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Studies on the different concentration of GA_3 and media for seed germination of Acid lime (*Citrus aurantifolia* Swingle) under protected structure

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Abstract
The present investigation entitled "Studies on the different concentration of GA_3 and media for seed germination of Acid lime (*Citrus aurantifolia* Swingle) under protected structure." Was carried out during the year 2020-21. The experiment was conducted in completely randomized Design comprising of 13 treatments and 3 replication. The treatment consists of three concentrations i.e. 30 ppm, 60 ppm & 90 ppm of Gibberellic acid for 12 hours and have been used to different media (M_1) Soil, Sand, FYM, (M_2) Soil, Sand, Vermicompost, (M_3) Soil, Sand, FYM, Cocopeat and (M_4) Soil, Sand, Vermicompost, Cocopeat. The study revealed that growth parameters of Seed and physical parameters of growth in plants significantly affect of the seed germination of Acid lime seed. The seed germination was found to be highest in 90 ppm for 12 hours of GA_3 recorded significantly highest germination percentages, rate of seed germination, Number of shoots per plant, Number of leaves per plant and height of plants, fresh and dry weight of shoots (g), length of tap root (cm), average number of secondary roots and fiberous roots, survival percentage of plants and number of days to be ready for planting of sapling.

Keywords: Acid lime seeds, gibberellic acid and growing media

Introduction
Acid lime (*Citrus aurantifolia* Swingle) is the most commercially important fruit crops of India as well as world and is grown in over 100 countries and it is often regarded as golden fruit. The different common name of this species are Acid lime, Sour lime, Kagzi lime, Mexican lime and are believed to have originated from south- East Asia. It belongs to family Rutaceae, chromosome no. 2n = 18 is one of the most important citrus fruit as a major source of Vitamin C grown throughout the world (Anon., 2015) [1]. Among acid lime is commercially grown in tropical and subtropical regions of India and third most important fruit crop of India after mango and banana and the largest producer of acid lime in world (Chin and Roberts, 1980) [3]. It is highly susceptible to citrus gummosis and root rot nematode has poor tolerance to Phytophthora (Naqvi, 2000) [13] and mineral element are affected by rootstocks (Toplu *et al.*, 2008) [18]. The trees medium sized, hardy and semi-vigorous, growth upright with an irregular and loose crown, foliage not dense, light green, thorns numerous, fruit round and oblong, greenish yellow in colour and juice is highly acidic and its seeds are highly polyembryonic in nature and commercially propagated by seed and other methods of propagation done by grafting, budding, air-layering.

Materials and Method
The Raipur district of Chhattisgarh is located at 21^0 16' n latitude and 81^0 36' east longitude on 305m above sea level. The average rainfall of this reaion is 1200 – 1400 mm. This location is classified as by (Köppen and Geiger). The average annual temperature in Raipur is 26.5 °C (79.8°F). The experiment was carried out at during 2020-21 at Precision Farming Development Centre (PFDC), Department of Fruit Science, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.). The uniform sized, fully matured and true to type fruits of acid lime seed were collected from Pendra road and Raipur. The seeds were extracted carefully, washed with clean water and dried in shade for a day. The shoft covering seed coat of Acid lime seed was removed with the help of hands and knife. Acid lime seed of remove of seed coat after sun drying for 1-2 days. One gram of GA_3 was dissolved in few ml of ethyl alcohol and volume was made to one liter by adding distilled water to obtain a concentration of 1000 ppm.

