



Research Article

EFFECT OF ZINC, BORON, AND IRON APPLICATION ON FLOWERING AND YIELD OF ACID LIME (*Citrus aurantifolia* L) cv KAGZI LIME

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Abstract- A study was conducted to investigate the effect of micronutrients on flowering and yield attributes like, number of flowers, fruit set, fruit drop, number fruits per shoot, number of fruits per plant, fruit yield per plant and yield per hectare in 20 years old trees of acid lime cv. Kagzi lime, under Junagadh Agricultural University, Junagadh, saurashtra region of Gujarat during 2013-14. Results indicated that zinc, boron and iron ($Z_1B_1F_1$) were increased number of flowers (22.37), fruit set (49.33%), number of fruits per shoot (8.53), number of fruits per plant (925.00), fruit yield (27.07 kg/ plant & 74.97qt/ ha) and minimum fruit drop (24.33%) in treated trees over non-treated trees at full bloom stage. Our results suggested that effect of combination of zinc, boron, and iron on acid lime cv. Kagzi lime to increased yield parameters.

Keywords- Acid lime, Micronutrients, Kagzi lime, Flowering and Yield

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Introduction

Trigonella foenum-graecum L is a leguminous herb cultivated in India and North African countries. It belongs to the family Fabaceae. India is the major producer of fenugreek and its main consumer for culinary and medicinal uses. The Acid lime (*Citrus aurantifolia* L.) is sub-tropical in its climacteric requirements and originated from sub-tropical Southeast Asia, where it can still be found wild. It is a most important and tenderest fruit crop in citrus group which occupies probably the third position among the sub-tropical countries after banana and mango in production of fruits. India is the largest producer of acid lime in the world followed by USA, Spain and Israel. It is cultivated in almost all the states in India, mainly in Andhra Pradesh, Maharashtra, Tamil Nadu, Karnataka, and Gujarat. The total area and production under acid lime in India is estimated 255.2 thousand hectares and 2,523.5 thousand metric tons respectively. Acid lime is one of the important fruit crops in Gujarat state. The area, production and productivity of acid lime is 40.80 thousand hectares, 433.12 thousand metric tons and 10.6 MT/ha, respectively [1]. It is good source of vitamin C (62.95mg/100ml), vitamin B₁ (0.02mg/100ml), vitamin B₂ (0.06mg/100ml), calcium (90mg/100ml), phosphorous (20mg/100ml) and iron (0.3mg/100ml). They are also rich source of bioflavonoid, acids and volatile oils. Special interest in limes has been flavonoids called flavonol glycosides, including many kaempferol-related molecules. While these flavonoids have been shown to stop cell division in many cancer cell lines, they are perhaps most interesting for their antibiotic effects [2] Acid lime starts bearing flowers and fruits from the fourth year onwards after planting. Under natural conditions the trees flower all the year round each flush put forth new blossom. The acid lime flowers thrice in a year, i.e., February, June-July and October. Thus, acid lime in this part seems to bear fruits almost throughout the year. Among all of these three bahars "Ambebaha" crop gives more fruit production than other bahars during June- July season. The fruits mature in six months after flowering. The followings are some common varieties of acid lime viz., Pramalini, Vikram, SaiSarabati and Jai Devi. "Kagzi lime" is dominant cultivar found on large area in Gujarat state. A good acid lime plant (7 year old) may give average yield of 600-800 fruits/ plant.

Micronutrients like Zn, Fe and B, play a vital role in plants. Foliar application of micronutrients is more successful than soil application. Among the several factors responsible for poor yield and declining health in citrus, deficiency of micronutrients is considered to be the major one [3]. Micronutrients can tremendously boost Kagzi lime flowering and fruiting quality. The problem of micronutrients deficiency in Kagzi lime causes great concern to the fruit growers and also flower drop as well as fruit drop is a major problem.

