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Seed Germination and Seedling Vigour of Kagzi Lime (*Citrus aurantifolia* Swingle) As Influenced by Growth Regulators and Fungicide

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ABSTRACT

The seeds of Kagzi lime were treated for this study with different concentrations of GA_3, NAA, Ridomil Gold and control (untreated check). Experiment was conducted during 2013-14 at the Fruit Research Station, Kuthulia, College of Agriculture, Rewa (M.P.) to study seed germination and seedling vigour of kagzi lime (citrus aurantifolia swingle) as influenced by growth regulators and fungicide. Present study comprised eight treatments GA_3 @ 10 ppm, IAA @ 50 ppm, Ridomil Gold (2 g/kg seed), GA_3 + IAA, GA_3 + Ridomil Gold, GA_3+ IAA + Ridomil Gold and IAA + Ridomil Gold. The treatment GA_3+ IAA+ Ridomil Gold gave maximum germination percentage (84.33) closely followed by IAA+ Ridomil Gold (83%), GA_3+IAA (75.67%) and then IAA (74.33%). Accordingly, the treatments like GA_3 +IAA+ Ridomil, IAA+ Ridomil, and GA_3 +IAA recorded the significantly lower seed mortality (14.00, 15.0% and 23.67% respectively) as compared to the untreated check (37.67%). The maximum root length at 135 DAS stage was recorded with the treatment namely GA_3 + IAA + Ridomil Gold (27.63 cm) and IAA +Ridomil Gold (27.51 cm.) while, untreated check recorded lowest root length (17.08 cm). Significantly lower seedling vigour index was recorded with the untreated check (840), Ridomil gold (2007) and IAA (1074).

Key words: *Kagzi lime, Growth regulator, Germination, Seedling vigour, Ridomil Gold.*

INTRODUCTION

Citrus fruits have a prominent place among popular and extensively grown tropical and sub-tropical fruits. India is sixth largest producer of citrus in the world contributing 4.8 per cent share in production. The kagzi lime (*Citrus aurantifolia* swingle) is an important citrus crop which is grown on commercial scale in India as well as in Madhya Pradesh. Citrus is a member of the family *Rutaceae*, sub family *aurantioideae*. It has very wide distribution in all parts of India and is the most important for multipurpose uses. Citrus has maximum area in India occupied third rank after mango and banana. Kagzi lime is available throughout the year and it can be also grown on wide range of soil and climatic condition. They are mostly used as fresh fruits for the table purpose or for the manufacture of beverages.

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They have a laxative effect also on the digestive system. Kagzi lime is rich in vitamin A, B and C, minerals and alkaloids salts. The Kagzi lime fruits are also used for preparing pickles and squeezed juice is consumed by adding into dal (cooked pulses). The Kagzi lime can be propagated by seed, layering marcottage and budding. It is usually grown by seeds all over the country. Seed treatment with different plant growth regulators and fungicides has given remarkable encouraging results in several fruit crops. Plant growth regulators like Auxin and GA hasten the germination and seedling growth of trifoliate orange, sour orange and acid lime. Plant growth regulators may be used as seed, root or foliage treatment. The purpose of seed treatment by using fungicides is to control the seed borne fungi and bacteria that cause seedling blight, seed decays or other diseases. Besides this, it may protect the germinating seed from the attack of certain soil inhibiting fungi during germination. In fact, treatment of seeds of all crops should be done as a routine practice since it is a type of cheap insurance against possible disasters at a later stage. Therefore, an attempt was made to know the "Seed germination and seedling vigour of kagzi lime (*citrus aurantifolia* swingle) as influenced by growth regulators and fungicide".

MATERIALS AND METHOS

The present investigation was carried at in the nursery are of instructional Farm of Horticulture, College of Agriculture, Rewa (M.P.) during rainy season (September 2014 to January 2015) with eight treatments in a randomized block design with three replication. From the single tree, uniformed sized, mature, healthy and true to type fruits of Rangpur lime were harvested. The seeds were extracted and washed in water several times and dried in shade for a day before sowing. The seeds were dipped in distilled water and allowed to settle at the bottom of the beaker for a few minutes. The seeds floating on the surface of the water were discarded and those, which settled at the bottom, were used for experiment. The chemical analysis was done in laboratory, Department of Soil Science, College of Agriculture Rewa (M.P.) The seeds of Kagzi lime were treated with solely and with different combinations of plant growth regulators viz. GA_3 @ 10 ppm, IAA @ 50 ppm, Ridomil Gold (2 g/kg seed), GA_3 + IAA, GA_3 + Ridomil Gold, GA_3+ IAA + Ridomil and Gold IAA + Ridomil Gold and untreated check.

