

EFFECTS OF SOIL FERTILIZATION ON YIELD, FRUIT QUALITY AND MINERAL CONTENT OF KHUDARI DATE PALM VARIETY

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ABSTRACT

Effect of 7 fertilizer treatments consisting of (N P K fertilizers and organic manure) on yield and fruit quality of Khudari date palm variety, grown at College of Agriculture farm, King Saud University, was studied during 1980 and 1981 seasons. Results showed that chemical fertilizers increased the yield of trees as compared with the organic manure. Some of the physical and chemical characteristics of the fruits were also affected by the chemical fertilizers during both seasons. Soil fertilization did not produce significant effect in the mineral content (N, P, K, Ca and Mg) of the fruits and the leaves.

Forty two Khudari trees of uniform vigor planted at a spacing of 7 × 7 meters were selected. The soil was clay loam, pH 7.6.

Seven fertilization treatments used are given in table 1. Each treatment consisted of two trees, replicated three times. Replications were separated by guard trees.

Nitrogen was applied in the form of ammonium sulphate (21% N).

Phosphorus was applied in the form of calcium super-phosphate (45-47% P₂O₅)

Potassium was applied in the form of potassium sulphate (50% K₂O).

INTRODUCTION

Date palm (*Phoenix dactylifera*, L.) is an economically important crop of Saudi Arabia. The general belief among Saudi growers is that date palm can grow and fruit successfully with addition of only organic manure without any inclusion of chemical fertilizers.

The present study was therefore carried out to investigate the effect of chemical fertilization on yield, fruit quality and mineral content of fruits and leaves of Khudari date palm variety grown in Riyadh region.

MATERIALS AND METHODS

This study was carried out at the College of Agriculture, King Saud University, during the growing seasons of 1980 and 1981.

Organic manure was added in January 1980 and 1981. Each year N fertilizer was added in three equal doses, on March 15 (before flowering), May 15 (fruit setting) and July 1 (fruit maturity). The P and K fertilizers were added once each year, on March 15. All trees received similar cultural practices e.g. irrigation, pollination, etc.

Fruits were harvested during the second week of August of each year. Number of bunches and yield per palm was recorded.

A sample of 50 fruits was taken from each tree for physical and chemical quality determinations. Physical characteristics included, fruit weight, volume, diameter and length. Whereas, chemical characteristics included, total soluble solids (T.S.S.),

moisture and dry matter. T.S.S. were determined by Abb refractometer. Moisture and dry matter were determined by drying 100 g of the fruit pulp in oven to constant weight (AOAC 1970).

For leaf samples four median pinnae were taken from 5 consecutive leaves around the palm (Reuther 1948, Minessy, Bacha and Azab 1974).

Leaf and fruit samples were washed, dried and grounded for chemical analyses. Nitrogen was determined by the micro-Kjeldahl Gunning method (AOAC 1970). Phosphorus was determined colorimetrically by the stannous chloride method (Toth et al. 1948). Potassium was determined by atomic absorption spectrophotometer. Both calcium and magnesium were determined by the versenate method (EDTA) (Cheng and Bray 1951).

RESULTS AND DISCUSSION

Effect of chemical fertilization on yield and number of bunches per palm:

Yield: In both seasons, the addition of N fertilizer plus organic manure increased the yield of Khudari date palm trees as compared with the addition of organic manure

only (Table 2). Furthermore, the yield was increased with increasing the level of N added to the trees from 500 g to 1500 g N. The differences between the different treatments were not significant. The highest yield was obtained from trees that received treatment 7 (1500 g N + 500 g, P₂O₅ + organic manure). The percentage increase in yield over treatment 1 (25 kg organic manure) ranged from 4.67 to 17.33% in the first season and from 9.93 to 20.82% in the second season (Table 2). The results obtained were in agreement with those of Furr and Armstrong (1958) and Furr and Brown (1965) on Deglet Noor variety, Rahim (1975) on Zahidi variety and Hussein et al. (1977) on Khunaizi and Sukkari varieties. Addition of P and K fertilizers had no appreciable effect on yield in both seasons (Table 2).

Number of bunches per palm: Chemical fertilization (NPK) did not affect the average number of bunches per palm at harvest (Table 2). These results were similar to those obtained by Hussein et al. (1977). Lussois (1972) and Furr and Armstrong (1958) found that the appreciable increase in number of inflorescences per palm as influenced by N fertilization required more than one year.