Materials and Methodology

The present investigation entitled "Effect of micronutrients application on flowering, fruiting and yield of Acid lime (*Citrus aurantifolia* L.) cv. Kagzi lime" was conducted at Department of Horticulture, College of Agriculture, Junagadh Agricultural University, Junagadh, during the year 2013. All the plants selected were uniform in growth and size which planted at the distance of 6m × 6m and were subjected to uniform application of cultural practices like weeding, irrigation, manures, fertilizers and plant protection measures etc. The experiment was laid out in Factorial Randomized Block Design with eight treatments and three replications. The treatments comprising two levels of each Zinc sulphate viz., Z₀ (control), Z₁ (Zinc sulphate @ 0.5%), Borax viz., B₀ (control), B₁ (Borax @ 0.4%) and Ferrous sulphate viz., F₀ (control), F₁ (Ferrous sulphate @ 0.4%). Two sprays were done at the full bloom stage and second at one month later of first spray.

Results and Discussion

Z₁B₁F₁ produced maximum number of flowers (22.37) per shoot. This indicated the positive combined effect of micronutrients on flowering. Zinc enhanced the synthesis of auxin in plants [4]. Iron is credited with a definite role in the synthesis of chlorophyll molecule [5]. Boron regulates metabolism involved in translocation of carbohydrates, cell wall development and RNA synthesis [6].

Table 1 Interaction effect of micronutrients application on flowering and yield parameters of acid lime

Treatments		Number of flowers	Fruit set%	Fruit drop%	Number of fruits /shoot	Number of fruits / plant	Fruit yield (kg / plant)	Fruit yield (qt /ha)
Zn ₀	B ₀ F ₀	12.33	27.33	42.5	4.6	573.33	16.5	45.7
	B ₀ F ₁	16.8	33.33	36.33	6.53	695	19.43	53.82
	B ₁ F ₀	16	38.33	35	7.43	640	21.33	59.09
	B ₁ F ₁	18.83	40.33	32.67	7.67	675	20.73	57.43
Zn ₁	B ₀ F ₀	19	41.67	32	8.07	693.33	22.43	62.14
	B ₀ F ₁	14.33	35.33	34.67	6.63	661.67	19.43	53.82
	B ₁ F ₀	18.67	36.33	35.67	7.27	813.33	22.83	63.25
	B ₁ F ₁	22.37	49.33	24.33	8.53	925	27.07	74.97
S.E _m		1.63	3.84	2.87	0.7	37.66	1.77	4.9

The maximum fruit set (49.33%) was observed in treatment (Z₁B₁F₁). All the micronutrients when sprayed in combination involved directly in various physiological processes and enzymatic activities. It seems to have helped to increase the fruits set either by improving pollen germination or by helping the growth of pollen tubes and thus facilitate in timely fertilization before the stigma loses its receptivity or the style becomes non-functional [7,8]. The minimum fruit drop (24.33%) was observed in Z₁B₁F₁. due to the indirect action of micronutrients in auxin synthesis that delayed formation of abscission layer during early stage of fruit development [9,10]. The number of fruits per tree influenced significantly by the application of foliar sprays of micronutrients. The maximum number of fruits per shoot was observed (8.53) in Z₁B₁F₁. That might be due to cumulative effect of micronutrients involved directly in various physiological process and enzymatic activities. These findings are in agreement with in Pomegranate and in Citrus [11,12]. The plants treated with higher dose of zinc, iron and boron in combination gave maximum number of fruits per plant. The maximum number of fruits per plant was observed (925.00) in Z₁B₁F₁. All the micronutrients when sprayed in combination involved directly in various physiological processes and enzymatic activity. Involvement of Zn in auxin synthesis and B in translocation of start to fruit resulted into better photosynthesis, greater accumulation of starch in fruits balance of auxin in plant regulates the fruit drop or retention in plants, which altered the control of fruit drop and increased the total number of fruits per plant. Similar results were also observed [13-16].

Application of research: The application of treatment Z₁B₁F₁ gave the maximum yield per tree (27.07 kg) and per hectare (74.97qt) followed by treatment Z₁B₁F₀. The cumulative effect of micronutrients might have helped to increase the fruit size and fruit weight and thereby increase in fruit yield.

Research Category: Micronutrients

Abbreviations:

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