The observation was recorded on randomly selected plants from each treatments in each replication for number of days taken to start germination and germination percentage (%), mortality percentage (%), diameter of seedlings (mm.), number of leaves per plant, fresh weight of leaves per plant, dry weight of leaves per plant (gm), seedling vigour index, root length (cm) were recorded. The Germination percentage was calculated by the formula (Total no. of germinated seeds of a treatment X 100/ Total no. of seeds sown in the treatment). The mortality percentage was calculated by the formula (Total no. of non - germinated seeds X 100 / Total no. of seeds sown in a treatment). Length of roots was measured in cm after 25, 55, 95 and 135 days of sowing with the help of meter scale in each treatment. The number of leaves was counted from randomly selected plants was counted after 25, 55, 95 and 135 days of sowing in each treatment. The dry weight of leaves was recorded with the help of an electrical balance after dryness of leaves and average leaves weight per plant was measured (g). The data was also subjected to calculate the seedling vigour index by the formula viz., S.V.I. = Total % of germinated seeds of treatment X root length.

RESULTS AND DISCUSSION

The data on days taken to start germination, complete germination and mortality

percentage of kagzi lime treated with GA_3, IAA and Ridomil Gold fungicide indicated the significant influence upon these parameters. The combined application of GA_3 + IAA + Ridomil Gold brought about earliest start of seed germination in 15 days and its completion in 20 days over rest of the treatments. The highest seed germination (84.33%) with lowest seed mortality (14.0%) was the ultimate beneficial impact of this treatment combination however , maximum period (20 days) taken to start germination, 27 days taken to complete germination, lowest percentage of seed germination (59.33%) and highest seedling mortality were 37.67% recorded with untreated check.

The combined influence of GA_3 + IAA + Ridomil Gold upon earlier germination and least seedling mortality may be owing to the fact that these auxins stimulated cell division, cell enlargement and cell elongation in the apical region. The elongation of cell is due to increasing osmotic pressure and permeability of cytoplasm to water. These are also helps in the production of ethylene. This ethylene invokes the synthesis of hydrolases, especially aamylose, which favours the seed germination

Amongst the growth parameters, the length and diameter of seedlings as well as number of leaves/plant were studied at different growth intervals starting from 25 DAS to 135 DAS stages. The treatment combination GA_3+ IAA + Ridomil gold was found to be the best in respect to diameter of seedling and formation of more number of leaves per plant at different stages of observations. At 135 DAS stage, the maximum shoot diameter 0.43 mm and leaves count 27.08/plant due to combined effect of GA_3+ IAA+ Ridomil Gold. On the other hand, untreated check at 135 DAS recorded lowest shoot diameter (0.22 mm) and lowest leaves/plant (17.33).

The maximum increase in these growth parameters as a result of combined treatment of GA_3+ IAA+ Ridomil Gold might be owing to their effect on cell enlargement, cell growth, physico-chemical properties of protoplasm, respiration and nucleic acid metabolism etc. The promotive effect of GA_3 and NAA on growth and seed germination might be due to enzyme alpha amylase is activated which catalyses the starch conversion in simple carbohydrates and chemical energy is liberated which is used up in the activation of embryo.

The increase in growth parameters due to GA_3 and IAA have also been reported by several workers.[1-7]The treatment combination GA_3+ IAA + Ridomil Gold contributed maximum and recorded highest fresh weight of leaves (2.45 g/plant), dry weight of leaves (0.86 g/plant) and seedling vigour index (2007). On the other hand, untreated check recorded minimum fresh leaves weight (1.23 g/plant), minimum dry leaves weight (0.32 g/plant) and minimum seedling vigour index (840). Higher seedling vigour index in GA_3+ IAA + Ridomil Gold treated seeds might be due to the cumulative effect of higher shoot length, root length and germination percentage which were greatly influenced by gibberellic acid in Kagzi lime[1-2, 8-10].