For soaking, the desired concentrations of GA_3 were prepared from respective stock solutions by adding distilled water. In this stock solution to make of 30 ppm, 60ppm, and 90ppm of GA_3 solution of each concentration was taken in 100 ml in beakers. The uniform sized, healthy Acid lime seed were soked in 100 ml beakers for soaked 30, 60 and 90 ppm GA_3 solution in different treatment for 12 hours. Seeds of control treatment were soaked in distilled water. Preparation of different media components in this equal ratio of soil, sand, FYM, vermicompost and cocopeat. Four media component are (M_1) = Soil + Sand + FYM (1:1:1), (M_2) = Soil + Sand + Vermicompost (1:1:1), (M_3) = Soil + Sand + FYM + Cocopeat (1:1:1:1) and (M_4) = Soil + Sand + Vermicompost + Cocopeat (1:1:1:1). The acid lime seed sowing in polybag of 18 × 24 cm size filled with a different media components in this equal ratio respectively. The sowing of acid lime seed was done on 5 December 2020. On seed was dipped at 1-2 cm depth in each polybags. Seed sowing after watering was done. The experiment was designed in Completely Randomized Design (CRD) with three replications and 13 treatment combinations which were as follows: T_0, Control (Distilled water),(M_1), T_1, GA_3 30 ppm, (M_1), T_2, GA_3 30 ppm,(M_2), T_3, GA_3 30 ppm, (M_3), T_4, GA_3 30 ppm,(M_4), T_5, GA_3 60 ppm, (M_1), T_6, GA_3 60 ppm,(M_2), T_7,GA_3 60 ppm, (M_3), T_8,GA_3 60 ppm,(M_4), T_9,GA_3 90 ppm, (M_1), T_{10},GA_3 90 ppm,(M_2), T_{11}, GA_3 90 ppm, (M_3), T_{12}, GA_3 90 ppm, (M_4) for 12 hours. The data observed to germination percentages, rate of seed germination, Number of shoots per plant, Number of leaves per plant and height of plants, fresh and dry weight of shoots (g), length of tap root (cm), average number of secondary roots and fiberous roots, survival percentage of plants and number of days to be ready for planting of sapling and was subjected to statistically by the method of analysis of variance. The significance of various treatments was judged and suggested by R. A. Fisher (1973) [8].

Results and Discussion

The study revealed that growth parameters of Seed and physical parameters of growth in plants of acid lime seed. The significant maximum germination percentage (93.33%), germination rate of 93.33%, number of shoots per plant of 7.67, number of leaves per plant of 17.67, height 20.23 cm, fresh shoot weight of 9.87 g and dry shoot weight of 4.83 g., length of tap roots 21.07 cm, average number of secondary roots and fiberous roots of 9.33 and 92.00, survival percentage of 83.33% and minimum number of days to be ready for planting of sapling (120 days) was recorded under T_{12} (GA_3 90 ppm and M_4 for 12hr.) in acid lime sapling. The germination percentage of seeds was recorded at 30 DAS. The data of the present investigation revealed that the effect of different seed treatments showed significant effect on percentage of seed germination. The highest germination percentage of 93.33% was seen in T_{12} (GA_3 @ 90 ppm and M_4 for 12 hours). Followed by T_8 (90.00%) and T_{11} (86.66%). The lowest germination percentage of 43.33% was in T_0 (control) (Table -1). Similar findings were also reported by Singh *et al.* (2017) [16] in Rangpur Lime. The rate of seed germination. The highest germination rate of 93.33% (23.00, 26.00, 27.00, 28.00 and 28.00) was seen in T_{12} (GA_3 @ 90 ppm and M_4 for 12 hours). The lowest germination rate of 43.33% (8.00, 10.00, 11.00, 13.00 and 13.00) was in T_0 (control). The rate of seed germination was recorded at 20, 25, 30, 35 and 40 DAS (Table -2). Similar findings were also reported by Singh *et al.* (2017) [16] in Rangpur Lime. The effect of different seed treatments had a significant effect on of shoot. Maximum number of shoots per plant 7.67 was obtained under T_{12} GA_3 @ 90 ppm and M_4 for 12 hr.). However, minimum number of shoots per plant of 2.33 was obtained in T_0 (control condition) at 90 DAS respectively (Table -3). Similar findings were also reported by Sinha *et al.* (2013) [15] in kagzi lime.

