

## ORIGINAL ARTICLES

### Benefits of Intercropping Samany Date Palms with Some Fruit Crops

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#### ABSTRACT

During 2010 and 2011 seasons Samany date palms were intercropped with Tofahy olives, Balady limes and Balady guavas. The study was focused on the impact of intercropping systems on growth, nutritional status of palms, yield and fruit quality of Samany date palm. Total counts of bacteria in the rhizosphere was also recorded. Pure stand of palms had greater leaf area, different nutrients in the leaves bunch weight and yield per palm in relative to intercropped palms. Rhizosphere of the intercropped palms had higher total counts of bacteria rather than pure stand of palms. Growing different fruit crops with Samany date palms had a slight negative effect on yield and fruit quality of Samany fruits comparing with pure stand of palms. The best intercrops with regard to productivity of the palm was Balady guavas, Balady limes and Tofahy olives, in descending order. In descending order growing Tofahy olives, Balady limes and Balady guava trees with Samany date palms could be essential for Maximizing net return per unit.

***Kew words:*** Intercropping, Date Palms, Fruit Crops, yield and fruit quality

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#### Introduction

Egypt is considered to be one of the major date producing countries in the world. The number of females and the yield reached 12 million palms and 1.5 million ton fruits, respectively (2011 statistics). Date palm supply enough space for intercropping even if they fully grown as they do not cover much area being very tall tree (Akyurt *et al.*, 2002). Previous studies showed that it is possible to grow a mixed fruit orchard such as date palm intercropped with citrus (Mortan, 1987 and Ali *et al.*, 1988).

Polyculture is claimed to be one the most considerable cropping techniques in sustainable agriculture to its utilization a number of environmental benefits from promoting land biodiversity to diversifying agricultural outcome. This model integrates low, medium and tall plants as well as plants of short, medium and long life cycles, including trees. Therefore, the tendency for exploitation the land under date palms whether for annual or perennial crops is increasing day by day to better utilization the microclimate and soils under date palm.

Previous studies showed that intercropping those trees that cultivated at wide spaces with various intercrops resulted in promoting net profit and at the same time had no considerable adverse effects on the yield and fruit quality of main crops (Samson, 1970; Simon, 1978; Purseg Love, 1978; Maharana and Das, 1981; Reuveni, 1986; Mortan, 1987; Bhuva *et al.*, 1988; Ashour *et al.*, 1992a and 1992b; Ebrahiem and Haggag, 1993; El-Halawany and Shaltout, 1993; El-Hebshi, 1993; Ashour *et al.*, 1993; Abou-Rayya and Kassem, 1993; Ashour *et al.*, 1994; Warigley, 1995; Ali *et al.*, 1998; Ong *et al.*, 2000; Abou-Elail, 2001; Akyurt *et al.*, 2002; Ahmed and Mansour, 2003 and Abouzienna *et al.*, 2010).

The merit of this study was testing the effect of intercropping of Tofahy olives, Balady limes and Balady guavas with Samany date palms on the yield quantitatively and qualitatively of date fruits.

#### Materials And Methods

This study was conducted during two consecutive seasons of 2010 and 2011 on forty eight 20-years old Samany date palms intercropped or not with Tofahy olive trees, Balady lime trees (12 years old) as well as Balady guava trees (11 year old) in a private orchard located at Minia district, Minia Governorate. The texture of soil is clay. Samany date palms are planted at 10 × 10 meters apart. The three intercrops are planted at the center of distance among palms in separate plots. Surface irrigation system was followed. All horticultural practices that usually applied in the orchard concerning the major and the three fruit intercrop species were followed as usual. Number of bunches per each palm was adjusted to 8 at the flowering stage.

The present experiment included the following four treatments:-

- 1- Pure stand of Samany date palms.
- 2- Intercropping Samany date palms with Tofahy olive trees.
- 3- Intercropping Samany date palms with Balady lime trees.
- 4- Intercropping Samany date palms with Balady guava trees.

Each treatment was replicated three time one plot containing four trees per each. Complete randomized block design was followed.

Leaf area was calculated on one six-months old leaf per palm from which the medium four pinnae were taken for calculating the leaf area according to the equation reported by Ahmed and Morsy (1999). In this pinnae, percentages of N, P, K and Mg were determined according to the procedures that outlined by Wilde *et al.*, (1985).

Rhizosphere samples were collected from the depth of 15-30 cm adhering very closely to Samany date palm roots. Rhizosphere from soil of pure stand and intercropped date palms (four treatments) were used to estimate the total counts of bacteria on the basis serial 10-fold dilutions (Johnson and Curl, 1972). Colony forming unites (CFU) were recorded after one week using extract ager medium modified by Mahmoud *et al.*, (1964).

