB. Effect of different chemicals and growth regulators on germination, vigour and growth of passion fruit (*Passiflora edulis Sims*). Bioscan. 2014;9(1):155-157.
14. Hore JK, Sen SK. Effect of seed treatment and longevity of bael (Aegle marmelos) seeds. Haryana J Hortic Sci. 1985;14(3-4):204-210.
15. Kumar HSY, Swamy GSK, Kanmadi VC, Kumar P, Sowmaya BN. Effect of organics and chemicals on germination, growth and graft take in mango. Asian J Hortic. 2008;3(2):336-339.
16. Meena RR, Jain MC. Effect of seed treatment with gibberellic acid on growth of papaya seedlings (*Carica papaya* L.). Prog Hortic. 2005;37(1):194-196.
17. Naik KC. South Indian fruits and their culture. Madras: Vardachary and Co.; c1949. p. 147-149.
18. Naguri A. Effect of organics and chemicals on germination of mango (Mangifera indica L.) stones. Navsari: Navsari Agricultural University; 2013.
19. Nimbalkar SD, Jadhav YS, Adat SS, Savvashe AY. Effect of different seed treatments on germination and growth of karonda (*Carissa congesta* W.). Green Farming. 2012;3(3):340-342.
20. Prajapati D, Patil SJ, Solanki PD, Gamit S. Influence of growth regulators on germination of jackfruit (*Artocarpus heterophyllus* Lam.) seed. Trends Biosci. 2014;7(24):4437-4441. Rajput K, Sharma TR. Effect of organic and inorganic sources on seed germination, growth and survival of custard apple (Annona

squamosa L.) seedlings. J Pharmacogn Phytochem. 2020;9(6):552-556.
21. Singh S, Panigrahi HK, Singh P, Sharma GL, Patel D. Influence of different pre-sowing treatments on seed germination and seedling growth parameters of custard apple (*Annona squamosa* L.). 2023.
22. Shant PS, Rao SN. Effect of gibberellic acid on seed germination and seedling growth of acid lime (*Citrus aurantifolia* Swingle). Prog Hortic. 1973;5(3):63-65.
23. Salisbury FB, Ross CW. Plant physiology. Delhi: CBS Publishers & Distributors; c1988. p. 319-329.
24. Thakur DR, Bajawa SS. Extent and polyembryony in some species and varieties of citrus. Indian J Hortic. 1968;28(2):25-28.
25. Zhang Y, Wu F, Yu J, Zhang Z, Huang X, Hou H, *et al.* Transcriptome analysis of seed in dormancy and dormancy release state of Epimedium koreanum Nakai. Agronomy. 2024;14(5):1037