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Effect of integrated nutrient management on physico-chemical parameters of acid lime fruits

U.B. Deshmukh, S. G. Bharad, S.P. Chavan and N.S. Wagh

Department of Horticulture, *Department of Soil Science and Agril. Chemistry, Dr. Panjabrao Deshmukh KrishiVidyapeeth, Akola 444 104 (M.S.). India

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ABSTRACT

A field experiment was conducted in the year 2010-11 and 2011-12 at Central Research Station, Dr. PDKV, Akola to find out effect of integrated nutrient management on Physico-Chemical Parameters of Acid Lime. The eleven different combination of treatments are taken to find out better better fruit physico-chemical parameters. Fruit physical quality viz., fruit weight,length and breadth, peel thickness and fruit juice content was observed due to the application of75% RDF (450:225:225g NPK) + 50kg FYM+100g Azospirillum + 100g PSB /plant+200g $ZnSO_4$/plant and 75% RDF (450:225:225 g NPK) + 50 kg FYM+ 500 g AM/plant + 100g PSB /plant + 200g $ZnSO_4$/plant. However, maximum TSS and titrable acidity was recorded with75% RDF (450:225:225g NPK) + 50kg FYM+100g *Azospirillum.* While, ascorbic acid content was found maximum with application of 75% RDF (450:225:225g NPK) + 50kg FYM+100g *Azospirillum* + 100g PSB /plant+200g $ZnSO_4$/plant.

Key words : *Acid lime, INM, Growth, Yield*

Introduction

Acid lime (*Citrus aurentifolia* Swingle) belongs to family Rutaceae. It is originated in India and its chromosome number is 2n=18 plant is medium in vigour and size, spreading and bushy with numerous, slender, willowy fine stemmed branchlets densely armed with small, slender spines. Acid lime has great value because of its various kind of uses and nutritional as well as medicinal values. Lime is appetizer, stomachic, antiscorbutic, antihelmintic and it checks biliousness. It is used in omitting and gastro-enteritis etc. Lime used in making candy, chocolate, ice-cream, pastries and 100 ml fruit juice content 80 percent of water, (26 IU carotene), 20 mg Vit. B1, 0.1 mg Riboflavin, 63 mg Vitamin C, 1.83 mg iron (Fe), 0.16 mg Copper (Cu), oxalo-acetic acid 0.30%, malic acid 8.2% and alkaline salt therefore it is an essential for human health (Srivastava, 2008).

For higher production of quality fruits in a sustainable manner application of nutrients at proper doses very important. It is reality that proper dose of nutrients to be standardized for a set of agro-climatic conditions which in turn to be economically acceptable, viable and eco-friendly suitable. In India, most of

Thefertilizers recommendations in for acid lime areon the basis of higher quality inorganic fertilizers like 600-800 g N and 300-500 P_2O_5 and K_2O. plant/ year (Srivastava, 2008), which Use of such higher

1.Ph.D. Scholar, Department of Horticulture, Dr. PDKV, Akola.
2.Associate Professor, Department of Horticulture, Dr. PDKV, Akola.
3. Ph.D. Scholar, Department of Horticulture, Dr. PDKV, Akola.
4. Ph.D. Scholar, Department of Soil Science and Agril. Chemistry, Dr. PDKV, Akola.

doses of N, P and K although helpful for increasing the production but may have deleterious effect on the soil environment. Very little published literature is available regarding integrated use of organic and inorganic sources of nutrients along with bio fertilizers in acid lime is an acceptable approach and no such report is available for Western Vidarbha conditions. Hence, the present investigation was carried out undertaken to find out most efficient manuring system and its possible effects on nutrient composition and its possible effects on yield andquality of acid lime along with soil biological properties.

Materialand Methods

The experiment was conducted at Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, in Randomized Block Design with eleven treatments, each replicated three times. The treatments were :T1 : RDF (600 g N + 300 g P_2O_5 + 300 g K_2O) + 50 kg FYM/ plant), T2 : T1 + 200 g $ZnSO_4$/plant, T3 : 75% RDF (450:225:225 g NPK) + 50 kg FYM + 500 g AM/ plant, T4 : T3 + 200 g ZnSO4/plant., T5 : 75% RDF (450:225:225 g NPK) + 50 kg FYM + 100 g Azospirillum, T6 : T5 + 200 g ZnSO4/plant, T7 : 75% RDF (450:225:225 g NPK) + 50 kg FYM+ 500 g AM/plant + 100g PSB /plant, T8 : T7 + 200g ZnSO4/plant., T9 : 75% RDF (450:225:225g NPK) + 50 kg FYM + 100g Azospirillum+ 100g PSB /plant, T10 : T9 + 200 g $ZnSO_4$/plantand T11 : Control.Half dose of nitrogen and full dose of potassium and phosphorus was applied in October and remaining half dose of nitrogen at fruit set stage. Fertilizers were applied between radial distances of 160 cm away from trunk.

