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Effect of integrated nutrients management on growth and development of date palm cv. Khadrawy under hot arid region

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ABSTRACT

A field experiment was conducted to see the effect of organic (FYM) and inorganic (NPK) sources as well as foliar spray of micronutrients on plant growth, development, fruit yield and quality of date palm fruits. Total eighteen treatments were allocated in randomized block design with three replications on uniform 35 years old date palm trees. The treatments were applied during last week of October in soil application and foliar applications of micronutrients were applied twice in November and March. The results revealed that combined application of 100 kg FYM + 1.00 kg N + 0.500 kg P_2O_5 + 1.00 kg K_2O + 1.00% $FeSO_4$ + 0.50% $ZnSO_4$ (T_{15}) significantly higher plant Spread, plant height, Number of leaves, length of leaves, and fruit yield characters i.e. no. of bunches/plant, length of bunch, number of strands/bunch, strand length, no. of berries/strand, fruit weight, fruit length, fruit width, fruit set percentage, dry weight of fruit, pulp thickness and pulp stone ratio and fruit yield with higher returns over rest of the treatments. Thus, this manure, fertilizers and micro-nutrients dose helped in sustainable optimum growth and production of quality and nutritional fruits of date palm cv. Khadrawy in Bikaner conditions.

Key words: Date palm, Growth, Development, organic, inorganic and berry

INTRODUCTION

The date palm is one of potential fruit crop of arid irrigated region in India. It is being grown in the state of Gujarat, Punjab and Rajasthan. It is a dioecious plant that produce delicious and nutritious fruits which are widely popular as 'dates' and are often consumed as a table fruit. It requires almost rain free conditions during the fruiting season particularly at the time of fruit ripening to avoid spoilage of fruit due to rains.

The climatic conditions of Thar desert especially in Western districts of Rajasthan (Bikaner, Jaisalmer and Barmer) and part of Kachchh district of Gujarat are suitable for cultivation of dates. The cultivated area of this crop was 8,973 hectares with production 0.54 lakh MT during the year 2000-01, but the area increased to 16,668 hectares with annual fruit production of 1.24 lakh MT of dates during 2009-10 in Bhuj, Anjar, Khedio, Mundra, Mandvi, Gadsissa and Kachchh district of Gujarat (Muralidharan *et al.*, 2011). However, in Rajasthan, the area under date cultivation is about 800 hectare which is increasing fast with the plantation of tissue cultured plants obtained from Al-Ain, UAE under Public Private Partnership (Govt. of Rajasthan and Atul Ltd.) under RKVY.

Date palm fruit, are eaten as raw dates (fresh fruit), dry dates (*chhuhara*) and soft dates (*pind khajoor*). Different products *viz.* sugar, starch, vinegar, juice, toffees, wine, chutney, jam, pickles *etc.* are prepared from dates fruits. Date fruit provide abundant quantities of iron, potassium, calcium, nicotinic acid and small amounts of protein, copper, magnesium, chlorine, sulphur, vitamin A, B and B_2. Date palm contain sugar (60-65%), fiber (2-6%), protein (1-3%), and less than 0.52-3.25% fat, mineral

matter and pectic substances (Shafiei *et al.*,2010). Its fresh fruit can supplement the dietary need of the desert people and provide about 3550 calories per kg. Dates are high in quality due to their high sugar to acid ratio; self-preserved fruit, good energy and mineral supplement, low moisture content, excellent skin integrity, natural dessert with minimum acidity and pleasant taste.

Owing to the increasing area under date palm cultivation there is an urgent need for development of package of plant integrated nutrients to attain long term sustainability of quality fruit production with maintaining soil fertility and productivity in western arid part of Rajasthan. Integration of different sources of plant nutrients such as application organic, biological and inorganic fertilizers *etc.* (Chejara *et al.*, 2021; Malik *et al.*, 2022; Bhardwaj *et al.*, 2023a) Nutrient management affects both productivity and quality of produce and also contribute substantial share in cost of production (Bhardwaj *et al.*, 2023b). Apart from this micronutrient are required in minute quantities but have some agronomic importance as macro nutrients have and play a vital role in the growth of plants (Bhardwaj *et al.*, 2019; 2023c). Micronutrients also increase plant productivity and yield (Bhardwaj *et al.*, 2022). Most of the micronutrients are associated with the enzymatic system of plants. Whenever, a micronutrient is deficient the abnormal growth of plant result which some time cause complete failure of crop plants. Foliar application of micro nutrient in plants after fruits setting gave not only higher yield of fruits, but also improve physic-chemical quality of produces. Keeping this in view the present experiment was conducted.

