

Nutrient Removal and Physical, Chemical Properties in Samany Date Palm as Influenced by Different Pruning Treatments

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Abstract: This study was carried out for two successive seasons (2004 and 2005) at El-Kanater El-Khairia, El-Kaliobia Governorate, Egypt, Samany cultivar were subjected to four pruning treatments concerning the leaf/bunch ratio; (A) control (without pruning); (B) 12:1 (Slight pruning); (C) 10:1 (moderate pruning) and (D) 6:1 (Heavy pruning). The moderate pruning gave the highest bunch weight, yield, fruit weight, flesh weight, fruit volume and fruit dimensions in both seasons. The same pruning treatment gave the highest increase non-reducing sugars percentage in both seasons. The slight pruning increasing total sugars and total soluble solids percentage. Total acidity increased with moderate pruning in the first season, but increased with slight pruning in the second season. Moderate pruning improved nutrient contents of different parts of palm. Nutrients removed by the palm annually under moderate pruning were: 1049 g K; 694 g N; 298.2 g Ca; 158.1g Mg, 136.1g P; 27.2 g Na; 19.1g Fe; 1.28 g Mn; 1.06g Zn and 0.53 g Cu. in the first season and in the second season were: 1386 g K; 857 g N; 372 g Ca; 286.7g Mg, 196.4g P; 34.5 g Na; 18.6 Fe; 1.42 g Mn; 1.23 g Zn and 0.77g Cu.

Key words: Date palm, nutrient removal, pruning, fruit properties

INTRODUCTION

Samany date palm is the most important cultivar of soft dates and is very demanded in the Egyptian market; its fruits are consumed fresh at Khalal stage. Pruning of date palms was studied by Nixon and Carpenter^[1] and also by Cornelissn^[2]. They stressed the importance of the presence of an adequate number of leaves per palm for maximum fruit quantity and quality. The bearing capacity of date palm is in proportion to the number of flower clusters. As flower clusters increased, low-quality fruits increased. So, it is recommended to retain adequate number of green leaves per tree. On Deglet Noor date palms in California, Nixon^[3] declared that, the old leaves are less active than the young ones, as such, removing the old leaves has no harmful effect on tree productivity. To determine the appropriate leaf/bunch ratio to improve the yield and quality, Hussein *et al.*,^[4-6] studied the effect of leaf/bunch ratio on yield and fruit quality of Barh date palm grown in Saudi Arabia. They found that size fresh weight, pulp weight, moisture content, total soluble solids, total sugars, reducing sugars and sucrose of fruit tended to increase as the number of leaves per bunch increased. The total yield per bunch and the percentage of fruit in grade I and II increased significantly with increasing leaves/bunch ratio up to 12 leaves/bunch, heavy pruning of Zahdi date palms decreased the yield. They

recommended 7.6-8.8 leaves/bunch of the Zahdi cultivar. The moderate pruning (10 leaves/bunch) of Bartamoda date palms under conditions of Aswan Governorate and other regions with similar conditions is recommended. Similar results were obtained by Abdulla *et al.*,^[7] for Hayany date palm cultivar grown in Kalubia province, Egypt. They found that the best yield and fruit quality in Hayany dates with 8 active leaves of each of 5 to 8 retentive bunches/palm. On Zaghlool and Hayany date, Hassaballa, *et al.*,^[8] found that pruning level at 8 leaves/bunch increased yield and fruit quality over those maintained under the ratio 6: 1 especially with Zaghlool cultivar. Harhash *et al.*,^[9] investigated Zaghlool date palm grown in Assiut Governorate, Egypt. They found that the pruning 1: 9 bunch/leaf ratio gave the best yield, bunch weight, grade A and number of inflorescence, also it gave a consistent number leaves during the consecutive years of the growth. Fresh weights of fruit and pulp, fruit dimensions were increased as the bunch/leaf ratio increased. The same ratio (1: 9) gave the highest increase in the T.S.S., reducing and non-reducing sugars and anthocyanin. Soliman & Osman^[10] found that pruning treatment 12 leaves/bunch was the best one regarding yield and fruit quality for Gondaila and Dagana under Aswan condition.

