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Effect of growing media and gibberellic acid on seed vigour and survival of acid lime (*Citrus aurantifolia* Swingle.) cv. Kagzi lime

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Abstract

An investigation entitled "Effect of growing media and gibberellic acid on seed vigour and survival of acid lime (*Citrus aurantifolia* Swingle) cv. Kagzi lime" was conducted during the year *Kharif*- 2019 at Horticultural Research Farm, Department of Horticulture, B. A. College of Agriculture, Anand Agricultural University, Anand. Treatments were comprised five levels of growing media (M)*viz.*, M₁- Soil + FYM (1:1), M₂-Soil + Vermicompost (1:1), M₃- Soil + FYM + Vermiculite (1:1:1), M₄- Soil + Vermicompost + Vermiculite (1:1:1) and M₅-Soil + FYM + Vermicompost + Vermiculite (1:1:1:1) with three levels dipping of seeds of acid lime in gibberellic acid for 24 hrs before sowing in polythene bags *viz.*, G₁- GA₃@ 50 mg/l, G₂- GA₃@ 100 mg/l and G₃- GA₃@ 150 mg/l with G₀- Control (Water). The experiment were laid out in a Completely Randomized Design (Factorial) with twenty treatment combinations and repeated thrice. Growing media of soil + FYM + vermicompost + vermiculite (1:1:1:1) recorded minimum number of days taken for initiation of germination (22.41), maximum germination percentage (82.08%), vigour index- I (3198.8), vigour index- II (64.81) and survival percentage (76.01%) at 120 DAS. Dipping of acid lime seeds for 24 hrs before sowing in GA₃@150 mg/l recorded minimum number of days taken for initiation of germination (24.26), maximum germination percentage (79.68), vigour index- I (3130.3), vigour index- II (52.36) and survival percentage (75.56%) at 120 DAS. Treatment combination of Growing media and GA₃ of soil + FYM + vermicompost + vermiculite (1:1:1:1) + Dipping of acid lime seeds before sowing in GA₃@150 mg/l apparently recorded minimum number of days taken for initiation of germination (20.66).

Keywords: Kagzi lime, growing media, GA₃, seed vigour, survival

Introduction

Citrus is one of the largest and most important fruits of tropical and subtropical regions. It is a native to India and South Eastern China. It occupies 3rd ranks after mango and banana in India. It comprised two groups: Lime and Lemon. Citrus is a member of the family Rutaceae. Small, fruited acid limes are classified botanically under the *Citrus aurantifolia* (Swingle).

Acid lime is an important fruit crop which is propagated through seeds only. The quality of seedlings obtained from a nursery influences re-establishment in the field and the eventual productivity of an orchard. Seed germination is affected by many factors like type of substrate used, environmental factors etc. Some of the problems faced by acid lime growers are slow, erratic and incomplete germination, high initial seedling mortality and incidence of soil born diseases. In heavy soil without enough drainage, the development of root system is suppressed and plants are more susceptible to soil born diseases. The increasing germination percentage and producing healthier seedling is a major challenge for farmers. Hence, there is a need to standardize the growing media with using different concentration of GA₃, which give high germination percentage and least seedling mortality.

Growing media play an important role in germination of seed. It is a substrate that provides the required elements and physical support to the seed. Media should also have good water holding capacity, drainage and other physical and chemical properties. During seed germinations, the role of GA₃ in the induction of synthesis of α - amylase and other hydrolytic enzymes among monocots and certain dicots is well documented. GA₃ appears mainly to induce the activity of the gluconeogenic enzymes during early stages of seed germinations.

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Materials and Methods

The experiment was conducted in the Net House at the Horticultural Research Farm, Department of Horticulture, B. A. College of Agriculture, Anand Agricultural University, Anand during the year kharif - 2019. The experiment was laid out in Completely Randomized Design (Factorial) with twenty treatment combinations and repeated thrice. 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 50, 100 and 150 mg/l GA₃ solution for 24 hours which was prepared by dissolving 50, 100 and 150 mg GA₃, respectively (GA₃ was completely dissolved by addition of small quantity of NaOH) in 1 liter of water. Various growing media *viz.*, soil, FYM, vermicompost and vermiculite were used in 1:1 proportion as a different combination or mixture used for sowing seeds. Black polythene bags of 7" × 5" size were filled with (1:1) proportion for different mixture of growing media according to the treatments. One seed of the acid lime was dibbled at about 2 to 3 cm depth in each polythene bag. For each replication and for each treatment 75 polythene bags were filled and kept in net house having 75% green shed net. Data on number of days taken for initiation of germination, germination percentage, vigour index- I, vigour index- II and survival percentage.