Table 1: Fertilization treatments used in 1980 and 1981 seasons.

Number	Treatment
1	25 Kg organic manure/tree
2	500 g N + 25 Kg organic manure/tree
3	1000 g N + 25 Kg organic manure/tree
4	1500 g N + 25 Kg organic manure/tree
5	500 g N + 500 g P ₂ O ₅ + 500 g K ₂ O + 25 Kg organic manure/ tree
6	1000 g N + 500 g P ₂ O ₅ + 500 g K ₂ O + 25 Kg organic manure/tree
7	1500 g N + 500 g P ₂ O ₅ + 500 g K ₂ O + 25 Kg organic manure/ tree

Table 2: Effect of chemical fertilization on yield and number of bunches per palm in 1980 and 1981 seasons.

Treatment	1980			1981		
	Yield (kg/palm)	Increase %	No. of bunches per palm	Yield (kg/palm)	Increase %	No. of bunches per palm
1	75.00	—	10.66	73.50	—	10.67
2	78.50	4.67	10.33	80.80	9.93	10.67
3	84.50	12.67	11.50	85.00	15.65	11.66
4	87.00	16.00	11.50	87.50	19.05	11.83
5	79.50	6.00	10.50	81.00	10.20	10.67
6	85.00	13.33	11.33	87.00	18.37	11.50
7	88.00	17.33	10.83	88.80	20.82	11.83
L S D 5%	N S	—	N S	N S	—	N S

Effect of chemical fertilization on fruit quality:

Physical characteristics: Data in (Table 3) showed that, generally, the addition of chemical fertilization increased weight, volume, diameter and length of Khudari

fruits as compared to the addition of organic manure only. However, the effect was not significant. Similar results were obtained by Hussein et al. (1977). On other hand, Furr et al. (1955) found that N fertilizer did not affect fruit weight of Deglet Noor variety.

Table 3: Effect of chemical fertilization on the physical characteristics of Khudari date palm fruits in 1980 and 1981 seasons.

Treatment	1980				1981			
	Fruit weight g	Fruit volume cc	Fruit diameter cm	Fruit length cm	Fruit weight g	Fruit volume cc	Fruit diameter cm	Fruit length cm
1	10.28	9.87	2.03	4.02	11.62	10.67	2.02	4.04
2	10.86	10.07	2.05	4.03	10.80	10.93	2.10	4.16
3	10.85	10.15	2.06	4.04	11.82	10.92	2.06	4.14
4	11.43	10.36	2.05	4.10	12.20	11.02	2.15	4.22
5	10.40	9.95	2.02	4.00	12.14	11.00	2.08	4.22
6	10.88	10.18	2.08	4.08	13.10	11.30	2.12	4.27
7	11.32	10.40	2.07	4.17	12.40	11.10	2.12	4.25
L S D 5%	N S	N S	N S	N S	N S	N S	N S	N S

Chemical characteristics: (Table 4) indicate that, the general trend was that, chemical fertilization decreased the TSS in the fruit as compared with the addition of organic manure only. However, the differences were not significant. Similar results were found by Hussein et al. (1977). On the other hand, Furr et al. (1955) on Deglet Noor variety found that fruit quality from N fertilized trees was not appreciably different from that of the control.

Regarding the effects of chemical fertilization on moisture and dry matter, the moisture level slightly decreased with the addition of chemical fertilizers. Whereas, the dry matter was increased (Table 4). These findings did not agree with those of Hussein et al. (1977), may be because of differences in variety, soil and climatic variations.

Effect of chemical fertilization on the mineral contents:

Fruits: Chemical fertilization did not significantly change the concentrations of N, P, K and Ca in the fruits (Table 5). However, it is

clear that increase of N fertilization inhibited Mg content in the fruits. Similar results were obtained by Furr and Cook (1955) with Khudrawy variety, while with Deglet Noor N in fruit samples from fertilized trees was higher than those from unfertilized trees. Hussein et al. (1977) also found that N in fruits of Khuneizi and Sukkari varieties increased with increasing amount of nitrogen added to the trees.

Leaves: Data in (Table 6) showed that the addition of N fertilizers to Khudari trees increased leaves N as compared with the addition of organic manure only. Furthermore, N in the leaves was increased with increasing the N application to the trees from 500 to 1500 g N. Similar results were noted by Furr and Cook (1955) and Hussein et al. (1977) on date palm.

