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Effect of storage period and growing media on seed germination and physiological attributes of acid lime seedlings (*Citrus aurantifolia* Swingle) cv. Kagzi

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Abstract

An investigation entitled "Effect of storage period and growing media on seed germination and physiological attributes of acid lime seedlings (*Citrus aurantifolia* Swingle) cv. Kagzi" was conducted during the year *Kharif* - 2016 at Horticultural Research Farm, Department of Horticulture, B. A. Collage of Agriculture, Anand Agricultural University, Anand. The treatments comprised four levels of storage period (S) viz., S₁- 0 day after seed extraction, S₂- 15 days after seed extraction, S₃- 30 days after seed extraction and S₄- 45 days after seed extraction with three levels of growing media (M) viz., M₁- Soil + Vermicompost (1:1), M₂- Soil + Cocopeat (1:1) and M₃- Soil + FYM (1:1). The experiment was laid out in a Completely Randomized Design (Factorial) with twelve treatment combinations and three repetition. Sowing of seed immediately after extraction observed minimum number of days (22.33) for 50 percent germination, maximum germination percentage (70.50) at 45 DAS and speed of germination (13.38) with maximum vigour index- I (3591.50), seedling vigour index- II (321.41) at 120 DAS and relative growth rate at 60-90 and 90-120 DAS (1.54 and 4.62 g/day). Growing media M₂ recorded minimum days (30.33) for 50 percent germination, maximum germination percentage (63.27) at 45 DAS and speed of germination (12.47). While, at 90-120 DAS growing media M₁ recorded maximum relative growth rate (2.55 g/day) with seedling vigour index- I (2097.18) and II (157.73) at 120 DAS. Treatment combination S₁M₂ recorded minimum days (18.00) for 50 percent germination with maximum germination percentage (74.55) at 45 DAS. At 60 DAS treatment combination S₁M₂ recorded seedling vigour index- II (44.81). At 90 DAS treatment combination S₁M₁ recorded the highest seedling vigour index- I (2777.90). Whereas, treatment combination S₁M₁ recorded maximum relative growth rate at 60-90 and 90-120 DAS (1.65 and 5.50 g/day) and seedling vigour index- II (388.73) at 120 DAS.

Keywords: Acid lime seeds, Storage period, Growing media, Germination attributes, Physiological attributes

Introduction

Acid lime (*Citrus aurantifolia* Swingle) is an important sub-tropical fruit crop of the world. It belongs to family Rutaceae and native of India and South-Eastern China. It is also known as kagzi lime or maxican lime or pati lime. India is the largest producer of acid lime in world. Citrus seeds are recalcitrant in nature hence impose serious storage problems due to their desiccation and chilling sensitivity. Seeds undergo no maturation and storage above critical level of time leads to loss of viability. Growth media composition influences seed germination and quality of the seedlings. It is a substrate that provides the required elements and physical support to the growing plants. Media should also have good water holding capacity, drainage and other physical and chemical properties.

Nurserymen do not know when to sow the seed after extraction and which media is suitable for better germination and growth of the kagzi lime seedling. Hence, the experiment was formulated to study the "Effect of storage period and growing media on seed germination and physiological attributes of acid lime seedlings (*Citrus aurantifolia* Swingle) cv. Kagzi".

Materials and Methods

The experiment was conducted at the Horticultural Research Farm, Department of Horticulture, B. A. Collage of Agriculture, Anand Agricultural University, Anand during the *Kharif* - 2016. Seeds of fully ripe kagzi lime fruit were extracted manually and rubbed in ash to remove sticky material on seed.

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Sowing of zero day was carried out at same day while remained seeds were stored in cloth bag at ambient condition. The seeds were stored in different lots for different sowing dates. Various growing media viz., soil, vermicompost, cocopeat and FYM were used in 1:1 proportion as a mixture for sowing seeds. Black polythene bags of 6" × 8" 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 60 polythene bags were filled and kept in

net house having 75% green shed net. Data on number of days required for 50 percent germination, germination percentage (At 45 DAS), Speed of germination were recorded. Physiological parameters viz., seedling height (cm), relative growth rate (60-90 and 90-120 DAS) and seedling vigour index- I and seedling vigour index- II at 60, 90 and 120 DAS was recorded from five randomly selected plants and statically analysed.

