RESEARCH PAPER International Journal of Agricultural Sciences, Vol. 7 Issue 1 (January, 2011) : 96-99

Effect of plant growth regulators and potassium nitrate on growth of seedling of Rangpur lime

A.B. KADAM*, D.B. SINGH AND R.A. KADE
Department of Horticulture, Allahabad Agriculture Institute Deemed University, ALLAHABAD (U.P.) INDIA

ABSTRACT

The growth and root studies like height of plant, number of leaves per plant, fresh and dry weight of shoots, length of taproot, number of secondary and fibrous roots and fresh and dry weight of roots were influenced significantly due to application of plant growth regulators and chemical. In Rangpur lime significantly more height (11.99 cm) was produced under the treatment GA_3 150 ppm, followed by the treatment T_2 (11.42 cm) over control (7.90 cm) and remaining treatments. At 120 DAS, Rangpur lime produced more number of leaves per plant (18.91) under the treatment GA_3 150 ppm. The less number of leaves per plant was recorded in the treatment control (11.28). The fresh and dry weight of shoot were more in GA_3 150 ppm (13.70 g and 8.70 g, respectively) over control. The maximum length of the tap root was recorded in NAA 150 ppm (16.28 cm), followed by the treatments T_4 and T_5 over control and rest of the treatments. Significantly less length of tap root was produced in the treatment control. In case of number of secondary and fibrous roots, significantly these were superior under the treatment NAA 150 ppm (6.26 and 86.88, respectively). The minimum number of secondary and fibrous roots was produced under the treatment control (2.56 and 57.06, respectively). Similarly, NAA 150 ppm was found to produce significantly maximum fresh as well as dry weight (5.94 g and 4.28 g, respectively) and minimum (2.41 and 1.95 g, respectively) in the treatment control (T_{10}) in Rangpur lime.

Kadam, A.B., Singh, D.B. and Kade, R.A. (2011). Effect of plant growth regulators and potassium nitrate on growth of seedling of Rangpur lime. *Internat. J. agric. Sci.*, **7**(1): 96-99.

Key words : Growth, GA_3, NAA, ppm

INTRODUCTION

Citrus fruits have a prominent place among the people and extensively grown in tropical and sub-tropical regions. Citrus fruit possess greater adoptability to different climatic conditions. Almost all the species and varieties of citrus are polyembryonic in nature with exception of *Citrus maxima*, *Citrus medica* and probably *Citrus latifolia*. Morerira *et al.* (1947) reported that the number of embryos present in a seed varied within a species, variety, strain and even on the same tree. In India, more than 80 per cent citrus plants are being raised on rough lemon and rest on other rootstocks like Rangpur lime, etc. Rootstocks play an important role exclusion of toxic, which are important for deciding the life of orchard. In recent times the rootstock has assumed a greater importance in view of role of dieback complex which is reduced to some extent by using rootstock like Rangpur lime. It is healthy, semi-vigorous, productive, tolerant to salt, greening diseases and resistant to tristiza (Choudhari *et al.,* 1974). Kagzi lime (*Citrus aurantifolia* Swingle) is commercially propagated through seeds in India (Naik, 1949) as it comes true to type, because of high degree (39-60 per cent) of nucellar embryony. In view of the above specific problems of Rangpur lime and Kagzi lime, two separate experiments were laid out to study the effect of plant growth regulators and potassium nitrate on growth of seedling of Rangpur lime.

MATERIALS AND METHODS

The field experiment was carried out during the year 2008-2009 under the agro-climatic conditions of Allahabad Agriculture Institute Deemed University, Department of Horticulture, Allahabad in a Randomized Block Design. There were 10 treatments in three replications. The treatments were as follows: T_1- GA_3 50 ppm, T_2- GA_3 100 ppm, T_3- GA_3 150 ppm, T_4- NAA 50 ppm, T_5- NAA 100 ppm, T_6- NAA 150 ppm, T_7- KNO_3 50 ppm, T_8- KNO_3 100 ppm, T_9- KNO_3 150 ppm, T_{10}- Control (Distilled water). 1 g of GA_3 was dissolved in few ml of ethyl alcohol and volume was made to one litre by adding distilled water to obtain a concentration of 1000 ppm and 1 g of NAA was dissolved in 10 ml of ethyl , alcohol with 2 g of $NaHCO_3$ and volume was made to one litre to get 1000 ppm concentration. Similarly, 5 g of well crushed KNO_3 powder was dissolved thoroughly in 500 ml of distilled water to obtain 1000 ppm concentration. The data recorded during the course of investigation were subjected to statistical analysis as per method of analysis of variance.

