Improving fruit quality and nutritional value of Saidy dates by using different fertilization sources

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ABSTRACTS

The beneficial effects of some fertilization treatments on fruit quality of Saidy date palm grown in sandy soil were investigated during 2004 to 2007 seasons. Various sources of nitrogen, phosphorus and potassium (NPK) such as organic, bio-fertilizers and slow-release forms of nitrogen were used compared to mineral NPK sources to determine the optimum and better source.

Amending the palms with organic form of farmyard manure (FYM) plus either potassien or rock phosphate, as well as, slow release plus either potassien and rock phosphate gave the heaviest and biggest fruits compared to fertilization with mineral sources of NPK.

The maximum fruit juice total soluble solids and sugar contents were obtained when using either organic form plus either potassien or phosphoren, or slow release-N plus potassien and rock phosphate. Also, fruit content of N, P and K were significantly increased by using organic manure, slow release-N, biofertilizers and potassien compared to fertilizing by mineral sources of N, P & K. Amending the palms with either organic plus bio-form or slow release-N gave the highest values of remaining soil-N, whereas, phsophoren or rock phosphate gave the highest value of the remaining soil-P. In addition using organic manure plus potassien significantly increased the remaining soil-K compared to other fertilization treatments.

It could be concluded that replacing the mineral requirements of Saidy date palm by either organic, bio-forms or slow release was very useful in improving the soil fertility and consequently improving the fruit traits. In addition, this procedure can reduce nitrate environmental pollution as well as maintain the soil fertility for sustainability of agricultural and organic farming production.

INTRODUCTION

Date palm (*Phoenix dactylifera* L.) is one of the oldest fruit crops grown in the arid regions of the Arabian peninsula, North Africa and Middle East (Chao and Krueger, 2007). Egypt is considered as the leader of Arab countries in producing dates [Food Agricultural Organization (FAO), 2009]. Dates are considered as an almost ideal food that provides a wide range of essential nutrients with many potential health benefits (Elleuch *et al.,* 2008). The dates quality can vary depending on cultivar, soil conditions, cultural practices as well as the ripening stage (Ismail *et al.,* 2006). Fertilization is one of the important tools to improve the dates physicochemical. Loss of elements of nutrients by leaching volatilization, denitrification as well as mobility of elements and other ways was the most important problem. Thus optimizing nitrogen agent loss can solve this problem. The loss of nitrogen via leaching through drainage water may be reduced to some extent by using slow release forms of nitrogen (Wang and Alva, 1996). Application of organic and chemical fertilizers were found to increase nutrient uptake and improved yield and fruit quality and decreased the fruit contents of nitrate and nitrite at both bisir and tamr stages. Increasing percentage of organic fertilizers from 25 to 75% of the recommended nitrogen rate was followed by

a gradual promotion on these traits (El-Morshedy, 1997; Shahein *et al.,* 2003; El-Assar, 2005; Badawi, 2007; El-Wasfy and El-Khawaga, 2008; El-Salhy *et al.,* 2008, Al-Kharusi *et al.,* 2009 and Marzouk and Kassem, 2011).

Moreover, the use of organic and bio-fertilization for fruit crops as good alternatives to chemical fertilization can depress environment pollution and produce a nutritive and safe food that is good for health (Blake, 1990). Using organic or biofertilization (Biogen) significantly improved the fruit quality (Osman, 2003; Mohamed and Gobara, 2004 and Mansour *et al.,* 2004).

Potassium fertilization applied to sewy date palm grown in calcareous soil increased fruit weight and TSS%, whereas, decreased the seed weight and fruit tannins content (El-Hammady *et al.,* 1991). Application of K fertilizer at two equal doses in May and December or at three equal doses in March, May and December is better. The optimum rate of economic potassium fertilization for date palms on sandy soil was 600 g of K2O/palm/year (Salama, 2007; Shahin, 2007 and Harhash & Abdel-Nasser, 2007).

Phosphorus is very important in the metabolic processes, i.e. blooming and flower development. Egyptian soils having alkaline pH are low in their availability that approximately 90-95% of P occur in an unavailable form (Olsen, 1973). Inoculation with P-biofertilizers increase phosphorus uptake by plants grown on high phosphate fixing soil (Gaur *et al.,* 1980 and Kurtsidze, 1984).

