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Effect of foliar application of micronutrients on yield of date palm cv. Halawy

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Abstract

An experiment was carried out to study the effect of foliar application of micronutrients on yield and quality of date palm. The applied treatments were arranged in a randomized block design (RBD) with three replications *viz.* T_1 Control, T_2 $ZnSO_4$ (0.5%), T_3 Borax (0.25 %), T_4 $FeSO_4$ (0.5 %), T_5 Thiourea (0.1 %), T_6 $ZnSO_4$ (0.5 %) + Thiourea (0.1%), T_7 Borax (0.25%) + Thiourea (0.1%) and T_8 $FeSO_4$ (0.5 %) + Thiourea (0.1%). Application of different micronutrients affects the yield, fruit weight and quality of date palm cv. Halawy. The maximum fruit yield (121.27 kg/palm) and fruit weight (7.81g/ berry) were recorded in treatment T_8 ($FeSO_4$ 0.5 % + Thiourea 0.1%) while highest TSS (35.42%) was recorded in treatment T_7 (Borax 0.25% + Thiourea 0.1%) followed by treatment T_8 ($FeSO_4$ 0.5 % + Thiourea 0.1%).

Key words: Micronutrients, foliar application, yield, fruit weight, TSS

Introduction

Date palm (*Phoenix dactylifera* L.) is a monocotyledonous, dioecious, perennial tree that belongs to the family Arecaceae. The latin name *Phoenix dactylifera* is derived from "*Phoenix*", which means date palm and *dactylifera* derived from a Greek word "daktulos" means a finger. Major date palm producing countries in world are Iraq, Saudi Arabia, Iran, United Arab Emirates, Egypt, Pakistan, Morocco and Algeria. Besides these countries, Libya, Tunisia, Sudan, Muscat, Oman, the Aden, United States of America and Bahrain also produce dates in substantial quantities. Middle East and North Africa produce 60% of the processed dates in the world (Sivalingum *et al*., 2014). In India, generally two species of *Phoenix viz*., *dactylifera* and *sylvestris* are found. The *Phoenix sylvestris* Roxb or "*desi khajoor*" is found throughout the country but it produces inferior quality fruits while commercially *dactylifera* is cultivated in Gujarat, Rajasthan, Punjab, Tamil Nadu, Maharashtra etc. states. Date is a highly nutritious and favourite fruit throughout world. Fresh 100g date fruit contains 59.2g moisture, 1.2g protein, 0.4g fat, 1.7g minerals, 3.7g fibre, 33.8g carbohydrates, 22.0 mg calcium, 38.0 mg phosphorus while 100g dry dates (*chhuhara*) provides 2.5g protein, 2.1g minerals, 3.9g fibres, 75.8g carbohydrates, 120 mg calcium, 50 mg phosphorus, 7.30 mg iron, 0.02 mg riboflavin, 0.9 mg Niacin, 3.0 mg vitamin C (Gopalan *et al*., 1985). Date palm has provided food, ornamentals material for shelter, fiber, and fuel. In India, it is believed that date palm has been introduced by the soldiers of Alexander in the 4th century B.C. in Indus valley. A large number of seedling date palm groves exist in the western part of the India and Kachchh region of Gujarat state (Johnson *et al*., 2013). In Rajasthan, date cultivation was first introduced by the ruler Ganga Singh Ji of the Bikaner state.

Micronutrients are essentially as important as macronutrients to have better growth, yield and quality in plants. The requirement of micronutrients is only in traces, which is partly met from the soil or through chemical fertilizer or through other sources. Micronutrients are involved in metabolic and cellular functions in the fruits plants. The sufficient amount of micronutrients necessary for better plant growth which resulted in higher yield due to increased growth, better flowering and higher fruit set (Ram and Bose, 2000). In date palm, very few study are undertaken to assess the effect of micronutrients. Therefore, present study is conducted to study the effect of micronutrients on yield and quality of date palm cv. Halawy.

Materials and Methods

The experiment was conducted at All India Coordinated Research Project on Arid Zone Fruits, Date Palm Research Centre, S.K. Rajasthan Agricultural University, Bikaner. The experiment site was situated an altitude of 234.7 m above mean sea level at latitude 28° 01" N and longitude 73° 22"E. The soil of experimental field was loamy-sand, alkaline in reaction (pH 8.6) having 120 kg ha^{-1} available N (Alkaline permanganate method), low level of available phosphorus (15.0 kg ha^{-1}, Olsen's method) and medium in available potassium (175.4 kg ha^{-1}, Flame photometric method). The uniform date palm plants spaced at 6 x 6 meters apart and irrigated by drip irrigation were selected. The treatments were applied after fruit set at pea sized fruit and second repeated after one month. The applied treatments were arranged in a

randomized block design (RBD) with three replicates (three trees) for each treatments *viz.* T_1 Control, T_2 $ZnSO_4$ (0.5%), T_3 Borax (0.25 %), T_4 $FeSO_4$ (0.5 %), T_5 Thiourea (0.1 %), T_6 $ZnSO_4$ (0.5%) + Thiourea (0.1%), T_7 Borax (0.25%) + Thiourea (0.1%) and T_8 $FeSO_4$ (0.5 %)+ Thiourea (0.1%).

The yield was recorded and data were statistically analyzed for estimation of analysis of variance as per method suggested by (Panse and Sukhatme, 1985). Fruit weight was measured with the help of electronic balance and average fruit weight was recorded in gram. Total soluble solids percentage in fruit juice (TSS) was determined using hand refractometer. The critical differences between the observed values under different treatment combinations were also estimated to understand the significant effects of different Treatments.