A significant part of the nutrient elements taken up by date palm tree are annually lost by way of fruit harvest

and leaf pruning. An assay of the mineral content of the different parts of fruit bunch including seed, flesh, fruit strands and bunch stalk, pinnae and rachis of leaf pruning can provide a quantitative appraisal of the amount of minerals annually removed by these parts away from the soil. These data give a clear picture on the amount of minerals annually absorbed by the whole palm under our experimental and environmental conditions.

Many studies have been reported on the mineral content of flesh by El-Shurafa and Nagi^[11], El-Shurafa *et al.*,^[12] Yousif *et al.*,^[13] and Attalla *et al.*,^[14,15] El-Shurafa^[16], Attala *et al.*,^[17] and Ibrahim *et al.*^[18]. Pinnae, Minesy *et al.*,^[19] Shawky and Mougheth^[20], Al-Kahtani *et al.*,^[21] Kassem *et al.*,^[22] and Soliman and Osman^[23], however, few attempts have been made to estimate the total quantities of minerals annually drawn or removed by fruit bunches and leaf pruning or by the whole palm. Embleten and Cook^[24] calculated that a moderate annual pruning of leaf and fruit bunches of one date palm consists of approximately 44 kg. of dry matter. This contains 213g N, 16g. P and 611g. K. Bliss and Hass^[25] estimated that the flesh of the fruits of a palm yielding 9000 fruit would contain about 239 g N, 41 g. P and 587g K. In coconut palm, according to the study of Pillal and Davis^[26] each palm annually removes 549 g. N, 115 g. P. 635 g, K, 497 g Ca and 196 g. Mg.

The objective of this research was to illustrate the effect of pruning on yield, bunch weight, fruit quality and physical & chemical properties. Also, determine and compare mineral content of yield, bunch stalk & strands and pinnae in an attempt to establish an estimate of the amount of minerals annually lost and removed by the individual parts and whole palm. This can help to provide a precise scientific basis for planning fertilizer program for date palm orchards.

MATERIALS AND METHODS

This study was conducted at Ministry of Agriculture Experiments Station at El-Kanater El-Khairia, El-Kaliobia Governorate, Egypt for two successive seasons during 2004 and 2005 on Samany date palm (*Phoenix dactylifera* L.).

Soil analysis: Soil samples were air-dried and were sieved through 2mm pores, Determinations of texture, Bauyoucos^[27], analyzed for pH suspension and electric conductivity (EC) in 1 soil: 2.5 water, calcium carbonate (CaCO₃%) : calcimeter method, Black^[28], organic matter (O.M%): potassium dichromate method, Chapman and Pratt^[29]. Nutrient extraction – Phosphorus (P⁵⁺) was extracted using sodium bicarbonate, Olsen *et al.*,^[30]. Potassium (K⁺) and Magnesium (Mg⁺²) were extracted

using ammonium acetate. Iron (Fe²⁺), Manganese (Mn²⁺), Zinc (Zn²⁺) and Copper (Cu²⁺) were extracted using DPTA, Chapman and Pratt^[29].

The values of analysis were as follows: Sand 22.20%, Silt 42.15%, Clay 35.65%, pH 8.01, EC. 0.83 (dS/m), CaCO₃ 3.65%, O.M 1.20%, Ca⁺⁺ 3.8 meq/l, Mg⁺⁺ 2.8 meq/l, N⁺ 1.58 meq/l, K⁺ 0.12 meq/l, Fe 2.9ppm, Mn 3.61ppm, Zn 0.91ppm, Cu 0.95ppm.

Plant analysis: For leaf bunch stalk & strands and fruit mineral analysis, newly emerged leaf was selected from each palm and composted for three palms of Samany cultivar. Leaflets Samples were taken during pruning, while fruit samples were collected at the end of Khalal stage (harvest date). Bunch stalk & strands were taken during harvest date. Pinnae, bunch stalk & strands and fruit samples were washed with tap water and then with distilled water to remove the dust and any chemical spray residues. After washing, they were oven dried at 60-70°C until a constant weight. The dried material was ground in an electric mill. Total nitrogen was determined in the dry plant material by semi-micro Kjeldahl methods as recommended by Bremner^[31], using a Buechi digestion and distillation apparatus.