MATERIALS AND METHODS

The present investigation was conducted at Date Palm Research Centre and Department of Horticulture, College of Agriculture of Swami Keshwanand Rajasthan Agriculture University, Beechwal, Bikaner during October 2014 to July 2016.

The experiment was laid out in Randomized Block Design with three replication and eighteen integrated nutrient treatments combinations of manure -FYM, fertilizers-N+P_2O_5+K_2O, and micro-nutrients-$FeSO_4$ + $ZnSO_4$ (Table 1). The treatments were applied during last week of October. Nitrogen

Table 1. Details of the treatments with their symbols

T_0 ($F_0N_0P_0K_0Fe_0Zn_0$)	0 kg FYM + 0 kg N + 0 kg P_2O_5 + 0 kg K_2O + Water sprays (Control)
T_1($F_0N_0P_0K_0Fe_{0.50}Zn_{0.25}$)	0 kg FYM + 0 kg N + 0 kg P_2O_5 + 0 kg K_2O +0.50% $FeSO_4$ + 0.25% $ZnSO_4$
T_3($F_0N_0P_0K_0Fe_{1.00}Zn_{0.50}$)	0 kg FYM + 0 kg N + 0 kg P_2O_5 + 0 kg K_2O + 1.00% $FeSO_4$ + 0.50% $ZnSO_4$
T_4($F_{25}N_{0.50}P_{0.25}K_{0.50}Fe_0Zn_0$)	25kg FYM + 0.50 kg N + 0.25 kg P_2O_5 + 0.50 kg K_2O + Water sprays
T_5 ($F_{25}N_{0.50}P_{0.25}K_{0.50}Fe_{0.50}Zn_{0.25}$)	25kg FYM + 0.50 kg N + 0.25 kg P_2O_5 + 0.50 kg K_2O + 0.50% $FeSO_4$ + 0.25% $ZnSO_4$
T_6($F_{25}N_{0.50}P_{0.25}K_{0.50}Fe_{1.00}Zn_{0.50}$)	25kg FYM + 0.50 kg N + 0.25 kg P_2O_5 + 0.50 kg K_2O + 1.00% $FeSO_4$ + 0.50% $ZnSO_4$
T_7($F_{50}N_{1.00}P_{0.50}K_{1.00}Fe_0Zn_0$)	50 kg FYM + 1.00 kg N + 0.50 kg P_2O_5 + 1.00 kg K_2O + Water sprays
T_8($F_{50}N_{1.00}P_{0.50}K_{1.00}Fe_{0.50}Zn_{0.25}$)	50 kg FYM + 1.00 kg N + 0.50 kg P_2O_5 + 1.00 kg K_2O +0.50% $FeSO_4$ + 0.25% $ZnSO_4$
T_9($F_{50}N_{1.00}P_{0.50}K_{1.00}Fe_{1.00}Zn_{0.50}$)	50 kg FYM + 1.00 kg N + 0.50 kg P_2O_5 + 1.00 kg K_2O + 1.00% $FeSO_4$ + 0.50% $ZnSO_4$
T_{10}($F_{100}N_{0.50}P_{0.25}K_{0.50}Fe_0Zn_0$)	100 kg FYM + 0.50 kg N + 0.25 kg P_2O_5 + 0.50 kg K_2O + Water sprays
T_{11}($F_{100}N_{0.50}P_{0.25}K_{0.50}Fe_{0.50}Zn_{0.25}$)	100 kg FYM + 0.50 kg N + 0.25 kg P_2O_5 + 0.50 kg K_2O + 0.50% $FeSO_4$ + 0.25% $ZnSO_4$
T_{12}($F_{100}N_{0.50}P_{0.25}K_{0.50}Fe_{1.00}Zn_{0.50}$)	100 kg FYM + 0.50 kg N + 0.25 kg P_2O_5 + 0.50 kg K_2O + 1.00% $FeSO_4$ + 0.50% $ZnSO_4$
T_{13}($F_{100}N_{1.00}P_{0.50}K_{1.00}Fe_0Zn_0$)	100 kg FYM + 1.00 kg N + 0.50 kg P_2O_5 + 1.00 kg K_2O + Water spays
T_{14}($F_{100}N_{1.00}P_{0.50}K_{1.00}Fe_{0.50}Zn_{0.25}$)	100 kg FYM + 1.00 kg N + 0.50 kg P_2O_5 + 1.00 kg K_2O + 0.50% $FeSO_4$ + 0.25% $ZnSO_4$
T_{15}($F_{100}N_{1.00}P_{0.50}K_{1.00}Fe_{1.00}Zn_{0.50}$)	100 kg FYM + 1.00 kg N + 0.50 kg P_2O_5 + 1.00 kg K_2O + 1.00% $FeSO_4$ + 0.50% $ZnSO_4$
T_{16}($F_{100}N_{1.50}P_{1.00}K_{1.50}Fe_0Zn_0$)	100 kg FYM + 1.50 kg N + 1.00 kg P_2O_5 + 1.50 kg K_2O + Water sprays
T_{17}($F_{100}N_{1.50}P_{1.00}K_{1.50}Fe_{0.50}Zn_{0.25}$)	100 kg FYM + 1.50 kg N + 1.00 kg P_2O_5 + 1.50 kg K_2O + 0.50% $FeSO_4$ + 0.25% $ZnSO_4$
T_{18}($F_{100}N_{1.50}P_{1.00}K_{1.50}Fe_{1.00}Zn_{0.50}$)	100 kg FYM + 1.50 kg N + 1.00 kg P_2O_5 + 1.50 kg K_2O + 1.00% $FeSO_4$ + 0.50% $ZnSO_4$