* Author for correspondence.

RESULTS AND DISCUSSION

The growth parameters like height of plant, number of leaves per plant, fresh and dry weight of shoots were significantly influenced by application of plant growth regulators and chemical (Table la).

Plant height:

In Rangpur lime it was observed that, at 30 and 60 DAS the treatment GA_3 150 ppm exhibited significantly increase in plant height (2.92 cm and 5.51 cm) over control and all other treatments, followed by treatment T_2 (2.75 cm and 4.40 cm) , respectively. Similar trend was observed at 90 and 120 DAS. The treatment GA3 150 ppm (T3) exhibited significantly increase in plant height (8.87 cm and 11.99 cm) which was at par to T_2 (8.22 cm) and the lowest plant height (5.04 cm and 7.90 cm), respectively, remaining treatments showed intermediate effect on producing plant height. The increased height of Jatti khatti and Jullunduri root stock with GA was reported by Bhambota and Kaul (1966) and Shanmugavalue (1971) thus supporting the findings of present study. Results obtained in present study are also supported by Srivastava and Singh (1965), Burns and Coggins (1969) and Shant and Rao (1973) and Chaudhari and Chakrawar (1981) in Rangpur lime.

Number of leaves per plant:

The data presented in Table 1a showed, at 30 and 60 DAS, the treatment T_3 produced significantly more number of leaves per plant (8.33 and 10.34), respectively which was statistically superior over control. At 90 and 120 DAS of, sowing, the treatment GA_3 150 ppm produced significantly maximum number of leaves (14.89 and 18.91) followed by T_2, T_6 and T_9 which were statistically similar to each other. Significantly minimum number of leaves (9.17 and 11.28) was produced at 90 and 120 DAS, respectively under the treatment control (T_{10}). Increase in number of leaves in GA 150 ppm might be due to maximum height of seedlings under this treatment. This also helps in invigoration of physiological process of plant and stimulatory effect of chemicals to form new leaves at faster rate as suggested by Sharma *et al.* (1999). Such type of findings were also reported by Brown *et al.* (1984) in sweet orange, Singh *et al.* (1989) and Babu and Lavnia (1985) in lemons which support the present findings.

Fresh and dry weight of shoots:

The application of various plant growth regulators and chemical regarding fresh and dry weight of shoots in Rangpur lime were highly significant. The maximum fresh and dry weight of shoot was produced by the treatment GA_3 150 ppm (13.70 g and 8.70 g, respectively) which was significantly superior over control and rest of the treatments, followed by the treatment T_2 (12.28 g). Significantly less fresh weight was observed under the treatment control (6.94 g). This seems to be the effect of mobilization of water and nutrients transported at higher rate which might have promoted more production of photosynthetic product and translocated them to various plant parts which might have resulted in better growth of the seedlings and hence, more fresh and dry weight (Brain *et al.,* 1959; Shenmugavelu, 1966). Similar results were obtained by Chourdhari and Chakrawar (1981) in Rangpur lime.

Root studies:

Under the root studies the length of taproot, number of secondary and fibrous roots and fresh and dry weight

Table 1a : Effect of plant growth regulators and potassium nitrate on growth of seedling of Rangpur lime

Tr. No.	Treatments	Height of plant (cm)				Number of leaves per plant				Fresh weight (g)	Dry weight (g)
		30 DAS	60 DAS	90 DAS	120 DAS	30 DAS	60 DAS	90 DAS	120 DAS		
T_1	GA_3 50 ppm	2.24	4.38	7.28	9.95	5.33	7.28	10.31	13.95	10.57	5.70
T_2	GA_3 100 ppm	2.75	4.40	8.22	11.42	5.78	8.80	12.75	17.46	12.28	6.35
T_3	GA_3 150 ppm	2.92	5.51	8.87	11.99	8.33	10.34	14.89	18.91	13.70	8.70
T_4	NAA 50 ppm	2.20	3.94	7.06	8.68	5.67	6.72	10.07	13.45	9.74	4.79
T_5	NAA 100 ppm	2.31	4.17	7.12	8.60	5.84	6.99	10.87	13.83	10.88	5.99
T_6	NAA 150 ppm	2.66	4.12	7.83	10.01	6.24	8.37	11.80	16.64	11.44	6.17
T_7	KNO_3 1000 ppm	2.15	3.71	7.41	11.03	4.68	6.75	9.34	13.15	9.34	4.71
T_8	KNO_3 2000 ppm	2.14	3.67	7.56	11.09	5.34	7.83	10.32	14.02	9.75	4.81
T_9	KNO_3 4000 ppm	2.12	3.52	7.82	11.63	5.76	8.17	11.66	14.33	10.10	5.32
T_{10}	Control	1.35	2.20	5.04	7.90	4.32	6.13	9.17	11.28	6.94	3.76
	S.E.±	0.17	0.38	0.32	0.43	0.264	0.266	0.534	0.602	0.32	0.33
	C.D. (P=0.05)	0.51	1.14	0.97	1.28	0.785	0.79	1.58	1.78	0.97	0.98