At the peak of colour development (1st week of August), bunches per palm were harvested for determining, yield (Kg.), bunch weigh (Kg.), fruit weight (g.) total soluble solids % total and reducing sugars % and total acidity % (as g malic acid/100 g pulp) (A.O.A.C., 1995). Soluble tannins % was determined using the method that outlined by Balbaa (1981).

The obtained data from each season were exposed to the proper statistical analysis of variance according to Mead *et al.*, (1993) using new L.S.D at 5% for made all comparisons between means.

## Results And Discussions

### 1- Leaf area and its content of N, P, K and Mg:

Data in Table (1) clearly show that leaf area and different nutrients in the palm pinnae were significantly varied according to various intercropping treatments. Intercropping Samany date palms with Tofahy olives, Balady limes and Balady guavas significantly reduced the leaf area and the four macronutrients comparing with pure stand of Samany date palms. A gradual and significant reduction on these characters were recorded with growing Tofahy olives, Balady limes and Balady guavas with date palms in descending order. The maximum values were recorded with using Balady guava intercrop rather than the other intercrops. Intercropping Tofahy olive trees with Samany date palm achieved the lowest values Pure stand of Samany date palms had the highest values. These results were true during both seasons.

The reduction on the leaf area and its content of macro nutrients might be attributed to the competition occurred on organic foods, mineral elements and water among the three intercrops cultivated with the major fruit crops.

These results are in agreement with those obtained by Ashour *et al.*, (1992a) and (1993) and Ahmed and Mansour (2003).

### 2- Total count of bacteria in the rhizosphere:

Data in Table (1) clearly show that total number of bacteria in the rhizosphere samples (d.w) ranged from 81 cfu x 10<sup>5</sup> g to 411 cfu x 10<sup>5</sup> g in the first season and from 82 cfu x 10<sup>5</sup> g to 415 cfu x 10<sup>5</sup> g in the second one. Intercropping significantly was responsible for increasing total number of bacteria rather than non-intercropping palms.

Total number of bacteria increased from 81 in pure stand of date palms to 411 cfu x 10<sup>5</sup> g in intercropped palms in the first season and from 82 to 415 cfu x 10<sup>5</sup> g in the second season. Using Balady guava intercrop with Samany date palms significantly produced the maximum values (411 and 415 cfu x 10<sup>5</sup> g during both season, respectively). Unintercropping (Sole palms) had the minimum values (81 and 82 cfu x 10<sup>5</sup> g during 2010 and 2011 season, respectively). Similar results were announced during both seasons.

The beneficial of intercropping in enhancing microflora in the rhizosphere was attributed to the decomposable root debris and root exudates that amending the bacteria with the available source of nutrients to grow and proliferate (Allen, 1961).

These results are in approval with those obtained by Mohamed, *et al.*, (1964).

### 3- Bunch weight and yield/palm:

It is evident from the data in Table (2) that bunch weight and yield/palm were slightly varied among the four intercropping treatments. Monoculture of Samany date palm produced higher fruit yield/palm rather than

intercropping. No significant differences between Sole Samany date palm and that intercropped with any intercrops (Tofahy olives, Balady limes and Balady guavas) on bunch weigh and yield/palm. Growing Balady guava trees under Samany date palm resulted in the highest fruit yield/palm compared to intercropping with Balady lime and Tofahy olives. The lightest bunch and the lowest yield were recorded on the palms that intercropping with Tofahy olives. The highest yield (176 & 784 kg/palm) was recorded on sole Samany date palms.

**Table 1:** Effect of intercropping Samany date palms with Tofahy olives, Balady limes and Balady guavas on the leaf area, percentages of N,P,K and Mg in the pinnae, total bacteria counts and bunch weight of date palms during 2010 and 2011 seasons.

Intercropping treatment	Character	Leaf area (m <sup>2</sup> )		Leaf N %		Leaf P %		Leaf K %		Leaf Mg %		Total bacteria counts (cfu)		Bunch (Kg.)	Weight
		2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
Pure stand of palm*		2.41	2.55	1.81	1.92	0.41	0.39	1.11	1.15	0.41	0.42	81.0	82.0	22.1	22.3
Palm intercropped with olives**		1.46	1.60	1.40	1.50	0.26	0.27	0.91	0.92	0.30	0.29	300.1	301.0	21.3	21.5
Palm intercropped with limes***		1.98	1.90	1.52	1.63	0.31	0.30	0.96	0.99	0.34	0.35	341.0	351.0	21.8	21.7
Palm intercropped with guavas****		2.11	2.20	1.71	1.73	0.36	0.37	1.02	1.07	0.37	0.38	411.0	415.0	22.0	22.0
New L.S.D at 5%		0.30	0.27	0.06	0.07	0.03	0.02	0.05	0.04	0.02	0.02	9.1	9.5	NS	NS

\* Samany date palms

\*\* Tofahy olive trees

\*\*\* Balady lime trees

\*\*\*\* Balady guava trees

The slight reduction on both bunch weight and yield in response to intercropping might be attributed to the competition on organic and mineral foods among different date palms. The reducing effect of intercropping on growth and nutritional status of the trees surely reflected on a slight reduction on yield and its components. Similar results were revealed by Abou- Elail (2001) and Ahmed and Mansour (2003).