was applied in two split doses *i.e* 50 per cent in October + 50 per cent in March month. Micro nutrients were applied as foliar spray. First application in month of November and second application at the pea size fruit stage in the month of March.

Growth parameters *viz.* height of the plants, spread (N-S and E-W), number of leaves and length of leaves was recorded initially and after completion of the experiment during both the years. Plant height was measured from the ground level to the highest point of the crown with help of measuring scale and plant spread was measured in two opposite directions (East-West and North-South) with the help of measuring tape and computed by subtracting final and initial values and expressed in the per cent increase. Number of leaves per tree in all replications were counted and average number of leaves per tree was calculated and the length of leaves were measured by scale from the origin of leaves to the end of leaves and average length was presented in centimeters.

The number of bunches per tree in all replications were counted after fruit set and average number of bunches per tree was calculated. Number of final berries harvest out of total set berries and counted and per cent fruit retention was calculated.

Total number of flowers developed into fruits on each selected strands and the number of fruits dropped, were counted and the per cent fruit drop was computed. The length of bunch was measured by scale from the origin of stalk to the end where the strands start appearing and average length was presented in centimeters.

Three bunches were selected randomly from each tree under observation and strands of each bunch were counted and average was presented in number and strands length was measured with the help of scale and average was presented in centimeters. Five strands from each bunch of the tree were taken and the fruit were counted and average was calculated.

Each bunch of the tree was weighted with the help of balance and their average was considered as average weight of the bunch in kg and summing up of weight of all bunches of a tree was considered as fruit yield per palm in kg.

Ten fruits sample from each treatment were taken randomly from three replications and weighed with the help of electronic balance. Average weight of fruit was calculated and presented in gram (g). Fruit length was measured from the base of calyx to the tip of the fruit and diameter at its central point (the point of maximum thickness) with the help of Verneer calliper and then summed and average length of the fruit was calculated in centimetres.

Number of days taken for *doka* stage of fruit maturity after opening of the spathe was recorded and present in number of days. The thickness of pulp after separation of stone was measured in centimetres at its central point with the help of Verneer calliper. Average thickness of pulp was calculated and presented in centimetre. The fruit which were used for fresh weight were dried in oven at 60ÚC for 48 hrs. after drying, the dry weight of the fruit were measured with the help of electronic balance and average weight calculated. The pulp: stone ratio was calculated using the following formula;

$$\text{Pulp: stone ratio} = \frac{\text{Pulp weight (g)}}{\text{Stone weight (g)}}$$

Observation of estimated fruit yield per hectare was recorded by per plant yield multiplying by total plants population (277 ha^{-1}).