Table 1b : Effect of plant growth regulators and potassium nitrate on growth of seedling of Rangpur lime

Tr. No.	Treatments	Length of tap root (cm)	Number of secondary roots	Number of fibrous roots	Fresh wt. (g)	Dry wt. (g)
T_1	GA_3 50 ppm	12.24	2.34	72.92	3.20	2.14
T_2	GA_3 100 ppm	13.88	3.48	61.52	3.28	2.56
T_3	GA_3 150 ppm	14.84	4.44	76.74	3.47	2.61
T_4	NAA 50 ppm	15.20	4.93	78.00	3.70	2.65
T_5	NAA 100 ppm	16.19	5.67	82.24	4.08	2.82
T_6	NAA 150 ppm	16.28	6.26	86.88	5.94	4.28
T_7	KNO_3 1000 ppm	12.12	2.96	58.58	2.48	1.98
T_8	KNO_3 2000 ppm	12.20	3.35	59.52	3.60	2.06
T_9	KNO_3 4000 ppm	12.43	3.57	69.65	2.91	2.03
T_{10}	Control	11.20	2.56	57.06	2.41	1.95
	S.E.±	0.47	0.25	1.36	0.26	0.13
	C.D. (P=0.05)	1.41	0.76	4.04	0.79	0.39

of roots were significantly influenced by application of plant growth regulators and chemical. (Table 1 b).

Length of taproot:

The more length of tap root was recorded under treatment NAA 150 ppm (16.28 cm), which was significantly superior over control and rest of the treatments. It was followed by the treatments T_4 and T_5, which were significantly superior over rest of the treatments. The remaining treatments were also significantly produced more length of tap root over control (11.20 cm). The more length of tap root in NAA might be due to restorer of apical dominance which promotes root initiation, more nutrient uptake and root cell elongation as suggested by Shanmugave1u (1970). The results obtained in the present studies are in agreement with that reported by Choudhari and Chakrawar, (1981) in Rangpur lime.

Number of secondary and fibrous roots:

The maximum number of secondary roots was obtained under treatment NAA 150 ppm (6.26), followed by the treatment T_5 (5.67) which were significantly superior over control and rest of the treatments under study. The remaining treatments produced intermediate number of secondary roots. The minimum number of secondary roots was produced under control (2.56). Similar trend was observed for number of fibrous roots. The maximum number of fibrous roots was obtained under treatment NAA 150 ppm (86.88), followed by the treatment T_5 (82.24) were significantly superior over control (57.06). In case of Rangpur lime more number of secondary and fibrous roots were 6.26 and 86.88 respectively were produced under the treatment NAA 150 ppm. Bhambota and Kaul (1966) reported that the application of GA decreased the tap root length and number of secondary roots of rootstock seedlings of citrus. Similar results were reported by Chourdhari and Chakrawar (1981) in Rangpur lime.

Fresh and dry weight of roots:

The maximum fresh and dry weight of roots was obtained in the treatment NAA 150 ppm (5.94 g and 4.28 g), respectively which were significantly superior over control. The minimum fresh weight of roots was obtained under the treatment control (2.41 g and 1.95 g), respectively. The effect of higher concentration of NAA was more pronounced to the fresh and dry weight of roots. The favourable effect of NAA might be due to increased auxin level in the roots which stimulated more root initiation, more nutrient uptake and root cell elongation, thus resulting into increased tap root length and number of secondary and fibrous roots and in return increased the fresh and dry weight. The results of present study are in accordance with findings of Chaudhari and Chakrawar (1981) in Rangpur lime.

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Received : July, 2010; Accepted : September, 2010