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Studies on Regulation of Flowering in Acid Lime (*Citrus aurantifolia* swingle.)

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Abstract: A field experiment was conducted at Lower Palani Hills, Tamil Nadu during 2004-2005 to study the effect of plant growth regulators viz., GA_3 and cycocel, chemicals viz., KNO_3, thiourea and salicylic acid on flowering and fruiting in acid lime. There were fifteen treatments and the experiment was laid out in a randomized block design replicated twiceThe study revealed that application of GA_3 50 ppm in June + cycocel 1000 ppm in september + KNO_3 two percent in october showed better performance in delaying of flowering, number of flower shoot^{-1}, initial fruit set, fruit retention, number of fruits and yield in acid lime.

Key words: *Acid lime, flowering, growth regulators, chemicals*

INTRODUCTION

Acid lime (*Citrus aurantifolia* Swingle) is the third important citrus fruit crop in India next to mandarins and sweet oranges. It is generally grown under both tropical and subtropical climatic conditions in the plains and upto 1200 m MSL. It is a good source of vitamin C and has good antioxidant properties. It is an appetizer, stomachic, antiscorbutic and antihelmintic and it checks biliousness[2]. The major constraint faced by the growers of acidlime is the peak and lean production in the same year. The acid lime trees under Tamil Nadu condition flowers normally twice a year during January – February and June – July and yield mainly during July – August and December – January [10] and causes glut in the market which results in poor returns to the growers. The present study was therefore undertaken to investigate the effect of combinations of plant growth regulators viz., GA_3 and cycocel, chemicals viz., KNO_3, thiourea and salicylic acid and a bioprodcuct *panchakavya* on flowering and fruiting of acid lime.

MATERIALS AND METHODS

An experiment was conducted at Pachalur (1000 m MSL) in Lower Palani Hills of Tamil Nadu during 2004-2005. The experiment was laid out in a randomized block design with fifteen treatments replicated twice. Five year old uniform acid lime trees were selected for the experiment. Four trees were used for each treatment. The treatments tried were T_1 (control – water spray), T_2 (GA_3 50 ppm in June + cycocel 1000 ppm in september), T_3 (GA_3 100 ppm in June + cycocel 1000 ppm in september), T_4 (T_2 + KNO_3 one percent in october), T_5 (T_2 + KNO_3 two percent in october), T_6 (T_2 + thiourea one percent in october), T_7 (T_2 + thiourea two percent in october), T_8 (T_2 + salicylic acid 100 ppm in october), T_9 (T_2 +salicylic acid 200 ppm in october), T_{10} (T_3 + KNO_3 one percent), T_{11} (T_3 + KNO_3 two percent in october), T_{12} (T_3 + thiourea one percent in october), T_{13} (T_3 + thiourea two percent in october), T_{14} (T_3 + Salicylic acid 100 ppm in october) and T_{15} (T_3 + salicylic acid 200 ppm in october). Observations on days to first flowering, number of flowers shoot^{-1}, initial fruit set, fruit retention at harvest, number of fruits tree^{-1} and yield tree^{-1} were recorded and presented.

RESULTS AND DISCUSSIONS

Number of days to first flowering is an important criterion that governs either delay or earliness of a crop. It is influenced by diverse factors like genetic, environmental, physiological, nutritional, hormonal and cultural. In the present study, the different treatments significantly delayed the flowering. The highest delay in flowering was observed in trees sprayed with (T_{15}) GA_3 100 ppm in June + cycocel 1000 ppm in september + salicylic acid 200 ppm in October by nearly two months when compared to control. This might be due to more vegetative growth by GA_3, which reduced the generative shoot and increased the vegetative shoot development[5, 6]. Cycocel, a growth retardant which was sprayed on september, might have acted as an antigibberellin compound and arrested the vegetative bud development, nucleic acid synthesis and protein metabolism by specific antimetabolites, which induce flower formation. Similar results were also reported by Nir *et al*, [7].

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Table 1: Effect of plant growth regulating chemicals on fruiting of acid lime

Treatments	Days to first flowering (Days)	Number of flowers shoot^{-1}	Initial fruit set	Fruit retention at harvest	Number of fruits tree^{-1}	Yield tree^{-1}(kg)
T_1	63	3.42	2.42	1.12	152	5.04
T_2	107	5.52	3.53	1.88	188	7.16
T_3	126	5.85	3.85	1.95	197	7.48
T_4	109	6.07	3.97	2.82	203	8.62
T_5	114	7.01	4.49	3.21	224	11.15
T_6	113	5.99	4.13	2.8	201	9.02
T_7	111	5.94	4.17	2.13	196	9.27
T_8	112	5.94	4.14	2.53	194	7.74
T_9	109	6.02	4.06	2.13	189	7.17
T_{10}	123	6.09	4.3	2.56	197	8.14
T_{11}	126	6.2	4.34	2.5	195	8.33
T_{12}	127	6.17	4.11	2.89	187	8.07
T_{13}	125	6.08	4.04	2.82	204	8.43
T_{14}	128	6.16	4.03	2.86	199	7.99
T_{15}	129	6.21	4.07	2.73	191	8.17
SEd	0.46	0.04	0.04	0.01	0.62	0.02
CD (0.05)	0.98	0.07	0.09	0.03	1.33	0.03

The number of flowers shoot^{-1} (7.01) and initial fruit set (4.59) was the highest in GA_3 50 ppm in june + cycocel 1000 ppm in september+ KNO_3 two percent in october (T_5) treated trees. The higher fruit set by GA_3 application might have been due to its beneficial effects on pollen germination and pollen tube growth. Similar increase in fruit set by GA_3 treatment was reported in acid lime [4], clementine mandarin [3] and pummelo [1]. The KNO_3 application during the later stage could also have helped the trees to set more fruits.

The highest fruit retention was noticed in trees sprayed with GA_3 50 ppm in June + cycocel 1000 ppm in september+ KNO_3 two percent in october (T_5) which retained 3.21 fruits shoot^{-1} at harvest. The spraying of plant growth regulators and chemicals enhanced the auxin production, which in turn controlled abscission. This is in conformity with findings of Saraswathi *et al*., [9]

Yield is the culmination of the interplay of several factors like biochemical, physiological characters and yield parameters. The purpose of all cultural operations is to manipulate these and thereby increased the yield. The highest number of fruits (224) and yield tree^{-1} (11.15 kg) were obtained in trees sprayed with GA_3 50 ppm in June + cycocel 1000 ppm in September+ KNO_3 two percent in October (T_5). The increase in yield might be due to more fruit set, fruit retention and number of fruits tree^{-1}. These results are in agreement with the findings of Shrestha [10]. Higher yield in mango as reported by Sanyal *et al*, [8] by KNO_3 also supported the findings of present study.

Conclusion: The study revealed that application of GA_3 50 ppm in June + cycocel 1000 ppm in September + KNO_3 two percent in October showed better performance in delaying of flowering, number of flower shoot^{-1}, initial fruit set, fruit retention, number of fruits and yield in acid lime.

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