In order to evaluate the economic feasibility of the treatments, the return (Rs. ha^{-1}) and B: C ratio was worked out on the basis of prevailing market prices (15/- kg).

RESULT AND DISCUSSION

The results obtained in the present investigation reveal that application of inorganic fertilizer and organic manure with foliar application of micronutrient significantly improved the vegetative growth parameters *viz.*, plant spread, number and length of leaves, while plant height did not exhibit significant variation (Table 2). Maximum plant spread, number and length of leaves were recorded in the treatment T_{18} (100 FYM + 1.50 N + 1.00 P_2O_5 + 1.50 K_2O + 1.00% $FeSO_4$ + 0.50% $ZnSO_4$) and minimum in T_1 (control) (Table 2). However, treatment T_{18}, T_{17}, T_{16}, T_{15} and T_{14} were at par among each other and the trend of treatments response were $T_{18} > T_{17} > T_{16} > T_{15} > T_{14}$. The better growth and developments of plant under these treatments might be attributed due to better nutritional environment in the root zone as well as in the plant system. The biological role of organic and inorganic nutrients as an essential constituent of chlorophyll and nucleic acid, in harvesting solar energy, energy

Table 2. Effect of INM levels on in vegetative growth parameters of date palm cv. Khadrawy

Treatments	Per cent increase			Number of leaves	Length of leaves (cm)
	E-W plant spread	N-S plant spread	Plant height		
T_1	1.13	1.14	0.51	30.33	195.33
T_2	1.21	1.19	0.61	30.33	196.00
T_3	1.29	1.24	0.64	30.33	196.00
T_4	2.50	1.90	0.97	32.00	201.17
T_5	2.59	2.00	1.01	32.17	201.33
T_6	2.63	2.06	1.03	32.33	201.67
T_7	4.88	4.30	1.67	35.50	210.83
T_8	4.96	4.42	1.82	35.67	211.50
T_9	5.06	4.46	1.90	35.67	212.33
T_{10}	3.41	2.99	1.28	33.33	203.83
T_{11}	3.48	3.03	1.31	33.33	204.00
T_{12}	3.55	3.07	1.33	33.67	204.50
T_{13}	6.15	5.61	2.71	36.83	216.17
T_{14}	6.24	5.68	2.84	37.17	216.83
T_{15}	6.27	5.72	2.89	37.17	217.00
T_{16}	6.67	6.24	3.73	37.67	219.17
T_{17}	6.76	6.26	3.75	37.83	219.50
T_{18}	6.82	6.30	3.80	37.83	219.50
S Em±	0.21	0.22	0.58	0.32	0.96
C D $_{(0.05)}$	0.60	0.63	NS	0.91	2.71

transformation from phosphorylated compound, transfer of genetic information, regulation of cellular metabolism and structural unit compound is well known. All are found abundantly in the growing and storage organs, promote healthy root, shoot and full development (Troughton *et al.*, 1974 and Devlin and Witham, 1986). Present study is strongly supported by the findings of Ibrahim *et al.* (2013) who have reported that the application of N fertilizer was the most effective factor in enhancing the production of bunches per palm. Organic matter in the form of FYM (100 kg/palm) also helped in increasing the absorption of nutrients from soil, enhanced carbohydrate assimilation and production of new tissues, which ultimately increased vegetative growth. Pillai *et al.* (1985) observed that a suitable combination of organic and inorganic sources of nutrients maintained long term soil fertility and sustained high level of productivity.