The main objective of this study is to evaluate the effect of some fertilization treatments on fruit quality of Saidy date palm grown in sandy soil. Furthermore, the possibility of using organic, bio or slow release fertilizers instead of mineral fertilizers.

MATERIALS AND METHODS

The present study was carried out during the four consecutive seasons of 2004 to 2007 at the Experimental Orchard of Agricultural Research Station that is located at El-Kharga Oasis, New Valley Governorate, Egypt.

Forty two Saidy date palms of uniform vigour 35 years old, healthy with no usual nutrient deficiency symptoms. They planted in sandy loam soil and water table depth at not less than two meters were chosen. Analysis of the soil was done before starting and after the end of study to determine the remaining soil NPK according to Wilde et al. (1985) and are shown in Table (1). The chosen palms were divided into fourteen fertilization treatments including the control. The experiment was arranged in completely randomized block design with three replicates, one palm per each. The treatments were arranged as follows:

1. Control palms received 1000 g N/palm (2.17 kg urea, 46.5%) plus 1.5 kg calcium super phosphate (15.5% P2O5) and 1.0 kg potassium sulphate (48% K2O).
2. Fertilization with 750 g N/palm as organic manure (100 kg Farmyard manure (FYM), 0.75% N).
3. Fertilization with 250 g N (33.3 kg FYM plus 1000 g Nitrobien/palm) plus 1.5 kg calcium super phosphate (15.5% P2O5) and 1.0 kg potassium sulphate (48% K2O).
4. Fertilization with 750 g N (1.9 kg Enciaben 40% N as slow release) plus 1.5 kg calcium super phosphate (15.5% P2O5) and 1.0 kg potassium sulphate (48% K2O).
5. Fertilization with 100 kg FYM plus 1.5 L Potassin-N/palm (30% K2O + 5% N).
6. Fertilization with 100 kg FYM plus 1.5 L Potassin-F/palm (30% K2O + 8% P).
7. Fertilization with 33.5 kg FYM + 1000 g Nitrobien plus 1.5 L Potassin F/palm.
8. Fertilization with 1.9 kg Enciaben plus 1.5 L Potassin F/palm.
9. Fertilization with 100 kg FYM plus 50 cm3 liquid Phosphoren/palm.
10. Fertilization with 100 kg FYM plus 1kg rock phosphate/palm.
11. Fertilization with 100 kg FYM plus 50 cm3 liquid phosphoren plus 1.5 L potassin N
12. Fertilization with 100 kg FYM plus 1kg rock phosphate/palm plus 1.5 L potassin N.
13. Fertilization with 250 g N (33.7 kg FYM) plus 1000 g Nitrobien + 50 cm3 liquid phosphoren/palm. plus 1.5 L potassin N
14. Fertilization with 1.9 k Enciaben plus 1 kg rock phosphate/palm. plus 1.5 L Potassin-N/palm

In addition, all treatments manured with 50 Kg FYM /palm

Farmyard manure (FYM), calcium superphosphate and rock phosphate were mixed and added once in a circle surrounded each palm on the middle of December. As well as enciaben as slow release fertilizer, potassin F and potassin N, as well as, Biostimulants namely nitrobien and phosphoren, were added at two equal batches on the middle of February and May. Urea was applied at three equal batches on the middle of February, May and July. In addition, potassium sulphate was added at two equal batches on middle of May and July. The data of FYM and rock phosphate analysis are given in table (1).

Other horticultural practices such as irrigation, pruning and pest control were used as usual. In addition, the artificial pollination was uniformly performed in respect of source, date and method to avoid residues of metaxenia.

In general, the following measurements were determined during the four seasons of study.

All bunches were harvested at late rutab stage and dates were picked and harvesting date was recorded. Sample of 50 fruits were taken randomly from each palm to determine of some physical and chemical fruit properties as outlined in A.O.A.C. (1985). In addition, the percentage of N, P and K in dried fruit were determined according to procedures outlined by Wild et al. (1985).

The proper statistical analysis was carried out according to the methods outlined by Snedecor and Cochran (1980) and Gomez and Gomez (1984) using L.S.D. test for distinguishing treatment means.

RESULTS AND DISCUSSION

1. Effect of some fertilization treatments on fruit quality:

Data presented in Tables (2 & 3) show the effect of some organic, bio and slow release fertilizers on some physical fruit traits of saidy dates during 2004, 2005, 2006 and 2007 seasons.