1 gram of the ground material was digested using an acid mixture consisting of nitric, perchloric and sulfuric in the ratio of 8:1:1 (v/v), respectively Chapman and Pratt,^[29] and clear digest was quantitatively transferred to 100 ml volumetric flask. In this solution, total contents of the following nutrients were determined: Phosphorus was photometrically determined using the molybdate vanadate method according to Jackson^[32]. Potassium, Calcium and Magnesium were extracted using ammonium acetate. Potassium, Calcium was determined using flame photometer Eppendorf.

Iron, Manganese, Zinc and Copper were extracted using DTPA Chapman and Pratt,^[29].

Magnesium, Iron, Manganese, Zinc and Copper estimated using the atomic absorption spectrophotometer.

Nutrient removals were calculated by multiplying dry weight by nutrient concentration.

Experimental design: Twelve female palm trees from cultivar of uniform growth vigor, height and fruiting capacity in the preceding years. Each of Samany, 30 years old grown on a silty caly loam soil, were selected according to their bearing of approximately the same number of spathes and leaves. Pollination was achieved by using pollen grains from the same male palm in both seasons and pollinated in the first week of April. Only 8 bunches were left on each experimental tree from all cultivar. All cultural practices were carried out according to the traditional schedule for experimental palms.

All pruning treatments were applied in the second week of March in both seasons as follows:

- Control: Without pruning (15 leaves/bunch).
- Slight pruning: Removing the oldest leaves maintaining 96 leaves per palm (12 leaves/bunch).
- Moderate pruning: Removing the oldest leaves maintaining 80 leaves per palm (10 leaves/bunch).
- Heavy pruning: Removing the oldest leaves maintaining 48 leaves per palm (6 leaves/bunch).

Each treatment consisted of three replicates. Each date palm tree was considered a replicate.

Data analysis: The design used was randomized complete block in factorial arrangement with three replicates Snedecor and Cochran^[33]. Treatment means were compared using the Duncan^[34] Least significant range (LSR) at 5 percent level of significance in both seasons of experimentation.

The yield of fruits for this experiment was harvested at the latest week of September in both seasons and the following characters were determined.

- 1 The average bunch weight and yield was expressed in Kg.
- 2 Fruit physical characters. Samples of three replicates, each of 10 fruits were taken randomly from each bunch to determine fruit size and fruit dimensions (length and diameter, in cm), fruit weight, fruit flesh weight and seed weight (in grams).
- 3 Fruit chemical characters:
 - a Moisture content: According to A.O.A.C.^[35].

- b Total soluble solids: The present age of TSS was determined in the fruit juice using refractometer A.O.A.C.^[35].
- c Fruit acidity: Fruit acidity was determined according to A.O.A.C.^[35] and the titrable acidity was calculated as citric acid Mawlood,^[36].
- d Total soluble sugars: It was determined according to Smith *et al.*,^[37] in the methanolic extract using the phenol sulphuric acid method and the percentage was calculated per dry weight.
- e Reducing soluble sugars: It was determined in the methanolic extract according to Nelson and Somogy^[38] and A.O.A.C.^[35]. The percentage was calculated per dry weight.
- f Non-reducing sugars: It was determined by the difference between total and reducing sugars.

RESULTS AND DISCUSSIONS

(A) Effect of different pruning on average bunch weight and yield:

1- Bunch weight (kg): Table (1) shows the effect of leaf/bunch ratios on Samany bunch weight during the present study. Treatment 10: 1 ratio gave the highest bunch weight compared to either of the other ratios in the two seasons. Similar results were obtained by Hassaballa *et al.*,^[8] Hussein *et al.*,^[6] Harhash *et al.*^[9] and Soliman and Osman^[10].

2- Yield per palm (kg): Table (1) shows the effect of leaf/bunch ratios on Samany yield during the present study. Maximum yield production from year to another was obtained for 10: 1 ratio (moderate pruning) in

Table 1: Effect of different pruning treatments on bunch weight, yield and fruit physical properties of Samany date palm cultivar during 2004 and 2005 seasons.