Results and Discussion

The six year data (2014-2019) of yield of date palm are presented in Table 1. On pooled analysis basis, the maximum fruit yield (121.27 kg/palm) was recorded in treatment T_8 ($FeSO_4$ 0.5 % + Thiourea 0.1 %) at *doka* stage followed by treatment T_7 (Borax 0.25% + Thiourea 0.1%) *i.e.*, 114.78 kg/palm and minimum in control (82.29 kg/palm). However, treatment T_{10} and T_8 were statistically at par with each other in pooled basis. The observed results were in accordance with Ahamad *et al*. (1998). He found that maximum yield (37.2 kg/plant) was recorded with 0.5 per cent ferrous sulfate foliar application in guava. Alila *et al*., (2004) reported that the foliar application of micronutrients *i.e.*, $FeSO_4$ (0.2%) and boric acid (0.1%) on papaya cv. Ranchi significantly increased growth parameters in comparison to the control. Pathak *et al*. (2011) reported that combined application of Fe (0.5%) and Zn (0.5%) showed the best response on plant growth in terms of plant height, basal girth of pseudostem, number of leaves produced per plant and minimum duration between emergences of two successive leaves in banana. Ferrous sulphate acted as catalyst in formation of chlorophyll and several enzymes which accelerate the yield. The low level of thiourea (sulfhydryl compound) facilitated nutrient acquisition and transport (Garg *et al*., 2006; Anjum *et al*., 2011). It may act either as a nutritional supplement due to having nitrogen and sulphur or as biostimulator of cell growth.

The six year data (2014-19) were presented in Table 2 on the pooled basis revealed that maximum fruit weight (7.81 g/ berry) was observed in treatment T_8 ($FeSO_4$ 0.5% + Thiourea 0.1 %) at *doka* stage followed by 7.68 g $berry^{-1}$ in treatment T_7 (Borax 0.25% + Thiourea 0.1%) and minimum in control (6.68 g/berry). Similar findings was also reported by Meena *et al*. (2008) and they stated that foliar application of ferrous sulphate and borax at 0.6 per cent produced maximum average fruit weight, fruit length, fruit breadth, pulp weight, stone weight, pulp to stone weight ratio compared than the control and 0.3 per cent spray in ber trees.

As far as total soluble solids is concerned from the year 2014 to 2019, the maximum TSS content was registered in treatment T_7 followed by T_8 and minimum in control. On pooled analysis basis maximum TSS content (35.42%) was

Table 1. Effect of different micronutrients on yield of date palm (pooled from 2014 to 2019)

Treatments	Average yield/palm (kg)						
	2014	2015	2016	2017	2018	2019	Pooled data
Control (T_1)	102.00	91.00	87.67	69.60	72.27	71.17	82.29
$ZnSO_4$ (0.5%) (T_2)	106.00	103.33	101.00	86.33	83.53	84.53	94.12
Borax (0.25 %) (T_3)	108.00	102.00	99.00	89.00	86.37	85.70	95.01
$FeSO_4$ (0.5 %) (T_4)	108.60	110.33	108.33	96.53	93.60	97.27	102.44
Thiourea (0.1 %) (T_5)	112.00	116.67	115.67	104.67	102.67	101.33	108.84
$ZnSO_4$ (0.5%) + Thiourea (0.1%) (T_6)	115.30	118.33	119.00	110.33	107.83	111.17	113.66
Borax (0.25%) + Thiourea (0.1 %) (T_7)	116.60	117.67	118.33	112.00	110.67	113.40	114.78
$FeSO_4$ (0.5 %)+ Thiourea (0.1 %) (T_8)	118.00	124.33	125.00	120.57	118.57	121.14	121.27
S.Em.±	4.23	6.029	5.946	3.56	4.32	5.34	2.26
CD (5%)	12.26	18.287	18.037	10.81	13.09	16.20	6.895

Table 2. Effect of different micronutrients on fruit weight of date palm (pooled from 2014 to 2019)

Treatments	Average fruit weight (g)						
	2014	2015	2016	2017	2018	2019	Pooled data
Control (T_1)	6.73	6.83	6.63	6.63	6.60	6.65	6.68
$ZnSO_4$ (0.5%) (T_2)	6.80	6.87	6.87	6.87	6.83	6.83	6.85
Borax (0.25 %) (T_3)	6.80	6.87	6.77	6.80	6.79	6.73	6.79
$FeSO_4$ (0.5 %) (T_4)	6.86	6.97	6.97	6.96	6.91	6.98	6.94
Thiourea (0.1 %) (T_5)	7.03	7.13	7.13	7.16	7.13	7.05	7.11
$ZnSO_4$ (0.5%) + Thiourea (0.1%) (T_6)	7.13	7.13	7.20	7.33	7.30	7.43	7.25
Borax (0.25%) + Thiourea (0.1 %) (T_7)	7.56	7.57	7.67	7.67	7.63	7.95	7.68
$FeSO_4$ (0.5 %) + Thiourea (0.1 %) (T_8)	7.66	7.80	7.80	7.80	7.80	8.02	7.81
S.Em.±	0.14	0.07	0.321	0.24	0.37	0.36	0.124
CD (5%)	0.39	0.21	0.974	0.71	1.11	1.10	0.381

recorded in T_7 (Borax 0.25% + Thiourea 0.1%) treatment closely followed by 35.33 % in treatment T_8 ($FeSO_4$ 0.5 % + Thiourea 0.1 %). Similar findings were reported by Pant and Lavania (1989) in papaya. They noticed that the foliar application of $FeSO_4$ (0.15%) was gave maximum TSS (14.3%) while maximum sugars (12.5%), highest sugar: acid ratio (49.2) and lowest acidity (0.25%) observed in borax 0.15% in papaya fruit.

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