The maximum number of leaves per plant of 10.67, 14.67 and 17.67 was obtained under T_{12} (GA_3 @ 90 ppm, M_4 for 12 hours) at 30, 60 and 90 DAS respectively. Whereas, minimum number of leaves of 2.67, 4.67 and 6.33 was obtained in T_0 (control) at 30, 60 and 90 DAS respectively (Table -4). The result of the present investigation is also supported by Kalalbandi *et al.* (2003) [10] in Kagzi lime. The maximum height of 6.27 cm, 14.87 cm and 20.23 cm was obtained under T_{12} (GA_3 @ 90 ppm, M_4 for 12 hours). However, minimum height of 2.33 cm, 4.23 cm and 7.27 cm was obtained in T_0 (control) at 30, 60 and 90 DAS respectively (Table -5). These results are in conformity with results reported by Singh *et al.* (2017) [17] in Rungpur lime. The maximum fresh shoot weight of 9.87 g and dry shoot weight of 4.83 g. at obtained under T_{12} (GA_3 @ 90 ppm, M_4 for 12 hours). Whereas, minimum fresh shoot weight of 4.70 g. and dry shoot weight of 2.07 g. at was obtained in T_0 (control) at 90 DAS (Table -6). The result is supported by the findings Choudhary and Chakrawar (1982) [5] in lime. Maximum length of tap roots 21.07 cm at was obtained under T_{12} (GA3 @ 90 ppm, M_4 for 12 hours). However, minimum length of tap roots 11.80 cm was obtained in T_0 (control) at 90 DAS (Table- 7). The maximum average number of secondary roots and fiberous roots of 9.33 and 92.00 at was obtained under T_{12} (GA_3 @ 90 ppm and M_4 for 12 hr.).Whereas, minimum average number of secoundry roots and fiberous roots of 3.33 and 62.33 was obtained in T_0 (control) at 90 DAS (Table-8). The similar reported by Singh *et al.* (2017) [17] in Rangpur Lime. The maximum survival percentage of 92.85% at was obtained under T_{12} (GA_3 @ 90 ppm and M_4 for 12hr.). However, minimum survival percentage of 38.46% was obtained in T_0 (control) (Table-9). Similar findings were also reported by Khatana *et al.* (2015) [11] in kagzi Lime. The minimum number of days to be ready for planting of sapling (120 days) was taken to under T_{12} (GA_3 @ 90 ppm and M_4 for 12hr.). Whereas, maximum number of days to be ready for planting of sapling (160 days) was taken to under T_0 (control) (Table-10). The gibberellic acid treatment the result of the present investigation is in close conformity with the findings of Vasantha *et al.* (2014) [19].

Table 1: Effect of different seed treatment and media on percentage of seed germination

Treatment	Treatments details		Germination % of seed
T_0	Control (Distilled water)	(M_1) = Soil +Sand + FYM	43.33
T_1	GA_3 (30 ppm for 12 hours)	(M_1) = Soil +Sand + FYM	53.33
T_2	GA_3 (30 ppm for 12 hours)	(M_2)= Soil +Sand +Vermicompost	70.00
T_3	GA_3 (30 ppm for 12 hours)	(M_3) =Soil +Sand +FYM +Cocopeat	73.33
T_4	GA_3 (30 ppm for 12 hours)	(M_4) =Soil +Sand +Vermicompost +Cocopeat	83.32
T_5	GA_3 (60 ppm for 12 hours)	(M_1)= Soil +Sand + FYM	63.33

T_6	GA_3 (60 ppm for 12 hours)	(M_2)= Soil +Sand +Vermicompost	76.66
T_7	GA_3 (60 ppm for 12 hours)	(M_3) =Soil +Sand +FYM +Cocopeat	83.33
T_8	GA_3 (60 ppm for 12 hours)	(M_4) =Soil +Sand +Vermicompost +Cocopeat	90.00
T_9	GA_3 (90 ppm for 12 hours)	(M_1)= Soil +Sand + FYM	66.66
T_{10}	GA_3 (90 ppm for 12 hours)	(M_2)= Soil +Sand +Vermicompost	80.00
T_{11}	GA_3 (90 ppm for 12 hours)	(M_3) =Soil +Sand +FYM +Cocopeat	86.66
T_{12}	GA_3 (90 ppm for 12 hours)	(M_4) =Soil +Sand +Vermicompost +Cocopeat	93.33
S.Em±			0.53
CD at 5%			1.56

Table 2: Effect of different seed treatment and media on rate of seed germination

Treatment	Treatments Details	Media	Number of seed germination				
			20 DAS	25 DAS	30 DAS	35 DAS	40 DAS
T_0	Control (Distilled water)	(M_1)	8.00	10.00	11.00	13.00	13.00
T_1	GA_3 (30 ppm for 12 hours)	(M_1)	11.00	14.00	15.00	16.00	16.00
T_2	GA_3 (30 ppm for 12 hours)	(M_2)	13.00	19.00	20.00	21.00	21.00
T_3	GA_3 (30 ppm for 12 hours)	(M_3)	16.00	21.00	22.00	22.00	22.00
T_4	GA_3 (30 ppm for 12 hours)	(M_4)	18.00	23.00	24.00	25.00	25.00
T_5	GA_3 (60 ppm for 12 hours)	(M_1)	11.00	16.00	18.00	19.00	19.00
T_6	GA_3 (60 ppm for 12 hours)	(M_2)	17.00	19.00	22.00	23.00	23.00
T_7	GA_3 (60 ppm for 12 hours)	(M_3)	19.00	22.00	24.00	25.00	25.00
T_8	GA_3 (60 ppm for 12 hours)	(M_4)	20.00	24.00	26.00	27.00	27.00
T_9	GA_3 (90 ppm for 12 hours)	(M_1)	14.00	18.00	20.00	20.00	20.00
T_{10}	GA_3 (90 ppm for 12 hours)	(M_2)	19.00	21.00	22.00	24.00	24.00
T_{11}	GA_3 (90 ppm for 12 hours)	(M_3)	21.00	23.00	25.00	26.00	26.00
T_{12}	GA_3 (90 ppm for 12 hours)	(M_4)	23.00	26.00	27.00	28.00	28.00
S.Em±			3.64	2.48	2.48	0.68	0.68
CD at 5%			11.27	7.68	7.68	2.13	2.13