As a general view it can be noticed that all fertilization treatments were materially advanced the harvest date compared to control (T1). Furthermore, using potassien combined with either organic or bio-form advanced the harvest date about two weeks earlier as compared to NPK at mineral sources (T1).

All treatments also, caused significant increases in fruit weight, flesh weight percentage and dimensions compared to using mineral NPK only (T1). The heaviest fruits were recorded on palms fertilized with either slow release-N plus potassien-F (T8), slow release-N plus potassien and rock phosphate (T14) or organic form plus rock phosphate (T10). Whereas, the smallest ones occurred on palms fertilized with mineral source of NPK (T1).

The important role of organic manure and slow release-N in providing palms with their requirements from various nutrients as well as the positive action of these elements in the biosynthesis of organic foods and cell division (Nijjar, 1985), as well as, controlling the uptake of nitrogen by roots for a long period could give a good explanation for the present effects on the physical fruit properties. Moreover, the role of potassien in increasing the fruit weight could be attributed to the physiological effect of potassium in increasing the osmotic potential of fruit cell that might promote the water movement into the fruit, consequently increase the fruit volume and weight.

Furthermore, data in Tables (3 & 4) showed that using fertilizers, either organic, bio-form or slow release-N as well as potassien plus either phosphoren or rock phosphate were accompanied with improving the fruit quality in terms of increasing total soluble solids and sugar contents and decreasing the moisture contents compared to fertilization by mineral sources of NPK (T1).

Such, improving of fruit quality due to organic, bio and slow release N fertilizers could be ascribed to a good balance between the growth and fruiting since improved the soil fertility, Table (5) that result in accumulating more carbohydrates and makes them very available for enhancing ripening of dates.

The highest values of total soluble solids and total and reducing sugar percentages were obtained with palms fertilizeed by bio-form plus potassien and phosphoren (T13), while the lowest ones were found due to fertilization of the palm by NPK at mineral sources only (T1).

Moreover, the maximum fruit juice total and reducing sugars was obtained from palms fertilized by organic form plus potassien (T5 & T6) and phosphoren (T11 & T13) and slow release-N plus potassien and rock phosphate (T14). These finding could be related to the role of potassien on translocation of photosynthesis products in leaves. Also, phosphoren hastened the maturation of fruits, hence increase the sugar contents. In addition, the effect of organic, bio and slow release-N fertilizers on controlling the uptake of N and other nutrients by the palm for a long period and on achieving a good balance between growth and fruiting.

These results are in accordance with those obtained by Osman (2003), Shahein et al. (2003), Abdel-Hameed and Ragab (2004), Gobara (2004), Gobara and Ahmed (2004), Mansour et al. (2004), Mohamed and Gobara (2004), Abou Sayed-Ahmed et al. (2005), El-Assar (2005), Badawi et al. (2007), El-Salhy et al. (2008) and Marzouk and Kassem (2011). They concluded that Zaghloul and Sewy date fruits were improved by organic and biofertilziation. In addition, El-Hammady et al. (1991), Attalla et al. (1999), Salama (2007) and Harhash and Abdel-Nasser (2007) found that the use of potassium fertilization improved the date fruit properties.

Moreover, Table (5) showed that the fruit N, P and K contents were significantly increased by using organic manure, biofertilizers, potassien and slow release-N compared to fertilize by mineral sources of N, P & K (T1). Furthermore, using the slow release-N (T4, T8 and T14), organic manure plus potassien and either phosphoren (T11) or rock phosphate (T12) and biofertilizer such as nitrobin plus potassien (T7). In addition, bio-fertilizer plus phosphorein (T13) resulted in more announced fruit-N percentage than that fertilized by mineral sources of N, P

and K. Whereas, the other remaining treatments showed intermediate values between the two extrems. This means that natural (organic and bio-form) markedly increase fruit content of nitrogen than artificial fertilizers.

Most fertilization treatments increased the fruit phosphorus content compared to control (T1). Using either phosphoren (T9, T11 & T13) or rock phosphate (T10, T12 & T14) produced significantly higher fruit phosphorus than those with other treatments. Furthermore, using potassien significantly increased the fruit content of potassium as compared with that of remaining treatments.

These results are nearly in the same line with those obtained by Shahein et al. (2003), Al-Kharusi et al. (2009) and Marzouk and Kassem (2011). They found that the application of nitrogen in both organic and inorganic sources was preferable than using inorganic nitrogen form only in improving dates quality.