Physical Propertie	Bunch weight (Kg)	Yield(Kg)	Fruit weight (g)	Seed weight (g)	Flesh weight (g)	Fruit volume (cm ³)	Fruit length (cm)	Fruit diameter (cm)
2004 season								
Control	14.73e	117.87e	25.43d	2.03c	23.40c	28.00d	5.17bc	2.90b
Slight pruning 12:1	18.11c	144.90c	27.87c	2.23bc	25.64b	30.57c	5.50ab	3.07a
Moderate pruning 10:1	21.10b	168.77b	31.40a	2.87a	28.53a	35.40a	5.67a	3.20a
Heavy pruning 6:1	12.26f	98.07f	23.53ef	2.13c	21.40d	25.87e	4.67d	2.73c
2005 season								
Control	15.79d	126.30d	24.50de	2.17c	22.33c	27.47d	5.47ab	2.77bc
Slight pruning 12:1	20.49b	163.90b	26.90c	2.47b	24.43b	30.40c	5.53a	2.83bc
Moderate pruning 10:1	22.17a	177.40a	29.57b	3.03a	26.54a	33.27b	5.67a	3.10a
Heavy pruning 6:1	11.95f	95.57f	22.50f	2.23bc	20.27d	25.77e	5.03cd	2.57d

Table 2: Effect of different pruning treatments on fruit chemical properties of Samany date palm during 2004 and 2005 seasons.

Chemical Properties					
Treatment	Total soluble solids (TSS%)	Total acidity (%)	Total sugars (%)	Reducing sugars (%)	Non-reducing sugars (%)
Season 2004					
Control	21.90f	0.080b	45.87e	43.13ab	2.77c
Slight pruning 12:1	27.80b	0.084b	52.57ab	41.87bc	10.70a
Moderate pruning 10:1	24.07d	0.092a	50.27c	39.13d	11.13a
Heavy pruning 6:1	21.47f	0.086b	42.57f	36.57e	6.03b
Season 2005					
Control	22.93e	0.162d	47.80d	44.77a	3.03c
Slight pruning 12:1	30.27a	0.219a	53.53a	42.97b	10.57a
Moderate pruning 10:1	26.40c	0.187c	51.80b	41.10c	10.70a
Heavy pruning 6:1	21.77f	0.200b	45.37e	39.07d	6.30b

Table 3: Effect of different pruning treatment on dry weight (kg) removed by different parts per palm per year during seasons 2004 and 2005.

Pruning treatment	Season 2004					Season 2005						
	Fruit	Strands & stalk per bunch	Leaves			Total palm year	Fruit	Strands & stalk per bunch	Leaves			Total palm year
			Pinnae	Rachis	Total				Pinnae	Rachis	Total	
C	41.73	5.37	Without pruning			47.10	44.78	5.44	Without pruning			50.22
S	49.82	6.94	08.41	09.86	18.27	75.03	56.35	6.63	08.23	10.28	18.51	81.49
M	53.27	6.26	09.25	10.60	19.85	79.38	59.98	6.10	12.22	11.66	23.88	89.96
H	33.23	5.13	13.01	13.77	26.78	65.14	32.38	5.22	13.34	15.10	28.44	66.04

C= without leave pruning. S= Slight pruning. M= Moderate pruning. H= Heavy pruning

comparison to either of the other ratios. The results are in agreement with those published by Bakr *et al.*,^[39] on Samany, Hussein *et al.*,^[4] on Barhi, Abdulla *et al.*,^[7] on Hayany, Hassaballa *et al.*,^[8] on Zaghoul, Harhash *et al.*^[9] on Zaghoul and Soliman & Osman^[10] on Gondaila and Dagana.

(B) Effect of different pruning on fruit characteristics: Data concerning the physical and chemical properties in both seasons are presented in table (1, 2), respectively.

Physical properties:

1- Fruit weight (g): Regarding the fruit weight, the data obtained indicated that, there were significant differences between all treatments for Samany cv., during the two seasons. Treatment ratio 10: 1 (moderate pruning) gave the highest fruit weight than those the control and other treatments. These data are in agreement with those obtained by Hussein *et al.*,^[6] Harhash *et al.*,^[9] and Soliman & Osman^[10].

