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Effect of fertigation on yield and quality of sweet orange

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Abstract

The experiment on Studies on integrated nutrient and water management in sweet orange was started in the year 2010-11 for next five year up to 2015-16 under All India Coordinated Research Project on Fruits, Department of Horticulture, MPKV, at Shrirampur Dist. Ahmednagar (MS) to evaluate the combined effect of nutrient levels at different levels of irrigation. The interaction effect of irrigation and fertigation I₃ F₃, drip irrigation at 90% ER and fertigation with 80% of RDF recorded significantly maximum yield with improvement in quality parameters.

Keywords: Sweet orange, fertigation, yield, quality

Introduction

Sweet orange (*Citrus sinensis*) is an important fruit crop which belongs to family commonly known as Mosambi. 2nd most important group of citrus, constituted 23% of total citrus production (Singh, 2001) in India. Sweet orange is one of the important fruit crop of Maharashtra cultivated on more than 54 thousand of area with more than 656 thousand MT of production, popularly grown in western as well as in marathwada region (Annon, 2017) [2]. Domestically Sweet orange is widely used for juice consumption. Its juice is rich in vitamin C or ascorbic acid. It contains not only appreciable amount of vitamin C but also is good source of vitamin A and B. The juice contains fruit sugars, fruit acid, minerals like calcium, phosphorus, iron and alkaline salt which play role of health promoting ingredients in human diet.

Material and Methods

The experiment on Studies on integrated nutrient and water management in sweet orange was started in the year 2010-11 for next five year up to 2015-16 under All India Coordinated Research Project on Fruits, Department of Horticulture, MPKV, at Shrirampur Dist. Ahmednagar (MS) to evaluate the combined effect of nutrient levels at different levels of irrigation. The experiment was started with different 9 treatments i.e. combinations of 3 different levels of irrigation (I₁-70%, I₂-80% & I₃-90% ER) and 3 levels of fertigation (F₁-60%, F₂-70% & F₃-80% of RDF). Irrigation will be applied by drip irrigation on an alternate day. The reference crop evapotranspiration is calculated using the FAO Penman-Monteith method. (Allen *et al.* 1998) [1]. Recommended Dose of Fertilizers is 800: 300: 600 g NPK + 20 kg FYM + 15 kg Neem cake/plant/year.

Results & Discussion

The pooled data on yield and quality parameters (2011-12 to 2015-16) presented in Table 1 revealed that, the interaction effect of irrigation and fertigation and the individual effect of irrigation and fertigation on yield was also significant. The treatment I₃ irrigation at 90% ER and F₃ fertigation with 80% RDF recorded significantly highest fruit yield (17.39 t ha⁻¹ and 17.18 t ha⁻¹), respectively. The interaction effect of irrigation and fertigation I₃F₃ i.e. drip irrigation at 90% ER and fertigation with 80% of RDF recorded highest fruit yield (18.84 t ha⁻¹) followed by I₃F₂ drip irrigation at 90% ER and fertigation with 70% of RDF. This might be due to uniform application and quantity of nutrients directly in vicinity of the root zone throughout crop growth period increased the nutrient use efficiency which leads to enhance yield of crop coupled with increase in physiological processes and efficient translocation of photosynthates towards reproductive growth in terms of yield of sweet orange.

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Similar results were reported by Panigrahi and Srivastava (2011) [5] in Nagpur mandarin, Shirgure and Shrivastava (2013) [7] in Nagpur mandarin, Ramana *et al.* (2014) [4] in sweet orange.

The quality data in respect of percent juice content, TSS, acidity, ascorbic acid, number of seeds fruit⁻¹, reducing sugar, non-reducing sugar, and total sugar were presented in Table 1. The individual effect of irrigation and fertigation as well as interaction effect was found significant in percent juice

content, TSS, acidity and ascorbic acid, non-reducing sugar and number of seed fruit⁻¹. Significantly maximum juice content (47.90%), TSS (10.47 °Brix), ascorbic acid (59.41 mg/100 ml juice) with minimum acidity (0.45%) and minimum number of seed fruit⁻¹ (18.96) were recorded in T₉ treatment i.e. I₃F₃ drip irrigation at 90% ER and fertigation with 80% of RDF than all other treatment combinations. Similar results were postulated by Shirgure *et al.* (2003) [6] in acid lime, Ghosh and Pal (2010) [3] in sweet orange.

Table 1: Effect of irrigation, fertigation and their interactions on yield and quality parameters of fruits in sweet orange (Pooled mean 2011-12 to 2015-16)

Treatment	Fruit yield (t ha ⁻¹)	Juice (%)	TSS (°Brix)	Acidity (%)	Ascorbic acid (mg/100 ml juice)	Number of seed fruit ⁻¹	Reducing sugars (%)	Non-reducing sugars (%)	Total sugars (%)
Pooled mean									
Irrigation levels (I)									
I ₁ - Drip irrigation at 70 % ER	14.49	42.85	9.65	0.58	52.46	23.24	3.56	2.54	5.93
I ₂ - Drip irrigation at 80 % ER	15.75	44.69	9.88	0.54	54.62	22.26	3.64	2.54	6.04
I ₃ - Drip irrigation at 90 % ER	17.39	45.98	10.06	0.51	57.80	19.83	3.71	2.57	6.20
S. E.(m) ±	0.14	0.29	0.03	0.002	0.21	1.20	0.005	0.17	0.014
C. D. at 5 %	0.40	0.83	0.10	0.006	0.62	3.37	0.16	0.051	0.041
Fertigation levels (F)									
F ₁ - Fertigation with 60 % of RDF	14.52	42.20	9.58	0.63	53.59	20.75	3.55	2.76	6.21
F ₂ - Fertigation with 70 % of RDF	15.95	44.58	9.84	0.56	54.76	22.03	3.63	2.64	6.11
F ₃ - Fertigation with 80 % of RDF	17.18	46.72	10.18	0.51	56.53	22.55	3.72	2.54	6.08
S. E.(m) ±	0.14	0.29	0.03	0.002	0.21	1.20	0.005	0.11	0.11
C. D. at 5 %	0.40	0.83	0.10	0.006	0.62	3.37	0.16	0.35	0.37
Treatment combinations									
T ₁ - I ₁ F ₁	13.33	39.89	9.39	0.70	51.17	22.07	3.43	2.85	6.26
T ₂ - I ₁ F ₂	14.56	42.74	9.73	0.67	52.00	23.63	3.47	2.63	5.99
T ₃ - I ₁ F ₃	15.60	45.54	9.83	0.59	54.17	24.03	3.50	2.42	5.88
T ₄ - I ₂ F ₁	14.58	42.71	9.67	0.63	53.58	20.73	3.46	2.72	6.15
T ₅ - I ₂ F ₂	15.59	44.56	9.73	0.54	54.29	22.47	3.56	2.61	6.14
T ₆ - I ₂ F ₃	17.09	46.74	10.26	0.50	55.99	23.60	3.49	2.74	6.18
T ₇ - I ₃ F ₁	15.064	43.61	9.67	0.56	56.01	19.20	3.53	2.72	6.22
T ₈ - I ₃ F ₂	17.68	46.45	10.05	0.48	57.98	20.97	3.56	2.67	6.19
T ₉ - I ₃ F ₃	18.84	47.90	10.47	0.45	59.41	18.96	3.71	2.48	6.16
S. E.(m) ±	0.14	0.29	0.03	0.027	0.21	1.28	0.05	0.12	0.13
C. D. at 5 %	0.40	0.83	0.10	0.079	0.62	3.59	0.15	0.35	0.37

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