Results and Discussion

Effect of growing media

Growing media showed the significant effect on germination parameters. Growing media of soil + FYM + vermicompost + vermiculite (1:1:1:1) recorded minimum number of days taken for initiation of germination (22.41) and maximum germination percentage (82.08%). This might be due to growing media of Soil + FYM + Vermicompost + Vermiculite (1:1:1:1) having ideal properties of good water holding capacity and retention property as well as sufficient porosity to permit adequate moisture and gaseous exchange between media and seeds, it might helped to reduce the germination period and enhanced physiological processes in seeds and higher level of available porosity, nutrient, moisture and some acids present in media may helped for better germination (Bisla *et al.* 1984) [3]. Similar results were also obtained by Parasana *et al.* (2013) [8] in mango, Prajapati *et al.* (2017) [9] in Kagzi lime, Kumar *et al.* (2018) [6] in siris. Growing media also observed significant effect on vigour index – I, vigour index – II and survival percentage. Growing media soil + FYM + vermicompost + vermiculite (1:1:1:1) recorded maximum vigour index- I (3198.8), vigour index- II (64.81) at 120 DAS and survival percentage (76.01%). This might be due to retention of more water and air by vermiculite

which enhanced germination and Fym and vermicompost provide adequate nutrients for better seedling growth, ultimately resulted high vigour of seedling and favourable media for better growth of seedling, particularly for good development of a root system. These results are in close agreement with Shamet *et al.*, (1994) [11]. Similar results were also reported by Mishra *et al.* (2017) [7] in papaya, Arvind *et al.* (2015) [2] and Abirami *et al.* (2010) [1] in nutmeg.

Effect of gibberellic acid

Gibberellic acid showed significant effect on germination attributes *viz.*, number of days taken for initiation of germination and germination percentage. GA₃@ 150 mg/l recorded minimum number of days taken for initiation of germination (24.26) and maximum germination percentage (79.68%). This might be due to its participation in the activities of hydrolyzing enzyme and alpha-amylase at initial stage of germination and increase of transcription or translation during protein synthesis provide structural component essential for emergence of the embryo. Similar results were also found by Khatana *et al.* (2015) [5] and Joshi *et al.* (2015) [4] in kagzi lime. Gibberellic acid also exhibited significant effect on vigour index – I, vigour index – II and survival percentage. At 120 DAS GA₃@ 150 mg/l recorded maximum vigour index- I(3130.3), vigour index- II(52.36) and survival percentage (75.56%). This might be due to increase germination parameters and GA₃ treatment, which helps in cell expansion and its elongation which promote growth of seedlings due to growth the ability of plant to survive, has increased. Similar result was reported by Ramteke *et al.* (2015) [10] and Khatana *et al.* (2015) [5] in acid lime.

Interaction effect of Growing media and Gibberellic acid

Interaction effect of growing media and gibberellic acid showed the significant effect on number of days taken for initiation of germination and non- significant effect on germination percentage. Treatment combination soil + FYM + vermicompost + vermiculite (1:1:1:1) + GA₃@ 150 mg/l recorded minimum days taken for initiation of germination (20.66). This might be due to this combination is ideal for early germination as growing media provide good moisture, aeration and water holding capacity and participation in the activity of alpha amylase, which catalyzes the starch conversion into simple carbohydrates and chemical energy liberated which might shorten and rapid germination duration. Similar results were also found by Ramteke *et al.* (2015) [10] in papaya. Interaction effect of growing media and gibberellic acid observed non-significant difference for vigour index-I, vigour index- II and survival percentage.

Table 1: Effect of growing media and GA₃ on seed germination, vigour and survival of acid lime cv. Kagzi lime

Treatments	Number of days taken for initiation of germination	Germination percentage (%)	Seedling vigour index- I	Seedling vigour index- II	Survival percentage (%)
Growing media (M)					
M ₁ : Soil + FYM	28.33	72.10	2479.9	38.55	70.88
M ₂ : Soil + Vermicompost	32.83	63.10	1784.0	25.78	60.88
M ₃ : Soil + FYM + Vermiculite	25.16	79.40	2952.8	46.83	73.57
M ₄ : Soil + Vermicompost + Vermiculite	30.33	68.13	2305.5	31.90	65.98
M ₅ : Soil + FYM + Vermicompost + Vermiculite	22.41	82.08	3198.8	64.81	76.01
S. Em±	0.27	1.21	55.66	1.14	0.76
C.D. at 5%	0.78	3.46	159.09	3.29	2.20
Gibberellic acid (G)					
G ₀ : Control (Water)	30.66	66.53	1935.0	33.47	64.13

G ₁ : GA ₃ 50 mg/l	29.33	69.58	2338.2	37.18	67.41
G ₂ : GA ₃ 100 mg/l	27.00	76.06	2773.3	43.29	70.76
G ₃ : GA ₃ 150 mg/l	24.26	79.68	3130.3	52.36	75.56
S. Em±	0.24	1.08	49.78	1.02	0.68
C.D. at 5%	0.70	3.09	142.30	2.94	1.97
Interaction (M × G)	Sig.	NS	NS	NS	NS
C.V. %	2.75	5.75	7.58	7.81	3.13

Table 2: Interaction effect of growing media and gibberellic acid on number of days taken for initiation of germination of acid lime cv. Kagzi lime

G M	G ₀	G ₁	G ₂	G ₃
M ₁	31.00	30.00	27.00	25.33
M ₂	35.00	34.66	33.00	28.66
M ₃	28.66	25.66	24.33	22.00
M ₄	33.66	33.33	29.66	24.66
M ₅	25.00	23.00	21.00	20.66
Mean (G)	30.66	29.33	27.00	24.26
S.Em±	0.543			
C.D. at 5%	1.557			

Conclusion

In the light of the results obtained from this investigation, it can be concluded that individually use as soil + FYM + vermicompost + vermiculite (1:1:1:1) and GA₃ @ 150 mg/l were found superior for seed germination, vigour and survival of acid lime cv. Kagzi lime.

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