Table 3: Effect of different seed treatment and media on number of shoots per plant

Treatment	Treatments details		Number of shoots per plant
T_0	Control (Distilled water)	(M_1)= Soil + Sand + FYM	2.33
T_1	GA_3 (30 ppm for 12 hours)	(M_1)= Soil +Sand + FYM	2.67
T_2	GA_3 (30 ppm for 12 hours)	(M_2)= Soil +Sand + Vermicompost	3.00
T_3	GA_3 (30 ppm for 12 hours)	(M_3) =Soil + Sand + FYM +Cocopeat	4.67
T_4	GA_3 (30 ppm for 12 hours)	(M_4) =Soil +Sand +Vermicompost +Cocopeat	5.67
T_5	GA_3 (60 ppm for 12 hours)	(M_1)= Soil +Sand + FYM	3.33
T_6	GA_3 (60 ppm for 12 hours)	(M_2)= Soil +Sand + Vermicompost	4.33
T_7	GA_3 (60 ppm for 12 hours)	(M_3) =Soil +Sand + FYM +Cocopeat	5.33
T_8	GA_3 (60 ppm for 12 hours)	(M_4) =Soil +Sand + Vermicompost + Cocopeat	6.33
T_9	GA_3 (90 ppm for 12 hours)	(M_1)= Soil +Sand + FYM	3.33
T_{10}	GA_3 (90 ppm for 12 hours)	(M_2)= Soil +Sand + Vermicompost	4.33
T_{11}	GA_3 (90 ppm for 12 hours)	(M_3) =Soil +Sand + FYM + Cocopeat	6.67
T_{12}	GA_3 (90 ppm for 12 hours)	(M_4) =Soil +Sand + Vermicompost +Cocopeat	7.67
S.Em±			0.24
CD at 5%			0.71

Table 4: Effect of different seed treatment and media on number of leaves per plant

Treatment	Treatments Details	Media	Number of leaves per plant		
			30 DAS	60 DAS	90 DAS
T_0	Control (Distilled water)	(M_1)	2.67	4.67	6.33
T_1	GA_3 (30 ppm for 12 hours)	(M_1)	3.67	5.67	7.00
T_2	GA_3 (30 ppm for 12 hours)	(M_2)	4.67	6.67	8.67
T_3	GA_3 (30 ppm for 12 hours)	(M_3)	5.67	8.67	11.67
T_4	GA_3 (30 ppm for 12 hours)	(M_4)	6.67	9.67	12.67
T_5	GA_3 (60 ppm for 12 hours)	(M_1)	4.33	6.33	7.67
T_6	GA_3 (60 ppm for 12 hours)	(M_2)	5.00	7.00	10.33
T_7	GA_3 (60 ppm for 12 hours)	(M_3)	6.00	9.00	10.67
T_8	GA_3 (60 ppm for 12 hours)	(M_4)	7.67	12.67	14.67
T_9	GA_3 (90 ppm for 12 hours)	(M_1)	4.00	6.00	8.00
T_{10}	GA_3 (90 ppm for 12 hours)	(M_2)	8.00	12.33	13.67
T_{11}	GA_3 (90 ppm for 12 hours)	(M_3)	10.33	13.67	15.67
T_{12}	GA_3 (90 ppm for 12 hours)	(M_4)	10.67	14.67	17.67
S.Em±			0.22	0.22	0.29
CD at 5%			0.65	0.65	0.84

Table 5: Effect of different seed treatment and media on height of the plant (cm)

