

Effect of seed soaking and growing media on seedling vigour and economics of acid lime (*Citrus aurantifolia*)

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Acidlime (*Citrus aurantifolia* Swingle) is the most commercially important fruit crops of India. Seeds of acid lime are soaked with plant growth regulator such as gibberellic acid (GA₃) as well as with organic substance such as cow urine, cow dung slurry and water for better seed germination. GA₃ controls mobilization of starch which acts as a respiratory substrate leading to immediate enhancement in cell elongation (Meghwal *et al.* 2021). Cow dung slurry also contains some growth promoting substances N, P, K, micronutrients and biodigestible enzymes which cause for softening of seed coat, enhancing seed germination and growth of seedlings (Raj *et al.* 2014). Water soaking of seeds is done to modify hard seed coats, remove inhibitors, soften seeds and reduce the time of germination. Media must also have good water holding capacity, drainage, physical and chemical properties for growth of seedlings (Solanki *et al.* 2023). Keeping in view, an experiment was conducted.

The experiment comprised six levels of seed soaking, *viz.*, S₁ (water), S₂ (GA₃ @ 50 ppm), S₃ (GA₃ @ 100 ppm), S₄ (cow urine @ 25 %), S₅ (cow urine @ 50 %) and S₆ (cow dung slurry; 1:1 w/w) and four levels of different growing media, *viz.*, G₁ (sand + vermicompost), G₂ (sand + FYM), G₃ (sand + vermicompost + cocopeat) and G₄ (sand + FYM + cocopeat) which were used in 1:1 proportion on volume basis. The poly bags were used in FCRD, which included 24 treatments with 3 replications. They were soaked before sowing in different seed soaking treatments for 12 hr in beaker. The seeds were dried for 10 minutes in shade after soaking. The dried seeds were immediately sown in polythene bags at 1.2 cm depth. Irrigation was given immediately by watering

cane. Observations were recorded by using standard procedure and statistically analyzed.

The seedling vigor index I was calculated by adding the values of root length and shoot length 150 days after sowing. These were randomly selected and multiplied with their corresponding germination percentage.

Seedling vigor index I = germination percentage x total length of seedling (cm)

The seedling vigor index II was calculated by multiplying dry weight of seedlings with their corresponding germination percentage.

Seedling vigor index II = germination percentage x dry weight of seedlings (g)

The survival percentage of each treatment was recorded at 150 DAS, as per using following formula:

$$\text{Survival (\%)} = \frac{\text{No. of survived seedlings}}{\text{Total no. of seedling}} \times 100$$

The interaction effect of seed soaking and growing media was significant with respect to seedling vigor index I. Freshly extracted acid lime seeds treated with GA₃ 100 ppm and sown in growing media [sand + vermicompost + cocopeat (1:1:1)] showed maximum seedling vigor index I (4355.44 cm). It might be due to increased germination and seedling height which has contributed to higher vigor index-I (Table 1) Ramteke *et al.* (2015) reported similar results. Media combination could have provided better condition like aeration and porosity for proper growth and development of seedlings which leads to increase seed vigor index-I. These results were in close agreement with Ramteke *et al.* (2015).

The interaction effect of seed soaking and growing media was found significant with respect to seedling vigor index II. Freshly extracted acid lime seeds treated with GA₃ 100 ppm and sown in growing media [sand + vermicompost + cocopeat (1:1:1)] showed maximum seedling vigor index II (360 gm). It might be due to increased germination and seedling weight which have contributed to higher vigor index-II. The

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results were in close agreement with these Ramteke *et al.* (2015). It might be due to increased α -amylase activity for breaking the starch stored in seeds by growth regulators and increasing metabolic activities in seeds, which resulted in higher seed vigour were obtained by Pangtu *et al.* (2024). This might be due to

favourable media for better growth and development of the seedlings. The similar results were reported by Bhardwaj (2014).

The interaction effect of seed soaking and growing media was significant with respect to survival percentage at 150 DAS (Table 1). Freshly extracted