Application of combined integrated nutrients treatment T_{18} (100 kg FYM + 1.50 kg N + 1.00 kg P_2O_5 + 1.50 kg K_2O + 1.00% $FeSO_4$ + 0.50% $ZnSO_4$) resulted in maximum number of bunches, length of bunch, average weight of bunch, number of strands per bunch, strand length, number of berry per strand, berry weight, berry length, berry diameter, fruit dry weight, pulp stone ratio and pulp thickness and minimum in T_1 (control) while the treatment T_{18} was found at par with treatment T_{14}, T_{15} and T_{17}. (Table 3, 4). Further, early spathe emergence on 8 February and 7 February was observed in T_{14} treatment during the first and second year, respectively. While spathe opening earliest jointly in T_{14} and T_{15} treatments over the other integrated nutrient treatments. Regards to fruit retention maximum fruit set and minimum fruit drop was recorded in the plant that received 100 Kg FYM, NPK as well as Fe and Zn (T_{14}). The probable explanation might be due to balance dose of nutrients favored the optimum fruit retention. This work in the close agreement with the findings of Omar *et al.* (2014) who have reported that the application of micronutrient foliar spray 1500 ppm boron + 300 ppm zinc pronounced effect on fruit set and fruit retention of date palm cultivar Mnifi. The above results are supported by earlier findings which indicated the importance of supplementing the organic matter with mineral fertilizers to increase yield attributes of date palms (Al-Bakr, 1982; Bacha and Abo-Hassan, 1983; Shahein *et al.*, 2003).

The supplementation of NPK through inorganic and organic sources and application of micronutrient as foliar spray significantly affected the yield attributes *i.e.* number of bunches, number of strands, berry weight, number of berry per strands, pulp: stone ratio, pulp thikness and fruits per plant during both the years and also in the pooled analysis (Table 5). However, the maximum values for most of these

Table 3. Effect of INM levels on spathe, bunch parameters and fruit retention of date palm *cv.* Khadrawy

Treatments	Spathe parameters					Bunch parameters			Fruit retention (%)
	Initiation (date)		Days taken to open		Days taken to *doka* stage (cm)	No. bunches/ plant (kg)	Bunch length	Bunch weight	
	1st year	2nd year	1st year	2nd year					
T_1	28 Feb	4 Mar	23	24	134.00	11.00	69.06	3.25	28.31
T_2	27 Feb	3 Mar	22	23	133.67	11.33	69.53	3.30	28.48
T_3	26 Feb	1 Mar	21	24	133.33	11.17	70.15	3.34	28.83
T_4	25 Feb	27 Feb	20	22	128.50	11.83	71.91	3.63	30.21
T_5	25 Feb	25 Feb	18	18	128.17	11.83	72.57	3.67	30.47
T_6	23 Feb	23 Feb	17	19	127.83	12.17	73.11	3.70	30.67
T_7	16 Feb	15 Feb	12	16	123.00	12.50	77.85	4.12	32.79
T_8	15 Feb	14Feb	13	16	122.67	12.83	78.40	4.16	33.13
T_9	13 Feb	12 Feb	14	16	122.33	12.83	78.65	4.20	33.39
T_{10}	21 Feb	19 Feb	16	21	126.17	12.17	73.87	3.86	31.41
T_{11}	20 Feb	18 Feb	16	19	125.50	12.33	74.45	3.90	31.61
T_{12}	18 Feb	17 Feb	17	18	125.33	12.33	75.17	3.95	32.14
T_{13}	12 Feb	9 Feb	16	16	121.67	12.83	79.85	4.30	33.90
T_{14}	08 Feb	7 Feb	10	10	120.50	14.00	84.52	4.83	40.36
T_{15}	08 Feb	6 Feb	10	10	119.67	14.33	84.77	4.89	40.27
T_{16}	11 Feb	10 Feb	13	14	121.33	13.17	82.65	4.46	34.69
T_{17}	10 Feb	9 Feb	12	12	120.33	14.00	84.70	4.86	39.08
T_{18}	10 Feb	8 Feb	11	12	119.50	14.33	84.87	4.91	39.89
S Em±		1.55	0.87	2.50	0.27	1.07	0.12	0.98	
C D $_{(0.05)}$		4.47	2.51	NS	0.77	3.01	0.33	2.76	

Table 4. Effect of INM levels on strands and berries parameters of date palm cv. Khadrawy