Among the root observations, length of roots was measured from 25 DAS to 135 DAS stages were recorded at the final 135 DAS stage of plant growth. All these parameters were found significantly higher in treatment combination GA_3 + IAA + Ridomil Gold treatments at 135 DAS stage. This treatment combination recorded maximum root length (27.63 cm) while, the lowest root length (17.08 cm) was noted with untreated check. The best response of kagzi lime due to applied GA3 + IAA+ Ridomil Gold towards root parameters might be attributed to synergistic effects of these inputs in the stimulation of combined growth through cell division and expansion. Similar increase in the growth of fruit crops and other plants with growth regulators has also been noticed by many research workers[1-2, 5-6, 10, 13].

Table: 1

	Treatment	Days taken To start germination	Germination (%)	Mortality (%)	Shoot diameter (mm)		Number of leaves			
					55 DAS	135 DAS	25 DAS	55 DAS	95 DAS	135 DAS
T_1	GA_3 @ 10 ppm	16.00	72.00	28.00	0.16	0.23	3.75	9.67	17.83	22.58
T_2	IAA @ 50ppm	18.33	74.33	26.67	0.07	0.26	3.67	10.75	19.25	22.50
T_3	Ridomil Gold (2 g/kg seed)	19.67	70.00	29.00	0.10	0.25	3.25	10.58	17.08	20.67
T_4	GA_3 + IAA	15.00	75.67	23.67	0.12	0.26	4.33	11.50	21.17	23.75
T_5	GA_3 + Ridomil Gold	16.00	66.67	28.33	0.21	0.30	4.17	10.67	18.83	22.00
T_6	GA_3+ IAA + Ridomil Gold	15.00	84.33	14.00	0.24	0.43	5.00	12.33	23.25	27.08
T_7	IAA + Ridomil Gold	17.00	83.00	15.00	0.16	0.23	4.58	11.50	20.42	25.67
T_8	Untreated Check	20.00	59.33	37.67	0.04	0.22	2.92	7.67	14.50	17.33
	S.E.M. ±	1.28	1.45	1.31	0.004	0.006	0.29	0.46	0.36	0.12
	C.D. at 5%	3. 95	4.51	4.10	0.014	0.020	0.92	1.43	1.12	0.35

Table: 2

	Treatment	Fresh weight of leaves (g/plant) 135 DAS	Dry weight of Leaves (g/plant) 135 DAS	Seedling vigour index 90 DAS	Root Length (cm)			
					25 DAS	55 DAS	95 DAS	135 DAS
T_1	GA_3 @ 10 ppm	1.90	0.53	1253	2.28	10.43	17.40	21.37
T_2	IAA @ 50ppm	1.90	0.52	1074	3.10	13.97	19.02	24.05
T_3	Ridomil Gold (2 g/kg seed)	1.66	0.43	1010	2.33	9.77	14.43	20.86
T_4	GA_3 + IAA	2.03	0.63	1356	4.04	11.90	17.92	24.53
T_5	GA_3 + Ridomil Gold	1.80	0.43	1414	2.26	10.14	16.11	25.11
T_6	GA_3+ IAA + Ridomil Gold	2.45	0.86	2007	4.18	15.62	23.80	27.63
T_7	IAA + Ridomil Gold	2.28	0.83	1835	3.37	13.58	22.12	27.51
T_8	Untreated Check	1.23	0.32	840	1.48	7.42	14.16	17.08
	S.E.M. ±	0.04	0.02	32.39	0.06	0.29	0.23	0.24
	C.D. at 5%	0.13	0.07	100.39	0.18	0.93	0.70	0.75

CONCLUSION

In the present study, the higher fresh and dry weight of shoot, root and seedling with GA_3 + IAA + Ridomil Gold pre-soaking seed treatment can be correlated with higher overall growth in the corresponding treatment of GA_3 and IAA. Hence, it can be stated that increase in overall growth of the seedling has lead to

the overall assimilation and redistribution of food material with the seedling and hence, resulted in higher fresh and dry weight. Thus, increased growth is a consequence of increased dry matter accumulation.

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