2. Effect of some fertilization treatments on remaining soil NPK:

Data in Table (5) show the effect of organic, bio and slow release-N as well as potassien, phosphorein and rock phosphate on the remaining soil NPK.

In general, fertilization with either organic manure, bio-form or slow release-N caused a significant increase in the remaining soil N compared to fertilization with the mineral source. Using slow release-N gave the highest values of the remaining soil-N in comparison with other fertilization treatments. Whereas, the remaining soil phosphorus was higher due to the application of organic manure, bio and slow release-N plus either phosphoren or rock phosphate. Moreover, using organic manure plus potassien significantly increased the remaining soil potassium compared to other fertilization treatments.

These finding emphasized the role of organic manure, bio-form and slow release-N as well as potassien, phosphorein and rock phosphate in enhancing the releasing nutrient substances from rocks in the soil and making them available to the uptake and thereby improving the soil fertility. So, such organic and biofertilization as well as the slow release treatments have a special importance for the sustainability of the soil fertility and agricultural production. These results are in partial agreement with those reported by Young (1997), Almadini and Al-Gosaibi (2007) and El-Salhy et al. (2008) who found that the fertilization of the palms with organic manures significantly improve the physical and chemical properties of soil, which on turn led to improvements in soil fertility status. They suggested that the organic fertilization practices possess a special importance for the sustainability of the soil.

CONCLUSION

According to the overall results, it can be concluded that replacing the mineral–N requirement of saidy date palms by either organic, bio forms or slow release–N, as well as potassien and phosphoren or rock phosphate would achieve a beneficial improvement of the fruit quality. In addition, these processes are very useful in saving fertilization cost and decreasing the environmental pollution problems.

These advantage will eventually enable growers to obtain high good fruit quality. Furthermore, using the organic, bio-form or slow release fertilization sources improves the soil fertility and reduces the added fertilizer requirements. Thus, the growers are able to produce organic farming products which are rellable with high price and maintain the human health.

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Tables

Table (1): Some physical and chemical characteristics of experimental soil, farmyard manure and rock phosphate used.

Soil property	Value	Farmyard manure	Value	Rock phosphate	value
Sand %	82	pH (1: 10 extract)	7.73	P2O5 %	30
Silt %	11.5	E.C (1:10 extract) (mmhos /1cm)	6.45	MgO %	0.85
Clay %	6.5	Total N %	0.75	CaO %	44
Texture grade	Sandy loam	Available P%	0.13	Fe2O3 total %	4.2
pH (1: 2.5 extract)	8.31	Available K %	1.73	Al2O3 %	0.55
E.C (1: 2.5 extract) (mmhos /1cm)	0.40	O. M. %	15.2	MnO %	0.13
CaCO3 %	4.0	C/N ratio	23.26	SO4 %	4.6
O. M. %	1.96			Na2O %	1.0
Total N %	0.13			K2O %	0.3
Available ppm (Olsen method)	2.92				
Available K ppm (ammonium acetate)	91.00				

Table (2): Effect of some organic, mineral, bio and slow release fertilizers on fruit weight (g) and pulp weight % of Saidy date palm cultivar during 2004, 2005, 2006 and 2007 seasons.