Addition of P and K fertilizers to the trees did not affect the concentration of N (Table 6). Regarding the concentrations of P, K, Ca and Mg in the leaves, data in (Table 6) indicated that chemical fertilizers had no significant effect on these elements.

Table 4: Effect of chemical fertilization on the chemical characteristics of Khudari date palm fruits in 1980 and 1981 seasons.

Treatment	1980			1981		
	T S S %	Moisture %	Dry matter %	T S S %	Moisture %	Dry matter %
1	70.67	13.95	86.05	71.92	16.00	84.00
2	70.05	11.31	88.69	70.48	13.68	86.32
3	69.95	12.41	87.59	68.38	14.65	85.35
4	70.60	11.12	88.88	70.16	14.58	85.42
5	67.15	11.92	88.08	70.30	13.43	86.57
6	68.42	11.68	88.32	70.22	14.77	85.23
7	66.45	11.26	88.74	70.30	13.68	86.32
L S D 5%	N S	N S	N S	N S	N S	N S

Table 5: Effect of chemical fertilization on the mineral contents (% on dry weight basis) of Khudari date palm fruits in 1980 and 1981 seasons.

Treatment	1980					1981				
	N	P	K	Ca	Mg	N	P	K	Ca	Mg
1	0.44	0.080	0.85	0.50	0.16	0.46	0.059	0.78	0.43	0.18
2	0.43	0.086	0.85	0.49	0.16	0.45	0.053	0.82	0.41	0.17
3	0.41	0.073	0.86	0.52	0.13	0.47	0.063	0.80	0.46	0.16
4	0.42	0.098	0.85	0.52	0.10	0.46	0.056	0.81	0.44	0.13
5	0.44	0.088	0.87	0.53	0.16	0.48	0.069	0.79	0.42	0.18
6	0.44	0.072	0.88	0.51	0.12	0.42	0.056	0.80	0.43	0.14
7	0.42	0.091	0.87	0.54	0.11	0.46	0.067	0.79	0.44	0.14
LSD 5%	NS	NS	NS	NS	0.04	NS	NS	NS	NS	NS
1%					0.05					

Table 6: Effect of chemical fertilization on the mineral contents (% on dry weight basis) of Khudari date palm leaves in 1981 seasons.

Treatment	N %	P %	K %	Ca %	Mg %
1	1.15	0.098	1.56	1.04	0.19
2	1.31	0.099	1.58	1.02	0.21
3	1.36	0.097	1.59	0.98	0.19
4	1.39	0.101	1.54	1.07	0.15
5	1.26	0.103	1.60	1.00	0.20
6	1.29	0.109	1.64	0.95	0.22
7	1.32	0.119	1.63	1.06	0.20
LSD 5%	0.10	NS	NS	NS	NS

CONCLUSION

It can be concluded from the results obtained that the addition of N fertilizers to Khudari date palm increased the yield of the trees. The addition of 1500 g N per tree was the best treatment for Khudari date palm variety. Fruit quality of trees fertilized with N was not significantly different from those which received organic manure only. The addition of P and K fertilizers had no appreciable effect on both yield and fruit quality.

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تأثير الأسمدة الكيميائية على المحصول وخواص الثمار والمحتويات المعدنية في نخيل البلح صنف الخضرى

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الخلاصة

درس تأثير معاملات سادية مختلفة (أسمدة نيتروجينية وأسمدة بوتاسية وأسمدة فوسفورية بالاضافة الى السماد العضوى) على المحصول وخواص الثمار لنخيل البلح صنف الخضرى النامية فى مزرعة كلية الزراعة - جامعة الملك سعود خلال موسمى ١٩٨٠ و ١٩٨١ م.
وقد أوضحت النتائج أن التسميد الكيميائى قد أدى الى زيادة محصول الاشجار بالمقارنة إلى السماد العضوى - كما أن بعض الصفات الطبيعية والكيميائية للثمار قد تأثرت ايضا بالتسميد الكيميائى وذلك خلال سنتى الدراسة.
بالاضافة الى ذلك درس تأثير المعاملات السادية المختلفة على محتويات الثمار والأوراق من العناصر المعدنية التالية:

التروجين والفسفور والبوتاسيوم والكالسيوم والمغنسيوم.