Treatments	Strand parameters			Berry parameters		
	No. of strands/bunch	Strand length (cm)	No. of berries/ strand	Berry weight (g)	Berry length (cm)	Berry diameter (cm)
T_1	41.23	25.60	7.28	8.81	2.78	1.93
T_2	41.27	25.95	7.32	8.86	2.84	1.94
T_3	41.30	26.25	7.35	8.89	2.84	1.95
T_4	41.52	27.01	7.60	9.24	2.89	1.97
T_5	41.57	27.71	7.67	9.28	2.92	1.99
T_6	41.60	28.03	7.70	9.29	2.95	1.99
T_7	41.93	29.78	7.98	9.72	3.19	2.07
T_8	41.97	30.04	8.03	9.74	3.26	2.08
T_9	41.97	30.23	8.06	9.79	3.30	2.09
T_{10}	41.72	28.59	7.82	9.51	2.98	2.02
T_{11}	41.78	28.97	7.85	9.53	3.05	2.03
T_{12}	41.80	29.21	7.93	9.57	3.07	2.04
T_{13}	42.00	30.86	8.15	9.85	3.35	2.11
T_{14}	42.75	33.07	8.95	10.22	3.56	2.21
T_{15}	42.80	33.33	9.25	10.32	3.61	2.23
T_{16}	42.23	31.75	8.28	10.14	3.42	2.16
T_{17}	42.75	33.20	9.20	10.28	3.58	2.22
T_{18}	42.83	33.80	9.35	10.38	3.62	2.23
S Em±	0.18	0.52	0.16	0.06	0.05	0.02
C D $_{(0.05)}$	0.50	1.48	0.44	0.16	0.14	0.06

Table 5. Effect of INM levels on fruit dry weight, pulp: stone ratio, pulp thickness and stone parameters of date palm fruit *cv.* Khadrawy

Treatments	Fruit dry weight (g)	Pulp: Stone ratio	Pulp thickness (cm)	Stone weight (g)	Stone length (cm)	Stone diameter (cm)
T_1	1.59	9.72	0.58	0.82	1.91	0.77
T_2	1.62	9.70	0.59	0.82	1.92	0.78
T_3	1.67	9.75	0.59	0.83	1.93	0.78
T_4	1.89	9.96	0.61	0.85	1.96	0.80
T_5	1.91	9.96	0.61	0.85	1.98	0.81
T_6	1.93	9.96	0.62	0.86	2.00	0.82
T_7	2.25	10.16	0.66	0.87	2.11	0.89
T_8	2.29	10.19	0.67	0.88	2.14	0.89
T_9	2.33	10.24	0.67	0.88	2.16	0.91
T_{10}	2.03	10.03	0.64	0.87	2.02	0.84
T_{11}	2.06	10.10	0.64	0.87	2.05	0.85
T_{12}	2.07	10.11	0.64	0.86	2.06	0.86
T_{13}	2.39	10.38	0.68	0.87	2.18	0.92
T_{14}	2.66	10.57	0.69	0.89	2.23	0.97
T_{15}	2.69	10.60	0.69	0.89	2.30	1.01
T_{16}	2.43	10.42	0.70	0.89	2.22	0.95
T_{17}	2.67	10.62	0.71	0.88	2.25	0.98
T_{18}	2.71	10.68	0.71	0.88	2.30	1.02
S Em±	0.06	0.11	0.01	0.03	0.07	0.05
C D $_{(0.05)}$	0.16	0.32	0.02	NS	NS	NS

traits were recorded with the treatment T_{18} followed by $T_{15,}$ T_{17}, T_{14} and T_{16} treatment. Present study is supported by the findings of Dialami and Mohebi (2010) in date palm cv. Sayer. They reported that application of 700 g N, 500 g P_2O_5 and 1300 g K_2O for each tree recorded highest average yield (111.49 kg/tree). Similarly, Ibrahim *et al.* (2013) reported that the application of N fertilizer was the most effective factor in enhancing the production of bunches per palm. Applying (1.5 kg N/palm/year) in combination with P and K at the smaller rates (0.044 g+ 0.250 g) greatly increased the yield attributes parameters of date palm (Ibrahim *et al.*, 2013). The combined application of inorganic fertilizers and organic manures (FYM) and micronutrient (Fe and Zn) as foliar application might have supplied adequate amount of nutrients and favored the metabolic and auxin activity which resulted in better values for yield attributing traits. Similar observations were recorded by Ahlawat *et al.*, 2000 in ber. Same treatments also improved soil condition which might have resulted into better development of plants. This is also supported by Singh and Abrol (1987). These results are in agreement with those of Bacha & Abo-Hassan (1983) for Khudari date palm, El-Hammady *et al.* (1993) for Khalas date palm, Kassem *et al.* (1997) for some Egyptian soft date varieties, Shawky *et al.* (1999) for Sewy date palm.