Treatment 2004		Bunch number/ palm				Bunch weight (Kg)				Yield / palm (Kg)					
		2005	2006	2007	Mean	2004	2005	2006	2007	Mean	2004	2005	2006	2007	Mean		
Control palms (N, P & K as mineral)	T_1	8.78	8.65	8.83	8.72	8.75	85.42	85.55	85.39	85.55	85.48	25/9	30	22	27	26	0.0
100 kg FYM, 0.75% N	T_2	9.12	9.01	9.13	8.98	9.06	86.73	86.57	85.76	86.64	86.43	21	27	12	12	18	8.0
33.3 kg FYM + 1.0 kg Nitrobien + 1.5 super phosphatee kg (15.5% P_2O_5) and 1.0 kg K_2SO_4 (48% K_2O).	T_3	9.14	8.96	9.23	9.04	9.09	86.76	86.83	85.91	85.95	86.36	22	23	11	12	17	9.0
1.9 kg Enciaben 40% N plus 1.5 kg super phosphate and 1.0 kg K_2SO_4	T_4	9.20	9.11	9.14	9.17	9.16	86.20	85.73	86.65	85.93	86.13	18	23	16	19	19	7.0
100 kg FYM plus 1.5 L Potassin-N	T_5	9.16	9.31	9.20	9.33	9.25	86.90	86.89	86.20	86.39	86.59	19	20	9	8	14	12.0
100 kg FYM plus 1.5 L Potassin-F	T_6	9.15	9.08	9.13	9.12	9.12	86.01	86.78	86.75	86.07	86.40	18	15	10	9	13	13.0
33.5 kg FYM + 1.0 kg Nitrobien + 1.5 L Potassin F	T_7	9.24	9.04	9.19	9.16	9.16	85.93	86.62	86.29	85.92	86.19	18	18	10	10	14	12.0
1.9 kg Enciaben + 1.5 L Potassin F	T_8	9.30	9.58	9.14	9.48	9.38	85.92	86.12	86.01	86.39	86.11	16	20	11	13	15	11.0
100 kg FYM + 50 cm^3 liquid Phosphoren	T_9	9.08	9.00	9.05	9.12	9.06	86.34	86.56	86.52	86.29	86.43	20	18	8	10	14	12.0
100 kg FYM plus 1kg rock phosphate	T_{10}	9.30	9.45	9.36	9.13	9.31	86.02	86.46	86.32	86.20	86.25	17	18	10	11	14	12.0
100 kg FYM + 50 cm^3 liquid phosphoren. + 1.5 L potassin N	T_{11}	9.13	9.02	9.13	9.08	9.09	86.09	86.47	86.53	85.90	86.25	13	16	9	10	12	14.0

Treatment 2004		Bunch number/ palm					Bunch weight (Kg)					Yield / palm (Kg)					
		2005	2006	2007	Mean	2004	2005	2006	2007	Mean	2004	2005	2006	2007	Mean		
100 kg FYM + 1.0 kg rock phosphate + 1.5 L potassin N.	T_{12}	9.20	9.01	9.11	8.99	9.08	86.09	86.57	85.51	86.76	86.23	17	18	10	11	14	12.0
33.5 kg FYM + 1.0 kg Nitrobien + 50 cm^3 phosphoren + 1.5 L potassin N	T_{13}	9.16	9.11	9.15	9.08	9.13	86.14	85.95	86.45	86.23	86.19	12	13	7	8	10	16.0
1.9 k Enciaben + 1.0 kg rock phosphate+ 1.5 L Potassin-N	T_{14}	9.31	9.45	9.38	9.50	9.41	86.14	86.35	86.14	86.10	86.18	17	17	8	10	13	13.0
L.S.D. 5%		0.33	0.30	0.28	0.25	0.26	0.41	0.36	0.52	0.43	0.42						

Table (3): Effect of some organic, mineral, bio and slow release fertilizers on dimension, fruit moisture % and T.S.S. of Saidy dates during 2004, 2005, 2006 and 2007 seasons.

Treat-ment	Fruit length(cm)					Fruit diameter (cm)					Fruit moisture %					T. S. S				
	2004	2005	2006	2007	Mean	2004	2005	2006	2007	Mean	2004	2005	2006	2007	Mean	2004	2005	2006	2007	Mean
T_1	3.44	3.41	3.46	3.45	3.44	2.01	2.02	2.08	2.09	2.05	14.25	14.50	14.68	15.00	14.61	78.30	77.60	78.50	77.80	78.05
T_2	3.55	3.55	3.53	3.48	3.53	2.04	2.06	2.12	2.10	2.08	12.67	1358	1353	13.45	13.31	81.25	79.90	80.30	80.20	80.41
T_3	3.53	3.50	3.60	3.41	3.51	2.10	2.09	2.14	2.16	2.12	13.07	13.47	14.10	13.60	13.56	80.80	80.10	79.90	80.10	80.23
T_4	3.53	3.61	3.53	3.51	3.55	2.06	2.14	2.12	2.14	2.12	13.47	13.56	13.83	13.95	13.70	79.00	78.70	79.00	78.90	78.90
T_5	3.54	3.60	3.52	3.53	3.55	2.12	2.07	2.12	2.17	2.12	12.53	12.77	13.10	13.25	12.91	81.60	81.10	80.50	80.30	80.88
T_6	3.54	3.59	3.52	3.49	3.54	2.13	2.40	2.04	2.15	2.18	12.15	12.60	12.96	13.06	12.70	81.90	81.30	80.90	80.50	81.15
T_7	3.56	3.51	3.51	3.46	3.51	2.11	2.09	2.13	2.12	2.11	12.67	12.82	13.45	13.38	13.08	81.20	81.10	80.60	80.20	80.78
T	3.59	3.61	3.46	3.70	3.59	2.23	2.07	2.17	2.19	2.17	12.70	13.20	13.26	13.00	13.04	81.30	80.80	80.30	80.50	80.73
T_9	3.56	3.43	3.57	3.43	3.50	2.08	2.12	2.08	2.15	2.11	13.33	13.50	13.07	13.43	13.33	80.60	80.20	80.80	80.04	80.50