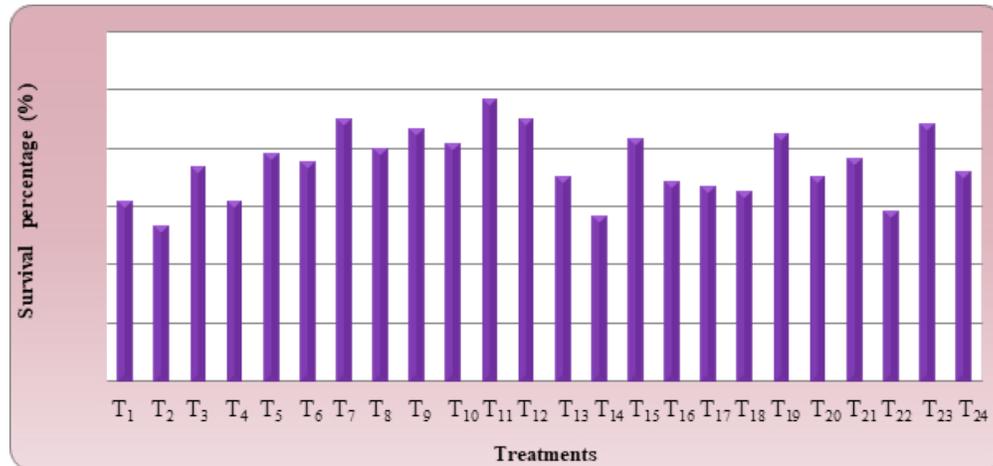


Fig. 1: Effect of seed soaking and growing media on survival percentage of acid lime

Table 1: Effect of seed soaking and growing media on economics of acid lime seedling

Treatment combinations	Plant survived	Fixed cost (₹)	Variable Cost(₹)	Total Cost (₹)	Gross realization(₹)	Net return (₹)	B: C ratio
s ₁ g ₁	37/60	313.58	229	543	740	197	1.36
s ₁ g ₂	32/60	313.58	106	420	640	220	1.52
s ₁ g ₃	44/60	313.58	453	767	880	113	1.15
s ₁ g ₄	37/60	313.58	371	685	740	55	1.08
s ₂ g ₁	47/60	313.58	228	542	940	398	1.73
s ₂ g ₂	45/60	313.58	105	419	900	481	2.15
s ₂ g ₃	54/60	313.58	452	766	1080	314	1.41
s ₂ g ₄	48/60	313.58	370	684	960	276	1.40
s ₃ g ₁	47/60	313.58	229	543	940	397	1.73
s ₃ g ₂	46/60	313.58	106	420	920	500	2.19
s ₃ g ₃	58/60	313.58	453	767	1160	393	1.51
s ₃ g ₄	54/60	313.58	371	685	1080	395	1.58
s ₄ g ₁	42/60	313.58	228	542	840	298	1.55
s ₄ g ₂	34/60	313.58	105	419	680	261	1.62
s ₄ g ₃	50/60	313.58	452	766	1000	234	1.31
s ₄ g ₄	41/60	313.58	370	684	820	136	1.20
s ₅ g ₁	40/60	313.58	228	542	800	258	1.48
s ₅ g ₂	39/60	313.58	105	419	780	361	1.86
s ₅ g ₃	51/60	313.58	452	766	1020	254	1.33
s ₅ g ₄	42/60	313.58	370	684	840	156	1.23
s ₆ g ₁	46/60	313.58	228	542	920	378	1.70
s ₆ g ₂	35/60	313.58	105	419	700	281	1.67
s ₆ g ₃	53/60	313.58	452	766	1060	294	1.38
s ₆ g ₄	43/60	313.58	370	684	860	176	1.26

seeds treated with GA₃ 100 ppm and sown in growing media [sand + vermicompost + cocopeat (1:1:1)] gave maximum survival percentage (96.67 %) at 150 DAS. Higher survival percentage might be due to optimum application of GA₃ helps in cell expansion and its elongation resulting better root and shoot growth (Patel *et al.*, 2018), which supports and encourage better survival of the seedlings (Rahangdale 2019 and Lunagariya *et al.*, 2022) and media containing vermicompost and cocopeat as most of the constituents provided a start for establishment of seedlings which further got supplemented by PGPR's. Good physical and biological conditions in media combination had positive effect on root and shoot growth which also helps in better survival. Similar results were obtained by Ramteke *et al.* (2015). These findings are in agreement with these of Gupta (1989), Khatana *et al.* (2015) and Patel *et al.* (2016).

The findings indicate that the highest gross return (₹ 1,160) was recorded in treatment s₃g₃ [GA₃ @ 100 ppm + sand + vermicompost + cocopeat (1:1:1 v/v/v)]. Whereas, highest net return (₹ 500) and benefit cost ratio (2.19) were recorded in treatment s₃g₂ [GA₃ @ 100 ppm + sand + FYM (1:1 v/v)].

The highest gross return obtained from s₃g₃ [GA₃ @ 100 ppm + sand + vermicompost + cocopeat (1:1:1 v/v/v)] might be due to maximum survival percentage of acid lime seedlings as compared to other treatments. Maximum net return and benefit cost ratio were due to comparatively less cost of the treatment.

Conclusion

It could be concluded that GA₃ @ 100 ppm and sand + vermicompost + cocopeat (1:1:1 v/v/v) were found to be superior for enhancing the seedling vigour with maximum gross return under shade net house condition.

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