Results and Discussion

Table 1: Effect of storage period and growing media on seed germination

Treatment	No. of days required for 50% germination	Germination % (At 45 DAS)	Speed of germination
Storage period (S)			
S ₁ 0 days after seed extraction	22.33	70.50	13.38
S ₂ 15 days after seed extraction	30.22	62.52	11.99
S ₃ 30 days after seed extraction	41.67	53.94	10.19
S ₄ 45 days after seed extraction	48.89	41.96	7.23
S.Em. ±	0.60	0.88	0.32
C.D. at 5%	1.75	2.56	0.93
Growing media (M)			
M ₁ Soil + Vermicompost (1 : 1)	37.83	54.97	9.95
M ₂ Soil + Cocopeat (1 : 1)	30.33	63.27	12.47
M ₃ Soil + FYM (1 : 1)	39.17	53.46	9.67
S.Em. ±	0.52	0.76	0.28
C. D. at 5%	1.51	2.21	0.81
C.V%	5.02	4.59	8.95
S X M	Sig.	Sig.	NS

Table 2: Interaction effect of storage period and growing media on seed germination

S	M Days required for 50 percent germination			Germination percentage (At 45 DAS)		
	M ₁	M ₂	M ₃	M ₁	M ₂	M ₃
S ₁	23.67	18.00	25.33	71.44	74.55	65.51
S ₂	31.67	26.67	32.33	57.11	68.77	61.67
S ₃	43.33	36.33	45.33	52.33	59.00	50.50
S ₄	52.67	40.33	53.67	39.00	50.74	36.15
S.Em ±	1.04			1.66		
C.D. at 5%	3.03			4.84		

Effect of storage period

Storage period showed the significant effect on germination parameters. Sowing of seed at immediately after extraction (S₁) recorded minimum number of days required for 50 percent germination (22.33), maximum germination percentage at 45 DAS (70.50) and speed of germination (13.38). This might be due to fresh seeds has more moisture and vigour and absence of dormancy. These results are in accordance with Mahasin and Mustafa (2015) [9] in mango, Khopkar *et al.* (2014) [7] in pummelo. Storage period of seed observed significant effect on physiological parameters. At 60, 90 and 120 DAS storage period S₁ recorded maximum vigour index- I (1515.83, 2484.24 and 3591.50, respectively), seedling vigour index- II (39.87, 109.54 and 321.41, respectively) whereas, relative growth rate was observed maximum (1.54 and 4.62 g/day) at 60-90 and 90-120 DAS. This might be due to higher germination capacity of fresh seed with more vigour, which resulted better growth of seedlings ultimately superior physiological attributes. These results are in accordance with Deepika *et al.* (2014) [5] in karonda, Singh and Singh (1981) [11] in papaya.

Effect of growing media

Growing media showed significant effect on germination and its attributes. Growing media M₂ recorded minimum days

(30.33) for 50 percent germination, maximum germination percentage at 45 DAS (63.27) and speed of germination (12.47). It might be due to the beneficial effect of cocopeat mixture which having high water holding capacity, porosity and soil aeration which is good for germination (Arvind *et al.*, 2015) [1]. Growing media observed significant effect on physiological parameters. Relative growth rate at the both phases (60-90 and 90-120 DAS) found maximum i.e. 1.05 and 2.55 g/day in M₁ treatment. Seedling vigour index-I was observed maximum in treatment M₂ at 60 and 90 DAS (1275.2 and 1733.8). While, at 120 DAS it was recorded maximum (2097.2) in M₁ treatment. At 60 DAS seedling vigour index-II was recorded maximum (31.28) in M₂ treatment. Whereas, it was found maximum in treatment M₁ at 90 and 120 DAS (63.42 and 157.73). It might be due to at initial stage soil and cocopeat improved soil texture, porosity, water holding capacity, activity of useful soil micro fauna and flora which maintained soil temperature and improved soil health and nutrient status of medium (Hartmann and Kester, 1997) [6]. While, at latter stage vermicompost which contain plant growth regulating materials, such as humic acid and plant growth regulators like auxin, gibberellins and cytokinins, which are responsible for increasing root length better physiological attributes (Atiyeh *et al.*, 2002) [2]. Similar results were also obtained by Bhardwaj (2014) [3] and Ramteke *et al.* (2015), Arvind *et al.* (2015) [1] in papaya.