Total soluble solids (TSS) was recorded with the help of digital refractometer.Titrable acidity was estimated as explained by Ranganna (1986).The data were statistically analyzed as suggested by Panse and Sukhatme (1967).

Results

Fruit Physical Quality: The fruit weight of acid lime was significantly influenced with combined application of organic, inorganic sources of nutrients along with biofertilizers. The maximum weight of the fruit was recorded with the application of 75% RDF (450:225:225g NPK) + 50 kg FYM+ 500 g AM/Plant + 100g PSB /plant (T7) (38.13g) and (33.82 g/fruit) and (35.97 g) respectively was recorded during first and second season of experimentation and also in pooled mean, which was found at par with all other treatments except control .While, Minimum weight of fruit was recorded in control.(27.70 g,26.18 gand26.94 g respectively) in first and second season of experiment and also in pooled mean.T10 recorded significantly maximum fruit length and breathduring first season, while treatment T8during the second season (4.10 cm and 3.90 cm respectively), while, during second season maximum fruit size (4.0 cm fruit length) and (3.8 cm fruit breath) was recorded in treatment(75% RDF (450:225:225g NPK) + 50 kg FYM+ 500 g AM/Plant + 100 g PSB / plant+200 g $ZnSO_4$/plant)which was found at par with treatmentT10, T9 and T7.

These results are in agreement with those obtained by Khan and Hameedunnisa-Begum (2004) Musmade *et al.* (2009) in acid lime,Dheware and Waghmare (2009) and Dheware and Gajbhiye (2010) in Sweet orange.

The maximum juice content in the fruits (35.27%) and (34.33%) was observed in treatment T9. The significantly minimum peel thickness was recorded 1.67 mm and 1.60 mm during first and second season in T10 with 75% RDF (450:225:225g NPK) + 50 kg FYM + 100g Azospirillum + 100g PSB + 200 g $ZnSO_4$ per plant per year while maximum peel thickness during first and second season (2.17 mm), (2.13 mm) respectively, was recorded in control. (T11) treatment.

However, the INM treatments did not showed consistent relationship withpeel thickness. The results are in close conformity with the findings of Musmade *et al.*, (2009) in acid lime and Yasin Ashraf *et al.*, (2010) in citrus.

Fruit Chemical Quality : The data regarding fruit quality in terms of acidity, ascorbic acid and total soluble solid Influenced by the application of combinations of organic, inorganic manures and biofertilizers was recorded and presented in Table significantly Maximum acidity of fruit juice 8.14% and 8.15% was recorded with treatment T5 75% RDF (450:225:225g NPK) + 50 kg FYM+100g Azospirillum/plant/ year, respectively during first and second season of the experiment while, minimum acidity during first and second season was 6.40%, 6.44% respectively, with control (T11). Maximum ascorbic acid content (32.44 mg/100 ml) was observed in treatment T10 due to the application of 75% RDF (450:225:225g NPK) + 50kg FYM+100g