2- Flesh weight (g): The obtained data indicated that, the flesh weight shows similar trend as the fruit weight.

The leaves/bunch ratio 10: 1 (moderate pruning) gave the highest flesh weight compared to the control and other treatments. While, leave/bunch ratio 6: 1 gave the lowest flesh weight in Samany date in both seasons.

These results are in agreement with those reported by Hussein *et al.*,^[4] Abdulla *et al.*,^[7] Hussein *et al.*,^[6] and Harhash *et al.*,^[9]. They found that the flesh weight of fruit increased with increasing leaf/bunch ratio.

3- Fruit size (cm³): It is noticed from obtained data that during the two seasons in Samany cv. The fruit size exhibits similar trend as the flesh weight.

4- Fruit dimensions (cm): Data of fruit dimensions (length and diameter) for Samany cv. In both seasons showed that the fruit length and diameter were increased significantly with moderate pruning in comparison with other treatments and the control. In line with Hussein *et al.*,^[6] who found that the fruit dimensions

Table 4: Nutrient concentrations of the different parts of Samany date palm as influenced by pruning treatments during 2004 and 2005 seasons.

Nutrient	Pruning	2004 season				2005 season			
		Fruits	Bunches stalk & strands	Leaves		Fruits	Bunches stalk & strands	Leaves	
				Pinna	Rachis			Pinna	Rachis
N%	C	0.37c	0.87b	0.73c	0.97d	0.42c	0.89b	0.88b	1.12d
	S	0.55ab	0.78c	1.07a	1.30b	0.69ab	0.75c	1.12a	1.38b
	M	0.70a	1.04a	1.11a	1.44a	0.77a	1.14a	1.18a	1.55a
	H	0.48bc	0.71d	0.92b	1.15c	0.55bc	0.67d	1.05a	1.20c
P%	C	0.034c	0.052c	0.115d	0.11b	0.122d	0.056b	0.111c	0.088c
	S	0.077b	0.060a	0.160b	0.22ab	0.143b	0.064a	0.168a	0.27b
	M	0.105a	0.059a	0.166a	0.58a	0.170a	0.056b	0.172a	0.60a
	H	0.065b	0.057b	0.129c	0.17ab	0.134c	0.055b	0.136b	0.23b
K%	C	0.773c	3.51c	0.26d	0.65c	0.96d	3.45b	0.35d	0.62d
	S	1.015b	3.62b	0.32b	1.02b	1.45b	3.61a	0.45b	1.16b
	M	1.197a	3.72a	0.40a	1.33a	1.56a	3.68a	0.50a	1.41a
	H	0.93b	2.96d	0.30c	0.82bc	1.34c	2.63c	0.40c	0.89c
Mg%	C	0.06c	0.02c	0.35d	0.16c	0.10d	0.04a	0.41d	0.21c
	S	0.11a	0.03b	0.57b	0.29b	0.21b	0.05a	0.63b	0.34b
	M	0.10ab	0.05a	0.67a	0.38a	0.24a	0.06a	0.71a	0.45a
	H	0.09b	0.03b	0.38c	0.20c	0.16c	0.04a	0.46c	0.27c
Ca %	C	0.12a	0.73c	0.63d	0.26c	0.15c	0.97c	0.52d	0.22b
	S	0.40a	1.02b	0.85a	0.77a	0.46a	1.13b	0.71a	0.57a
	M	0.17a	1.13a	0.77b	0.61b	0.27b	1.22a	0.65b	0.49a
	H	0.15a	0.65d	0.72c	0.53b	0.19c	0.89d	0.61c	0.44ab
Na %	C	0.001c	0.025c	0.142c	0.002d	0.003d	0.028c	0.149c	0.003d
	S	0.005b	0.052a	0.219a	0.020a	0.009a	0.062a	0.206a	0.018b
	M	0.009a	0.032b	0.205a	0.013b	0.006b	0.033c	0.214a	0.025a
	H	0.003bc	0.052a	0.173b	0.009c	0.005c	0.036b	0.185b	0.013c
Fe ppm	C	45.0d	679.0a	365.0c	191.0c	21.7d	684.0b	337.7b	166.0c
	S	166.0a	510.3a	422.0a	337.3a	65.0b	740.0a	299.0a	272.0b
	M	126.0b	679.7a	426.0a	392.7a	89.3a	671.7c	404.7a	356.7a
	H	97.7c	663.3a	383.7b	260.3b	45.0c	651.7d	349.0b	243.3b
Mn ppm	C	3.0c	4.67c	19.0d	24.8c	4.7d	5.4c	15.0d	21.5c
	S	5.0b	6.20a	24.3b	31.0b	7.3b	7.5a	24.7b	27.7b
	M	7.2a	5.50b	34.7a	51.3a	9.3a	6.2b	29.0a	41.0a
	H	4.3b	4.17d	22.3c	30.3bc	6.0c	4.2d	21.7c	24.2b