The economics and yield of various treatment combinations with respect to net return and benefit: cost ratios (Table 6, Figure 1). Application of T_{15}-

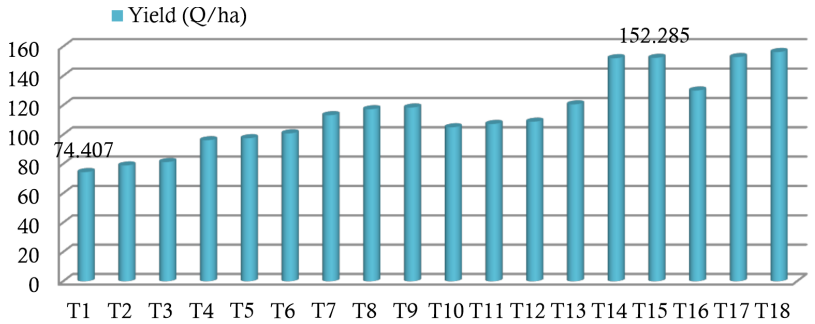

Fig. 1. Effect of integrated nutrient management on estimated fruit yield (q ha^{-1}) of date palm *cv.* Khadrawy

Table 6. Effect of INM levels on estimated fruit yield, return and B:C of date palm *cv.* Khadrawy

Treatments	Estimated yield (t/ha)		Cost of cultivation	Return(Rs. Lakh)		B:C	
	1st year	2nd year	(Rs. Lakh)	1st year	2nd year	1st year	2nd year
T_1	7.38	7.50	0.71	1.11	1.12	1.55	1.58
T_2	7.71	8.08	0.72	1.16	1.21	1.61	1.68
T_3	7.77	8.49	0.72	1.17	1.27	1.61	1.76
T_4	8.67	10.55	0.86	1.30	1.58	1.52	1.85
T_5	8.84	10.66	0.86	1.33	1.60	1.54	1.85
T_6	9.17	10.99	0.87	1.38	1.65	1.59	1.90
T_7	10.53	12.10	1.00	1.58	1.82	1.59	1.82
T_8	10.93	12.52	1.00	1.64	1.88	1.63	1.87
T_9	11.02	12.66	1.01	1.65	1.90	1.64	1.88
T_{10}	9.61	11.38	1.06	1.44	1.71	1.36	1.61
T_{11}	9.71	11.73	1.07	1.46	1.76	1.36	1.65
T_{12}	9.84	11.92	1.07	1.48	1.79	1.37	1.66
T_{13}	11.24	12.88	1.14	1.69	1.93	1.48	1.70
T_{14}	14.08	16.33	1.14	2.11	2.45	1.85	2.15
T_{15}	14.11	16.35	1.15	2.12	2.45	1.85	2.14
T_{16}	11.96	14.04	1.24	1.79	2.11	1.45	1.70
T_{17}	14.11	16.45	1.24	2.12	2.47	1.70	1.99
T_{18}	14.60	16.65	1.25	2.19	2.50	1.76	2.00
S Em±	0.01	0.01	-	0.10	0.10	0.11	0.11
C D $_{(0.05)}$	0.02	0.02	-	0.29	0.28	0.33	0.32

FYM (100 kg plant) + NPK (1.0+ 0.50 + 1.0 kg plant^{-1}) + spray of $FeSO_4$ (1.0%) + $ZnSO_4$ (0.5%) significantly higher yield. The data revealed that the maximum net return of Rs. 1,13,879 ha^{-1} was obtained under the treatment combination of T_{14} which was closely followed by T_{15} (with net return of Rs 1,13,817 ha^{-1}) whereas, the minimum net return was gained under the treatment combination of T_1 (Rs 40,238 ha^{-1}).

CONCLUSION

It is concluded that combined application of FYM (100 kg plant) + NPK (1.0+ 0.50 + 1.0 kg plant^{-1}) + spray of $FeSO_4$ (1.0%) + $ZnSO_4$ (0.5%) during November significantly higher yield and improved the fruit quality value as well as better returns from date palm cultivation.

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