#### 4- Quality of the fruits:

Data in Table (2) clearly show that different intercropping patterns had no significant adverse effects on fruit quality comparing with pure stand of date palms. Growing Smany date palms alone slightly improved quality 'of the fruits in terms of increasing fruit weight, total soluble solids %, total and reducing sugars % and reducing both total acidity and soluble tannins % comparing with pure stand of date palms. The best intercrops in this connection was Balady guavas followed by Balady limes and finally with Tofahy olive trees. Similar results were announced during each season.

The reducing effect of intercropping on fruit quality might be attributed to the competition for carbohydrates and water between the various crops.

The results of Abou- EI- Lail (2001) and Ahmed and Mansour (2003) emphasized the present result.

**Table 2:** Effect of intercropping Samany date palms with Tofahy olives, Balady limes and Balady guavas on the yield per palm (Kg.) as well as some physical and chemical characteristics of the fruit of Samany date palms during 2010 and 2011 seasons

Intercropping treatment	Character	Yield/palm (kg.)		Fruit Weight (g.)		T.S.S %		Total sugars %		Reducing sugars %		Total acidity %		Soluble Tannins %	
		2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
Pure stand of palm*		176.8	178.7	28.3	28.0	27.0	27.5	20.0	20.0	13.5	13.3	0.241	0.250	0.53	0.55
Palm intercropped with olives**		170.4	172.0	27.0	26.8	26.7	27.0	19.6	19.5	12.9	12.8	0.255	0.255	0.50	0.50
Palm intercropped with limes***		174.4	173.6	27.8	27.6	26.9	27.1	19.7	19.7	13.0	13.0	0.255	0.252	0.51	0.51
Palm intercropped with guavas****		176.0	176.0	28.0	27.9	27.0	27.3	19.9	19.8	13.3	13.1	0.250	0.250	0.52	0.52
New L.S.D at 5%		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

\* Samany date palms

\*\* Tofahy olive trees

\*\*\* Balady lime trees

\*\*\*\* Balady guava trees

#### 5- Net return:

Data in Table (3) obviously reveal that intercropping gave the highest net profit comparing with pure stand of date palms. The promotion was associated with intercropping date palms with Balady guavas, Balady limes and Tofahy olive trees in ascending order.

It could be concluded that intercropping Tofahy olives with Samany date palm can be more profitable than growing pure stand. These results were true during both seasons.

The beneficial of intercropping on promoting net profit might be attributed to the summation of both yields of main crop and intercrop.

The results of EI- Halawany and Shaltout (1993) who found that date palm plantation which is intercropped characterized by higher net profit rather than non- intercropping.

As a conclusion, it is suggested to intercropping Tofahy olive or Balady lime trees with Samany date palms for utilization a number of environmental benefits from promoting yield and biodiversity to diversifying agricultural outcomes.

**Table 3:** Effect of intercropping Tofahy olive trees Balady lime trees and Baldy guava trees with Samany date palms on net return (L.E/Fed./year) during 2010 and 2011 seasons.

Character	2010							2011						
	Yield of Date palm ton/fed./year	Price of selling	Yield of intercrops Ton/fed./year	Price of intercrops	Total of selling (L.E)	Total costs	Net profit	Yield of Zaghloul Date palm ton/fed./year	Price of selling	Yield of intercrops Ton/fed./year	Price of intercrops	Total of selling (L.E)	Total costs	Net profit
Pure stand of palm*	7.1	14200	---	---	14200	4000	10200	7.1	14200	---	---	14200	4000	10200
Palm intercropped with olives**	6.8	13600	8.0	24000	37600	7000	30600	6.9	13800	7.9	23700	37500	7000	30500
Palm intercropped with limes***	7.0	14000	8.0	16000	30000	7000	23000	6.9	13800	8.2	16400	30200	7000	23300
Palm intercropped with guavas****	7.0	14000	8.0	12000	26000	7000	19000	7.0	14000	8.2	12300	26300	7000	19300

\* Samany date palms

\*\* Tofahy olive trees

\*\*\* Balady lime trees

\*\*\*\* Balady guava trees

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