Table 4: Continued

Zn ppm	C	3.7c	19.7b	11.7d	7.8c	5.3d	17.7c	9.7d	7.0d
	S	6.5b	22.3a	21.3b	14.3b	8.3b	24.0b	19.3b	10.0b
	M	9.5a	22.3a	25.3a	17.0a	10.7a	25.8a	22.3a	13.3a
	H	4.7c	15.4c	14.7c	9.50c	7.0c	17.4c	12.3c	8.7c
Cu ppm	C	4.2c	3.0c	3.2d	2.8c	6.7d	4.0c	2.7c	2.2c
	S	8.0a	5.5a	21.7a	6.2a	12.3a	6.2a	18.3a	5.3a
	M	5.8b	5.0a	15.3b	4.5b	9.0b	5.3b	12.7b	3.8b
	H	5.0bc	4.2b	4.8c	3.8c	8.0c	4.7c	4.0c	3.4b

Means within each column with the same letter are not significantly different at 5% level.

C= Without leave pruning. S= Slight pruning. M= Moderate pruning. H= Heavy pruning

gave higher values in the three seasons with moderate pruning in comparison with other treatments and control, Harhash *et al.*,^[9] found that significant differences in fruit dimensions between treatments in the first season and Soliman & Osman^[10] who found that the obtained results revealed that pruning treatment 12: 1 leaves/bunch ratio increasing fruit dimensions for Gondaila and Dagara cultivars under Aswan conditions.

Chemical properties:

1- Total soluble solids (TSS%): The total soluble solids percentage was significantly affected with leaves/bunch ratio in Samany cv. during two seasons. TSS percentage was increased with pruning treatment 12: 1 leaves/bunch ratio (slight pruning). Results are in agreement with those found by Hussein *et al.*,^[6] Hassaballa *et al.*,^[8] and Harhash *et al.*^[9].

2- Total acidity (%): Regarding the investigated, total acidity percentage was significantly affected by leaves/bunch ratio treatments for Samany cultivar in both seasons. Treatment 10: 1 leaves/bunch ratio (moderate pruning) gave the highest total acidity percentage in the first season, while treatment 12: 1 leaves/bunch ratio (slight pruning) gave the highest values in the second season. These data are in agreement with those obtained by Bakr *et al.*,^[39] who found negative correlation between the fruit acidity and leaves/bunch ratio treatments.

3- Sugar content:

3.1-Total sugar percentages: The obtained data indicated that the total sugar percentages were significantly affected by treatments for Samany cv. in both seasons. The 12: 1 leaves/bunch ratio (slight pruning) produced the highest values compared to the other treatment and control. These results are in line with those of Hussein *et al.*^[4], Abdulla *et al.*,^[7] Hassaballa *et al.*^[8], Harhash *et al.*^[9] and Soliman & Osaman^[10].

3-2. Reducing sugars (%): Concerning the effect of leaves/bunch ratio on reducing sugars, data indicated that the control gave the highest values for Samany cultivar in both seasons.