Treat-ment	Fruit length(cm)					Fruit diameter (cm)					Fruit moisture %					T. S. S				
	2004	2005	2006	2007	Mean	2004	2005	2006	2007	Mean	2004	2005	2006	2007	Mean	2004	2005	2006	2007	Mean
T_{10}	3.50	3.67	3.55	3.52	3.56	2.18	2.19	2.19	2.21	2.19	13.28	13.10	13.00	13.43	13.20	80.60	80.40	81.10	80.20	80.58
T_{11}	3.57	3.65	3.54	3.59	3.57	2.08	2.15	2.14	2.13	2.13	12.27	12.66	13.42	13.30	12.91	81.80	81.30	80.60	80.50	81.05
T_{12}	3.6	3.71	3.48	3.62	3.60	2.11	2.20	2.17	2.21	2.17	12.73	12.95	13.36	13.17	13.05	81.35	80.85	80.50	80.30	80.75
T_{13}	3.56	3.51	3.57	3.60	3.56	2.07	2.05	2.16	2.16	2.11	12.87	12.20	12.61	12.65	12.58	81.00	81.70	81.30	80.90	81.23
T_{14}	3.59	3.61	3.58	3.62	3.60	2.17	2.19	2.18	2.22	2.19	12.93	13.18	13.13	13.43	13.17	81.10	80.80	80.90	80.40	80.80
L.S.D 5%	0.11	0.1	0.09	0.07	0.06	0.08	0.07	0.08	0.09	0.06	0.31	0.36	0.39	0.35	0.60	0.83	1.20	0.98	1.11	0.98

Table (4) : Effect of some organic, mineral, bio and slow release fertilizers on total sugar %, reducing sugars% and non reducing sugars % of Saidy dates during 2004, 2005, 2006 and 2007 seasons.

Treatment	Total sugar %					Reducing sugars %					Non reducing sugars %				
	2004	2005	2006	2007	Mean	2004	2005	2006	2007	Mean	2004	2005	2006	2007	Mean
T_1	72.8	71.43	72.95	70.95	72.03	63.80	62.48	63.90	61.70	62.97	9.00	8.95	9.05	9.25	9.06
T_2	75.65	73.67	73.87	72.60	73.95	66.75	64.57	64.73	63.37	64.86	8.90	9.10	9.14	9.23	9.09
T_3	74.82	73.67	73.40	74.17	74.02	65.9	64.86	64.05	64.07	64.72	8.92	8.81	9.35	10.10	9.30
T_4	73.50	73.53	72.85	71.60	72.87	64.66	63.59	63.53	61.80	63.40	8.84	9.94	9.32	9.80	9.48
T_5	75.95	75.13	74.27	73.25	74.65	66.78	65.93	64.87	64.05	65.41	9.17	9.20	9.40	9.20	9.24
T_6	76.13	75.33	75.27	73.32	75.01	66.63	66.10	65.07	64.18	65.5	9.50	9.23	10.20	9.14	9.52
T_7	75.46	74.50	74.38	73.20	74.39	65.92	65.9	64.98	64.25	65.26	9.54	8.60	9.40	8.95	9.12
T_8	75.33	74.50	74.15	73.13	74.28	66.16	65.47	64.72	64.27	65.16	9.17	9.03	9.43	8.86	9.12
T_9	74.90	74.30	74.50	73.58	74.32	66.67	65.17	65.00	64.32	65.29	8.23	9.13	9.50	9.26	9.03