Treatment	Treatments Details	Media	Height of the plant (cm)		
			30 DAS	60 DAS	90 DAS
T_0	Control (Distilled water)	(M_1)	2.33	4.23	7.27
T_1	GA_3 (30 ppm for 12 hours)	(M_1)	2.40	5.67	7.80
T_2	GA_3 (30 ppm for 12 hours)	(M_2)	2.53	6.27	8.57
T_3	GA_3 (30 ppm for 12 hours)	(M_3)	2.83	7.23	10.57
T_4	GA_3 (30 ppm for 12 hours)	(M_4)	3.43	8.73	12.63
T_5	GA_3 (60 ppm for 12 hours)	(M_1)	2.63	6.87	10.17
T_6	GA_3 (60 ppm for 12 hours)	(M_2)	3.27	8.20	12.27
T_7	GA_3 (60 ppm for 12 hours)	(M_3)	3.67	9.47	12.87
T_8	GA_3 (60 ppm for 12 hours)	(M_4)	5.37	11.87	15.23
T_9	GA_3 (90 ppm for 12 hours)	(M_1)	3.63	8.27	12.37
T_{10}	GA_3 (90 ppm for 12 hours)	(M_2)	3.77	9.73	13.80
T_{11}	GA_3 (90 ppm for 12 hours)	(M_3)	5.90	13.57	18.50
T_{12}	GA_3 (90 ppm for 12 hours)	(M_4)	6.27	14.87	20.23
S.Em±			0.07	0.02	0.029
CD at 5%			0.22	0.08	0.084

Table 6: Effect of different seed treatment and media on fresh and dry weight of shoot (g)

Treatment	Treatments Details	Media	Fresh weight of shoots (g.)	Dry weight of shoots (g.)
T_0	Control (Distilled water)	(M_1)	4.70	2.07
T_1	GA_3 (30 ppm for 12 hours)	(M_1)	5.77	2.17
T_2	GA_3 (30 ppm for 12 hours)	(M_2)	6.30	2.23
T_3	GA_3 (30 ppm for 12 hours)	(M_3)	7.73	2.87
T_4	GA_3 (30 ppm for 12 hours)	(M_4)	8.20	3.37
T_5	GA_3 (60 ppm for 12 hours)	(M_1)	6.50	2.37
T_6	GA_3 (60 ppm for 12 hours)	(M_2)	7.47	2.57
T_7	GA_3 (60 ppm for 12 hours)	(M_3)	8.13	3.13
T_8	GA_3 (60 ppm for 12 hours)	(M_4)	8.67	4.13
T_9	GA_3 (90 ppm for 12 hours)	(M_1)	6.43	2.40
T_{10}	GA_3 (90 ppm for 12 hours)	(M_2)	7.87	3.33
T_{11}	GA_3 (90 ppm for 12 hours)	(M_3)	8.37	3.77
T_{12}	GA_3 (90 ppm for 12 hours)	(M_4)	9.87	4.83
S.Em±			0.03	0.06
CD at 5%			0.10	0.17

Table 7: Effect of different seed treatment and media on length of tap roots (cm)

Treatment	Treatments details		Length of tap root (cm)
T_0	Control (Distilled water)	(M_1)= Soil + Sand + FYM	11.80
T_1	GA_3 (30 ppm for 12 hours)	(M_1)= Soil + Sand + FYM	12.77
T_2	GA_3 (30 ppm for 12 hours)	(M_2)= Soil +Sand + Vermicompost	13.37
T_3	GA_3 (30 ppm for 12 hours)	(M_3) =Soil +Sand + FYM +Cocopeat	14.80
T_4	GA_3 (30 ppm for 12 hours)	(M_4) = Soil +Sand + Vermicompost +Cocopeat	16.80
T_5	GA_3 (60 ppm for 12 hours)	(M_1) = Soil + Sand + FYM	13.73
T_6	GA_3 (60 ppm for 12 hours)	(M_2) = Soil +Sand + Vermicompost	14.87
T_7	GA_3 (60 ppm for 12 hours)	(M_3) = Soil +Sand + FYM + Cocopeat	16.23
T_8	GA_3 (60 ppm for 12 hours)	(M_4) = Soil + Sand +Vermicompost +Cocopeat	17.80
T_9	GA_3 (90 ppm for 12 hours)	(M_1) = Soil +Sand + FYM	14.60
T_{10}	GA_3 (90 ppm for 12 hours)	(M_2)= Soil + Sand +Vermicompost	17.27
T_{11}	GA_3 (90 ppm for 12 hours)	(M_3) =Soil + Sand +FYM + Cocopeat	18.17
T_{12}	GA_3 (90 ppm for 12 hours)	(M_4) =Soil +Sand +Vermicompost +Cocopeat	21.07
S.Em±			0.05
CD at 5%			0.15

Table 8: Effect of different seed treatment and media on average number of secoundry roots and fiberous roots