3-3. Non-reducing sugars (%): The obtained data indicated that leaves/bunch ratio at 10: 1 produced the highest values for Samany cv. in the two seasons. These results are in accordance with those of Hussein *et al.*^[4, 6] and Harhash *et al.*^[9], they all found that non-reducing sugars increased with increasing leaves/bunch ratio.

(C) Effect of different pruning on dry weight: Dry weights removed per year by fruits, stalk and strands per bunches and pinnae and rachis per leaves under the effect of different pruning treatments during the two seasons are given in Table 3. Moderate pruning produced the highest of dry matter annually (79.38 and 89.96 Kg/palm, respectively). Fruits produced about 67% of dry matters.

(D) Effect of different pruning on nutrient concentrations: Data in Table (4) showed that moderate pruning (10: 1 leaves/bunch ratio) had significant effect on N, P, K, Mn and Zn fruit contents in both seasons and Ca in first season and Mg, Fe in second season. Concerning leaf (pinnae, rachis) contents, N, P, K, Mg, Fe, Mn and Zn contents were significant effect by moderate pruning in both seasons. As for, bunches stalk & strands, N, P, K, Mg, Ca and Zn contents were the highest under moderate pruning in both seasons. It might be concluded that moderate pruning can improve the nutrient contents on the different parts of date palm trees.

(E) Effect of different pruning on nutrient removal: Table (5) contained estimated amounts of nutrients annually removal from the soil by the different parts of date palm trees as well as the total nutrients removed by the palm/year. In comparison, with different parts, it was found under moderate pruning in both seasons, that fruit removed the highest amount of K, Zn and Cu, leaf (pinna, rachis) removed the highest amount Fe and Mn.

Table 5: Nutrient removal of the different parts per Samany palm as influenced by pruning treatments during 2004 and 2005 seasons.

Nutrient g/palm	2004						2005						
	Pruning	Bunches stalk		Leaves		Total palm/year	Fruits	Bunches stalk		Leaves		Total Palm/year	
		Fruits	& strands	Pinna	Rachis			Pinna	Rachis	Total			
N	C	154.0c	47.0c	--	--	--	201	188.0b	48.0b	--	--	--	236
	S	274.0b	54.0b	90.0a	128.0a	218	546	389.0a	50.0b	93.0a	142.0a	235	674
	M	373.0a	65.0a	103.0a	153.0a	256	694	462.0a	70.0a	144.0a	181.0a	325	857
	H	160.0c	36.0d	120.0a	158.0a	278	474	178.0b	35.0c	140.0a	181.0a	321	534
P	C	14.0c	3.22b	--	--	--	17.22	55.0c	3.0c	--	--	--	58
	S	38.0b	4.16a	13.5a	22.0a	35.5	77.66	81.0b	4.2a	14.0a	28.0b	42	127.2
	M	56.0a	3.69a	15.4a	61.0a	76.4	136.09	102.0a	3.4b	21.0a	70.0a	91	196.4
	H	22.0c	2.92b	16.8a	23.0a	39.8	64.72	43.0d	2.9c	18.0a	35.0b	53	98.9
K	C	323.0b	188.0b	--	--	--	511	430.0b	188.0b	--	--	--	618
	S	506.0a	251.0a	27.0a	101.0a	128	885	817.0a	239.0a	37.0a	119.0a	156	1212
	M	638.0a	233.0a	37.0a	141.0a	178	1049	936.0a	225.0a	61.0a	164.0a	225	1386
	H	309.0b	152.0b	39.0a	113.0a	152	613	434.0b	137.0c	53.0a	134.0a	187	758
Mg	C	25.0b	1.07c	--	--	--	26.07	46.0b	2.18a	--	--	--	48.18
	S	55.0a	2.08b	48.0b	29.0a	77	134.08	118.0a	3.30a	52.0a	35.0b	87	208.3
	M	53.0a	3.13a	62.0a	40.0a	102	158.13	144.0a	3.70a	87.0a	52.0a	139	286.7
	H	30.0b	1.54b	49.0b	28.0a	77	108.54	52.0b	2.10a	61.0a	41.0b	102	156.1
Ca	C	50.0b	39.0b	--	--	--	89	67.0c	53.0b	--	--	--	120
	S	199.0a	71.0a	71.5b	76.0a	147.5	417.5	259.0a	75.0a	58.0a	59.0a	117	451
	M	91.0b	71.0a	71.2b	65.0a	136.2	298.2	162.0b	74.0a	79.0a	57.0a	136	372
	H	50.0b	33.0b	93.7a	73.0a	166.7	249.7	62.0c	46.0b	81.0a	66.0a	147	255
Na	C	0.42c	1.34b	--	--	--	1.76	1.34c	1.52c	--	--	--	2.86
	S	2.49b	3.61a	18.4a	1.97a	20.37	26.47	5.07a	4.10a	17.0a	1.85b	18.85	28.02
	M	4.79a	2.00b	19.0a	1.38a	20.38	27.17	3.60b	2.00b	26.0a	2.92a	28.92	34.52
	H	1.00c	2.67a	22.5a	1.24a	23.74	27.41	1.62c	1.90b	25.0a	1.96b	26.96	30.48
Fe	C	1.88d	3.65b	--	--	--	5.53	0.97d	3.72b	--	--	--	4.69
	S	8.27a	3.54b	3.55a	3.33a	6.88	18.69	3.66b	4.91a	2.46b	2.80a	5.26	13.83
	M	6.71b	4.26a	3.94a	4.16a	8.1	19.07	5.35a	4.10b	4.95a	4.16a	9.11	18.56
	H	3.25c	3.40b	4.99a	3.58a	8.57	15.22	1.46c	3.40b	4.66a	3.67a	8.33	13.19
Mn	C	0.125b	0.025b	--	--	--	0.15	0.210c	0.029c	--	--	--	0.24
	S	0.249a	0.043a	0.204b	0.31b	0.51	0.81	0.411b	0.050a	0.20a	0.285a	0.485	0.95
	M	0.384a	0.034a	0.321a	0.54a	0.86	1.28	0.558a	0.038b	0.35a	0.478a	0.828	1.42
	H	0.143b	0.021b	0.290b	0.42ab	0.71	0.87	0.194c	0.022	0.29a	0.365a	0.655	0.87

