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Effect of irrigation, fertigation and their interactions on growth and yield 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 plant height (4.54 m) and canopy volume (34.87 m³) with highest number of fruits (286.49 fruits tree⁻¹), weight of fruit (238.69 g) and yield (68.20 kg tree⁻¹).

Keywords: Sweet orange, irrigation, fertigation, growth, yield

Introduction

Sweet orange (*Citrus sinensis*), is an important fruit crop which belongs to family Rutaceae and it is native to China. Sweet orange is a large shrub or bushy tree commonly found in subtropical and tropical areas. It is adaptable to dry and arid conditions having low rainfall in a winter. It is commonly known as Mosambi. 2nd most important group of citrus, constituted 23% of total citrus production (Singh, 2001) [8] in India. Application of water through drip irrigation along with fertigation helpful for getting proper plant growth with higher yield of fruits. The integrated nutrient management infuses long term sustainability in the productivity level.

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 and Discussion

The pooled data on growth and yield (2011-12 to 2015-16) presented in Table 1 showed that, the interaction effect of irrigation and fertigation and individual effect of irrigation and fertigation on growth and yield of sweet orange was found significant. The irrigation level I₃ drip irrigation at 90% ER recorded significantly maximum plant height (4.54 m) and canopy volume (34.87 m³). Similarly within fertigation level F₃, fertigation with 80% of RDF recorded significantly maximum plant height (4.47 m) and canopy volume (35.44 m³) followed by F₂ fertigation with 70% of RDF. The interaction effect of irrigation and fertigation on growth was also significant and the maximum plant height (4.66 m) and canopy volume (40.32 m³) was recorded in T₉ i.e. I₃ F₃ drip irrigation at 90% ER and fertigation with 80% of RDF followed by I₃ F₂ drip irrigation at 90% ER and fertigation with 70% of RDF. This might be due to improved nutritional status and physical properties of the soil caused by the improved irrigation. This made the plant to uptake water and mineral nutrients better, resulting in its increased growth rate. These results are in conformity with those reported by Kumar *et al.* (2013) [4] in sweet orange, Shirgure and Panchariya (2012) [6] in Nagpur Mandarin and Patel *et al.* (2012) [5] in acid lime.

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The yield data showed 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 number of fruits (267.55 and 272.15 fruits tree⁻¹), weight of fruit (228.17 g and 228.12 g), fruit yield (62.84 kg tree⁻¹ and 62.07 kg tree⁻¹) respectively. The interaction effect of irrigation and fertigation I₃ F₃, drip

irrigation at 90% ER and fertigation with 80% of RDF recorded highest number of fruits (286.49 fruits tree⁻¹), weight of fruit (238.69 g) and yield (68.20 kg tree⁻¹) followed by I₃ F₂, drip irrigation at 90% ER and fertigation with 70% of RDF. These results are in conformity with findings of Ghosh and Pal (2010) [3] in sweet orange, Shirgure and Shrivastava (2013) [7] in Nagpur mandarin, Barua and Hazarika (2014) [2] in Assam lemon.

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

Treatment	Plant height (m)	Canopy Volume (m ³)	Number of fruits (tree ⁻¹)	Average fruit weight (g)	Fruit yield (kg tree ⁻¹)
	Pooled mean	Pooled mean	Pooled mean	Pooled mean	Pooled mean
A. Irrigation levels (I)					
I ₁ - Drip irrigation at 70% ER	4.24	27.76	244.76	211.75	51.67
I ₂ - Drip irrigation at 80% ER	4.32	29.82	265.90	217.61	56.85
I ₃ - Drip irrigation at 90% ER	4.54	34.87	267.55	228.17	62.84
S. E.(m) ±	0.018	0.45	1.17	1.31	0.52
C. D. at 5%	0.053	1.27	3.29	3.69	1.47
B. Fertigation levels (F)					
F ₁ - Fertigation with 60% of RDF	4.23	25.98	248.13	209.85	52.30
F ₂ - Fertigation with 70% of RDF	4.39	31.03	257.94	219.57	57.51
F ₃ - Fertigation with 80% of RDF	4.47	35.44	272.15	228.12	62.07
S.E.(m) ±	0.018	0.45	1.17	1.31	0.52
C. D. at 5%	0.053	1.27	3.29	3.69	1.47
C. Treatment combinations					
T ₁ - I ₁ F ₁	4.12	23.93	232.97	203.88	47.97
T ₂ - I ₁ F ₂	4.22	26.33	246.84	212.22	52.43
T ₃ - I ₁ F ₃	4.38	34.04	254.47	219.16	56.20
T ₄ - I ₂ F ₁	4.20	26.76	259.07	210.28	52.54
T ₅ - I ₂ F ₂	4.38	30.75	263.15	216.05	56.20
T ₆ - I ₂ F ₃	4.38	31.96	275.48	226.51	61.82
T ₇ - I ₃ F ₁	4.38	27.25	252.34	215.39	56.39
T ₈ - I ₃ F ₂	4.58	37.04	263.84	230.43	63.90
T ₉ - I ₃ F ₃	4.66	40.32	286.49	238.69	68.20
S. E.(m) ±	0.018	0.45	1.17	1.31	0.52
C. D. at 5%	0.053	1.27	3.29	3.69	1.47

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