Table 1. Effect of integrated nutrient management on fruit weight and fruit size

Treatment	Fruit weight (g)			Length of fruit (cm)		Breadth of fruit (cm)		Fruit juice (%)		Peel thickness (mm)		Acidity (%)		Ascorbicacid (mg/ 100ml)		TSS (°B)	
	2010-11	2011-12	Pooled mean	2010-11	2011-12	2010-11	2011-12	2010-11	2011-12	2010-11	2011-12	2010-11	2011-12	2010-11	2011-12	2010-11	2011-12
T1	36.75	33.37	35.06	3.20	2.90	3.00	2.80	29.90	29.77	2.10	2.10	7.67	7.67	29.92	30.18	7.62	7.52
T2	34.14	32.45	33.19	3.40	3.40	3.20	3.20	31.11	30.87	2.13	2.07	7.68	7.67	29.59	29.96	7.60	7.67
T3	36.24	32.22	34.23	3.40	3.40	3.20	3.20	30.08	30.05	1.87	1.80	6.70	(7.03	30.14	29.88	7.57	7.57
T4	35.17	33.47	34.32	3.30	3.30	3.20	3.20	32.87	32.25	1.90	1.83	7.66	7.64	29.27	29.88	7.30	8.10
T5	36.15	33.20	34.67	3.40	3.20	3.30	3.10	33.20	33.20	1.87	1.97	8.14	8.15	31.79	32.15	7.81	8.13
T6	36.50	32.83	34.66	3.10	3.60	3.00	3.40	33.13	33.13	1.93	1.93	7.39	7.35	31.37	31.61	7.17	7.17
T7	38.13	33.82	35.97	3.30	3.90	3.20	3.70	31.33	31.10	2.07	2.00	6.87	6.78	29.55	29.81	7.42	7.33
T8	36.13	32.94	34.53	3.60	4.00	3.50	3.80	33.87	33.60	1.87	1.77	7.51	7.37	32.15	32.26	7.59	8.07
T9	36.47	33.43	34.95	3.70	3.90	3.60	3.70	35.27	34.33	1.80	1.73	6.47	6.42	31.49	32.13	7.30	7.17
T10	36.47	33.09	34.78	4.10	3.90	3.90	3.60	35.20	33.87	1.67	1.60	6.59	6.81	32.44	32.11	7.67	7.83
T11	27.70	26.18	26.94	3.00	2.80	2.90	2.70	27.50	27.50	2.17	2.13	6.40	6.44	28.07	27.88	7.14	7.13
SE (m) ±	1.44	1.30	1.28	0.07	0.05	0.07	0.05	0.31	0.28	0.008	0.007	0.02	0.03	0.35	0.69	0.14	0.13
CD at 5 %	4.26	3.80	3.68	0.22	0.16	0.23	0.16	0.90	0.83	0.024	0.022	0.06	0.10	1.05	2.05	0.41	0.40

*Figures in parentheses arc sin transformed values,
** Figures in parentheses are square root transformed values,

Azospirillum + 100g PSB+200g ZnSO4 per plant per year, while during first season which, was found at par with (T8) 32.15 mg/100 mL, T5 (31.79 mg/100 mL), T9 (31.49 mg/100 mL).

However, during second season of experiment maximum ascorbic acid (32.26 mg/100 ml) observed in treatment T875% RDF (450:225:225g NPK) + 50 kg FYM+ 500 g AM + 100g PSB +200g $ZnSO_4$/plant/year. which, was at par with T5 (32.15 mg/100 mL), T9 (32.13 mg/100 mL), T10 (32.11 mg/100 mL), T6 (31.61 mg/100mL). While, minimum ascorbic acid content in acid lime juice (28.07 mg/100 mL and 27.88 mg/100 mL) was recorded first and second season of experiment respectively in control (T11).

Total soluble solids (TSS) in the fruit juice was maximum (7.810B) during first season in treatment T5 with 75% RDF (450:225:225g NPK) + 50 kg FYM + 100g Azospirillum /plant/ year which, was found at par with treatment T10 (7.670B), T1 (7.620B) T2 (7.600B), T8 (7.590B), T3 (7.570B), T7 (7.420B). However, during second season maximum fruit juice TSS (8.130B) was found associated with treatment T5 which, was found at par with T4 (8.100B), T8 (8.070B),T10 (7.830B) whereas, minimum TSS was recorded (7.140B and 7.130B) during first and second season of experiment respectively, in control .

An improvement in fruit quality under the influence on INM was also observed by Chokha Singh *et al.* (2000), Patel *et al.* (2009) and Marathe *et al.* (2012) in sweet orange, Ingle *et al.* (2001) and Musmade *et al.* (2009) in acid lime, Taywade (2006) in Nagpur mandarin, Dutta *et al.* (2009), Shukla *et al.* in (2009) in guava.

Discussion

The positive effect of integrated nutrient management on growth performance in respect of plant height , plant spread and plant volume could be attributed due to beneficial effect of microbe present in rhizosphere leading to higher mobilization of solute to the roots and hence the improvement in plant growth (Singh *et al.* 2000).

Fruit weight and fruit size are highly correlated with dry matter content and balance level of hormones. Increase in fruit weight and fruit size might be due to fact that, organic manure and microbial fertilizers enhances the nutrient availability by enhancing the capability of plant

to better solute uptake from rhizosphere, also these nitrogen fixers are known for accumulation of dry matters and their translocation as well as favors synthesis of different growth regulators .The increased fruit chemical quality may be explained from the fact these microbial fertilizers enhance the nutrient availability by enhancing the capability of plant to better solute uptake from rhizosphere and also helped in mitigating stresses in plant (Patel *et al.* 2009).

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