Table 5: Continued

Zn	C	0.154c	0.106b	--	--	--	0.26	0.237c	0.10b	--	--	--	0.34
	S	0.324b	0.155a	0.179b	0.141a	0.32	0.8	0.468b	0.16a	0.159b	0.103a	0.262	0.89
	M	0.506a	0.140a	0.234a	0.180a	0.41	1.06	0.642a	0.16a	0.273a	0.155a	0.428	1.23
	H	0.156c	0.079b	0.191b	0.131a	0.32	0.56	0.227c	0.09b	0.164b	0.131a	0.295	0.61
Cu	C	0.175b	0.016c	--	--	--	0.19	0.300c	0.022c	--	--	--	0.32
	S	0.399a	0.038a	0.182a	0.061a	0.246	0.68	0.693a	0.041a	0.151a	0.054a	0.205	0.94
	M	0.309a	0.031a	0.142b	0.048a	0.19	0.53	0.540b	0.032b	0.155a	0.044a	0.199	0.77
	H	0.166b	0.022b	0.062c	0.052a	0.114	0.3	0.259c	0.025b	0.053b	0.051a	0.104	0.39

Means within each column with the same letter are not significantly different at 5% level.

C= Without leave pruning, S= Slight pruning, M= Moderate pruning, H= Heavy pruning

The total amounts of nutrients removed by palm per year are showed in Table (5) for the two seasons. It was calculated that each palm annually under moderate pruning removes: 1049 g K; 694 g N; 298.2 g Ca; 158.1g Mg, 136.1g P; 27.2 g Na; 19.1g Fe; 1.28 g Mn; 1.06g Zn and 0.53 g Cu. in the first season and in the second season were: 1386 g K; 857 g N; 372 g Ca; 286.7g Mg, 196.4g P; 34.5 g Na; 18.6 Fe; 1.42 g Mn; 1.23 g Zn and 0.77g Cu.

These amounts of nutrients should be returned to the tree with fertilizers, with taken into account the fertilizers efficiency.

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