Treatment	Treatments Details	Media	Average number of secondary roots	Average number of Fiberous roots
T_0	Control (Distilled water)	(M_1)	3.33	62.33
T_1	GA_3 (30 ppm for 12 hours)	(M_1)	4.33	67.67
T_2	GA_3 (30 ppm for 12 hours)	(M_2)	5.33	72.00
T_3	GA_3 (30 ppm for 12 hours)	(M_3)	5.67	82.00
T_4	GA_3 (30 ppm for 12 hours)	(M_4)	6.67	86.33
T_5	GA_3 (60 ppm for 12 hours)	(M_1)	4.67	70.00
T_6	GA_3 (60 ppm for 12 hours)	(M_2)	5.33	77.00
T_7	GA_3 (60 ppm for 12 hours)	(M_3)	6.67	84.33

T_8	GA_3 (60 ppm for 12 hours)	(M_4)	7.33	87.00
T_9	GA_3 (90 ppm for 12 hours)	(M_1)	5.33	71.33
T_{10}	GA_3 (90 ppm for 12 hours)	(M_2)	7.00	78.67
T_{11}	GA_3 (90 ppm for 12 hours)	(M_3)	8.33	88.33
T_{12}	GA_3 (90 ppm for 12 hours)	(M_4)	9.33	92.00
S.Em±			0.34	0.36
CD at 5%			1.00	1.07

Table 9: Effect of different seed treatment and media on survival percentage of plants

Treatment	Treatments details	Media	Survival % of plant
T_0	Control (Distilled water)	(M_1)	38.46
T_1	GA_3 (30 ppm for 12 hours)	(M_1)	50.00
T_2	GA_3 (30 ppm for 12 hours)	(M_2)	66.66
T_3	GA_3 (30 ppm for 12 hours)	(M_3)	72.72
T_4	GA_3 (30 ppm for 12 hours)	(M_4)	76.00
T_5	GA_3 (60 ppm for 12 hours)	(M_1)	63.15
T_6	GA_3 (60 ppm for 12 hours)	(M_2)	73.91
T_7	GA_3 (60 ppm for 12 hours)	(M_3)	80.00
T_8	GA_3 (60 ppm for 12 hours)	(M_4)	88.88
T_9	GA_3 (90 ppm for 12 hours)	(M_1)	65.00
T_{10}	GA_3 (90 ppm for 12 hours)	(M_2)	75.00
T_{11}	GA_3 (90 ppm for 12 hours)	(M_3)	84.61
T_{12}	GA_3 (90 ppm for 12 hours)	(M_4)	92.85
S.Em±			0.48
CD at 5%			1.39

Table 10: Effect of different seed treatment and media on number of days to be ready for planting of sapling

Treatment	Treatments details	Media	Number of days to be ready for planting of sapling
T_0	Control (Distilled water)	(M_1)	160
T_1	GA_3 (30 ppm for 12 hours)	(M_1)	158
T_2	GA_3 (30 ppm for 12 hours)	(M_2)	152
T_3	GA_3 (30 ppm for 12 hours)	(M_3)	146
T_4	GA_3 (30 ppm for 12 hours)	(M_4)	140
T_5	GA_3 (60 ppm for 12 hours)	(M_1)	155
T_6	GA_3 (60 ppm for 12 hours)	(M_2)	150
T_7	GA_3 (60 ppm for 12 hours)	(M_3)	135
T_8	GA_3 (60 ppm for 12 hours)	(M_4)	130
T_9	GA_3 (90 ppm for 12 hours)	(M_1)	154
T_{10}	GA_3 (90 ppm for 12 hours)	(M_2)	148
T_{11}	GA_3 (90 ppm for 12 hours)	(M_3)	125
T_{12}	GA_3 (90 ppm for 12 hours)	(M_4)	120
S.Em±			1.87
CD at 5%			5.44

Conclusions

From the result of the present investigation, it can concluded that the effect of GA_3 and different media components had significant effect on seed germination and Physical parameters of growth in acid lime sapling.

This experiment after found to be superior over other treatments for initiation of germination. However, all parameters like seed germination percentage, Rate of seed germination, number of shoots per plant, number of leaves per plant, height of plant (cm), fresh and dry weight of shoots (g), length of tap root (cm), average number of secondary roots and fiberous roots, survival percentage of plant and number of days to be ready for planting were found significantly superior over other treatments under T_{12} (GA_3 @ 90 ppm for 12 hr. and used to M_4= Soil, Snad, Vermicompost and Cocopeat).

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