Interaction effect of storage period and growing media

Interaction effect of storage period and growing media showed the significant effect on germination parameters. Treatment combination S₁M₂ recorded minimum days (18.00) for 50 percent germination with maximum germination percentage at 45 DAS (74.55) whereas, speed of germination was found non-significant. This might be due to initially high vigour and viability of seed gave high germination (Khopkar *et al.*, 2014) and media enhanced the physiological processes in seeds and higher level of available nutrient, moisture and

some acids may helped for better germination (Bisla *et al.* 1984) [4]. These results are in accordance with Bhardwaj (2013), Kumawat *et al.* (2014) [8] and Arvind *et al.* (2015) [1] in papaya. Interaction effect of storage period and growing media showed the significant effect on physiological attributes. Relative growth rate was observed maximum (1.65 and 5.50 g/day) in S₁M₁ treatment combination at 60-90 and 90-120 DAS. At 60 DAS seedling vigour index-I and II observed the maximum (1710 and 44.81) in treatment combination S₁M₂. While, at 90 and 120 DAS it was found maximum in S₁M₁ (2778 and 3798) and (119.35 and 388.73), respectively. This might be due to high moisture, proteins, lipids and starch content and vigour of fresh seed that resulted better development of seedling. This result are similar with result found by Deepika *et al.* (2014) [5] in karonda. Cocopeat media initially improved soil texture and having porosity with

more water holding capacity. While, at latter stage vermicompost provided good activity of useful soil micro fauna and flora which maintained soil temperature, improved soil health and nutrient status of medium. Similar results were also obtained by Bhardwaj (2014) [3] and Ramteke *et al.* (2015) in papaya.

Conclusion

Better germination of acid lime seed can be obtained by sowing the seed immediately after seed extraction in growing media soil + cocopeat (1:1). Better physiological parameters of seedling viz. relative growth rate, seedling vigour index- I and seedling vigour index- II were found when seed sown immediately after extraction in soil + Vermicompost (1:1) growing media.

Table 3: Influence of storage period and growing media on development of acid lime seedling

Treatment	Relative growth rate (g/day)		Seedling vigour index- I			Seedling vigour index- II		
	60 - 90 DAS	90 - 120 DAS	60 DAS	90 DAS	120 DAS	60 DAS	90 DAS	120 DAS
Storage period (S)								
S ₁ 0 days after seed extraction	1.54	4.62	1515.8	2484.2	3591.5	39.87	109.54	321.41
S ₂ 15 days after seed extraction	0.95	2.04	1183.3	1804.1	2069.8	29.99	59.40	124.59
S ₃ 30 days after seed extraction	0.74	1.37	942.4	1303.9	1403.7	22.58	40.78	72.26
S ₄ 45 days after seed extraction	0.47	0.70	683.7	897.3	989.2	15.37	20.30	28.18
S.Em. ±	0.01	0.03	29.6	45.9	65.5	0.50	1.42	3.29
C.D. at 5%	0.04	0.09	86.3	133.8	191.3	1.47	4.15	9.59
Growing media (M)								
M ₁ Soil+ Vermicompost (1 : 1)	1.05	2.55	1020.4	1695.9	2097.2	26.56	63.42	157.73
M ₂ Soil + Cocopeat (1 : 1)	0.86	1.85	1275.2	1733.8	2065.1	31.28	57.96	125.22
M ₃ Soil + FYM (1 : 1)	0.87	2.16	948.3	1437.4	1878.4	23.02	51.13	126.88
S.Em. ±	0.01	0.03	25.6	39.7	56.8	0.436	1.233	2.845
C.D. at 5%	0.03	0.07	74.8	115.9	165.6	1.27	3.60	8.30
C.V%	4.37	4.00	8.2	8.5	9.8	5.60	7.42	7.22
S X M	Sig.	Sig.	NS	Sig.	NS	Sig.	Sig.	Sig.

Table 4: Interaction effect of storage period and growing media on development of acid lime seedling

M \ S	Relative growth rate (g/day)						Seedling vigour index- I			Seedling vigour index- II								
	60 - 90 DAS			90 - 120 DAS			90 DAS			60 DAS			90 DAS			120 DAS		
	M ₁	M ₂	M ₃	M ₁	M ₂	M ₃	M ₁	M ₂	M ₃	M ₁	M ₂	M ₃	M ₁	M ₂	M ₃	M ₁	M ₂	M ₃
S ₁	1.65	1.43	1.53	5.50	3.83	4.53	2778	2507	2168	41.99	44.81	32.81	119.35	108.03	101.22	388.73	282.15	293.33
S ₂	1.31	0.76	0.78	2.44	1.79	1.90	1779	2105	1528	27.07	35.09	27.82	75.90	53.13	49.16	136.68	121.31	115.79
S ₃	0.72	0.77	0.73	1.45	1.21	1.46	1419	1274	1219	22.36	25.69	19.69	38.61	46.17	37.55	74.67	69.88	72.23
S ₄	0.50	0.47	0.45	0.81	0.56	0.74	809	1049	834	14.82	19.52	11.75	19.81	24.52	16.56	30.85	27.52	26.18
S.Em.±	0.02			0.05			79.42			0.87			2.46			5.69		
C.D. 5%	0.07			0.15			231.80			2.54			7.19			16.60		

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