Treatment	Total sugar %					Reducing sugars %					Non reducing sugars %				
	2004	2005	2006	2007	Mean	2004	2005	2006	2007	Mean	2004	2005	2006	2007	Mean
T_{10}	75.65	74.10	74.78	73.38	74.48	66.60	65.33	65.15	64.08	65.29	9.05	8.77	9.63	9.30	9.19
T_{11}	76.07	75.15	74.28	73.62	74.78	66.87	65.88	64.95	64.88	65.65	9.20	9.27	9.33	8.74	9.14
T_{12}	75.10	74.90	74.20	73.26	74.37	66.76	65.35	64.64	64.46	65.3	8.34	9.55	9.56	8.80	9.06
T_{13}	75.23	76.00	75.15	73.70	75.02	66.33	66.20	65.98	65.12	65.91	8.90	9.80	9.17	8.58	9.11
T_{14}	75.40	74.50	74.64	73.97	74.63	66.38	65.87	65.10	64.67	65.51	9.02	8.63	9.54	9.30	9.12
L. S.D 5%	1.56	1.45	1.63	1.25	1.38	1.33	0.75	0.89	1.28	1.02	N.S	N.S	N.S	N.S	N.S

Table (5): Effect of some organic, mineral, bio and slow release fertilizers on fruit-N %, fruit -P % and fruit-K % of Saidy dates during 2004, 2005, 2006 and 2007 seasons and remaining soil (RS), N, P and K at the end of the experiment.

Treatment	fruit-N %					fruit -P %					fruit -K %					RS-NPK		
	2004	2005	2006	2007	Mean	2004	2005	2006	2007	Mean	2004	2005	2006	2007	Mean	N %	P ppm	K ppm
T1	0.49	0.48	0.51	0.54	0.51	0.108	0.104	0.126	0.126	0.116	0.93	0.87	0.92	0.96	0.92	0.13	2.92	91
T2	0.52	0.51	0.54	0.58	0.54	0.101	0.097	0.112	0.113	0.106	0.93	0.89	0.95	0.93	0.93	0.20	2.58	103
T3	0.55	0.54	0.57	0.61	0.57	0.106	0.112	0.127	0.128	0.118	0.94	0.89	0.94	0.96	0.93	0.19	2.95	85
T4	0.59	0.58	0.62	0.66	0.61	0.111	0.110	0.126	0.132	0.120	1.00	0.95	1.02	1.03	1.00	0.23	2.89	86
T5	0.56	0.55	0.59	0.62	0.58	0.118	0.097	0.119	0.120	0.114	0.98	0.98	1.04	1.06	1.02	0.20	2.74	120
T6	0.54	0.54	0.57	0.59	0.56	0.115	0.112	0.126	0.128	0.120	1.03	0.98	1.06	1.08	1.04	0.19	3.08	112
T7	0.57	0.56	0.6	0.63	0.59	0.110	0.106	0.123	0.129	0.117	0.99	0.95	1.05	1.07	1.02	0.19	2.93	117
T8	0.61	0.59	0.63	0.67	0.63	0.113	0.120	0.13	0.128	0.123	1.05	0.96	1.05	1.11	1.04	0.21	3.10	103
T9	0.56	0.55	0.59	0.63	0.58	0.158	0.148	0.153	0.163	0.156	0.96	0.92	1.01	1.01	0.98	0.22	3.61	102

Treatment	fruit-N %					fruit -P %					fruit -K %					RS-NPK		
	2004	2005	2006	2007	Mean	2004	2005	2006	2007	Mean	2004	2005	2006	2007	Mean	N %	P ppm	K ppm
T10	0.55	0.54	0.57	0.59	0.56	0.151	0.150	0.154	0.171	0.157	0.96	0.91	0.97	1.00	0.96	0.22	3.57	107
T11	0.57	0.56	0.61	0.64	0.60	0.144	0.135	0.167	0.170	0.154	1.05	0.99	1.06	1.10	1.05	0.20	3.44	122
T12	0.58	0.56	0.6	0.63	0.59	0.153	0.133	0.151	0.151	0.147	0.99	0.96	1.05	1.06	1.02	0.20	3.24	124
T13	0.56	0.57	0.59	0.63	0.59	0.151	0.148	0.160	0.181	0.160	1.04	0.98	1.06	1.08	1.04	0.23	3.53	118
T14	0.59	0.59	0.61	0.63	0.61	0.151	0.148	0.156	0.173	0.157	1.04	0.98	1.03	1.06	1.03	0.25	3.70	116
L.S.D.	0.05	0.04	0.03	0.04	0.03	0.008	0.007	0.010	0.009	0.010	0.07	0.09	0.08	0.07	0.09	0.05	0.38	11