Archives of Agriculture Sciences Journal
Print ISSN: 2535-1680
Online ISSN: 2535-1699

ARCHIVES OF AGRICULTURAL SCIENCES JOURNAL
Volume 1, Issue 3, 2018, Pages 83–104
Available online at www.agricuta.edu.eg
The 1st International Conference on Applied Agricultural Sciences and Prospective Technology

Intercropping efficiency of two maize hybrids with peanut under sandy soils conditions

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Abstract

A field experiment was carried out at Ismailia Agricultural Research Station, Agricultural Research Center, Ismailia, Egypt, during 2015 and 2016 summer seasons to maximize land usage and agro-economic feasibility of different intercropping patterns of maize and peanut. Treatments were compared in a randomized complete block design in four replications with nine cropping systems that included two maize hybrids (white hybrid SC 132 and yellow hybrid SC176) were grow in intercropping patterns with peanut cv. Giza 5 (intercropping pattern 100% peanut + 67% maize, intercropping pattern 100% peanut + 50% maize and intercropping pattern 100% peanut + 33% maize) in addition to solid culture of both cops. The results showed that maize and peanut of different cropping systems affected significantly yield and its attributes of both crops. Intercropping pattern 100% peanut + 67% white maize hybrid SC 132 had the highest grain yield fad-1, meanwhile intercropping pattern 100% peanut + 33% yellow maize hybrid SC 176 had the highest pod yield fad-1 in comparison with the other treatments. Intercropping cultures were advantageous compared to solid cultures of maize and peanut. Intercropping pattern 100% peanut + 33% yellow maize hybrid SC 176 was the best treatment which achieved 16.6 ardab of peanut seeds + 10.9 ardab of maize grains with low aggressivity (maize was the dominant and peanut was the dominated component), and high land equivalent ratio (1.32 and 1.32), relative crowding coefficient (7.45 and 5.42), net return (L.E. 10257 fad-1 and L.E. 9855 fad-1) and monetary advantage index (3816 and 3687) in the first and second seasons, respectively, compared with solid culture of peanut.

Keywords: intercropping, maize hybrids, peanut, competitive relationships, farmers' benefit.

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1. Introduction

In the last decade in Egypt, special attention has been directed towards reclaiming desert soils, sandy or calcareous in nature. Sandy soils have very poor hydrophysical and nutritional values. If Egyptian agricultural production must be intensified, different cropping systems should be followed in these soils, depending on proper management to offer optimum productivity of crops per unit area and increase gross income. Fortunately, peanut (*Arachis hypogaea* L.) is the most suitable crop for conditions of these soils. Oil content in seeds of this crop ranges between 48 and 52% (Khalil, 2010). Also, peanut has high protein, fatty acid, carbohydrates, vitamins and minerals contents (Gulluoglu, 2011). Peanut cultivated area reached about 143 thousand fad, while maize cultivated area reached about 125 thousand fad in 2016 under sandy soil conditions (Bulletin of Statistical Cost Production and Net Return, 2016). Thus, great efforts should be directed toward the increasing land usage by growing peanut and maize together unit area^{-1} through intercropping system especially outside the Nile Valley and Delta. Consequently, the cropping system adopted by the farmer in these soils must be physically viable, sustainable, less exhaustive acceptable to farming community and most important thing is that it should be economical. Intercropping peanut with maize attracted the attention of some investigators as Metwally *et al.* (2005), Jiao *et al.* (2008) and Shams *et al*. (2012). Moreover, intercropping has been found to be a means of making good use of limited water (Qin *et al*., 2013). However, intra and inter-competition between the intercrops for basic growth resources especially water can occur in several ways under intercropping conditions. In this concern, Misbahulmunir *et al*. (1988) who reported that land equivalent ratio (LER) ranged from 1.20 to 1.25 and 0.96 to 1.26 in the first and second seasons, respectively. Maize contributed 69 to 72% and 49 to 62% of total intercrop production in the first and the second seasons, respectively. It is known that intercropping maize with legumes achieved yield advantage (Hussein *et al*., 2002). Also, Metwally *et al*. (2005) concluded that intercropping cultures increased LER as compared to solid plantings of groundnut and maize where it ranged from 1.20 to 1.80 under sandy soil conditions. They added that intercropping peanut with yellow maize hybrids is strongly recommended to increase farmer's profitability especially in new reclaimed lands where peanut is considered as an important cash crop. In addition, Sherif *et al.* (2005) indicated that when peanut and maize are grown in association, they are able to complement each other than when they are grown separately. Finally, Hefny and Hemdan (2016) reported that LER ranged from 1.09 by intercropping 100% peanut + 25.0% maize with application of humic acid to 1.43 by intercropping 100% peanut + 50.0% maize with application of mineral N fertilizer. Accordingly, maize hybrid that interacts positively with an intercropping pattern could play an important role to reach advantages of intercropping under sandy soil conditions. There were significant varietal differences among three maize cultivars, distinguished by root length density and length/weight ratio distributions at depth and at varying soil moisture regimes under sandy loam soil (Aina and Fapohunda, 1986). The competition of yellow maize hybrids to peanut is less than the white maize hybrids (Nofal and Attalla, 2006). However, El-Mesker *et al*. (2008) indicated clearly that planting yellow maize hybrids intercropping with peanut gave the highest values of LER and net return compared with white maize hybrids. Furthermore, Dahmardeh (2013) showed that the highest LER was obtained by sowing the crop in a ratio of intercrop of maize var. KSC 604 50% + peanut 50% and the lowest LER was obtained by sowing the crops intercrop of maize var. KSC 301 25% + peanut 75%. Therefore, the objective of this investigation was to maximize land usage and agro-economic feasibility of different intercropping patterns of maize and peanut.

2. Materials and methods

A two-year study was carried out at Ismailia Agricultural Research Station, Ismailia governorate, Egypt (Lat. 30° 35' 30" N, Long. 32° 14' 50" E, 10 m a.m.) during 2015 and 2016 seasons. Wheat was the preceding crop in both seasons. Mechanical and chemical analyses of the soil (0 – 30 cm) were done by Water, Soil and Environment Research Institute, ARC (Table 1). Mechanical and chemical analyses of the soil were determined using the methods described by Jackson (1958) and Chapman and Pratt (1961). The average monthly temperature for the two years ranged from 30.0 to 35.0 °C in the first season and from 31.0 to 35.0 °C in the second season, while the average relative humidity ranged from 48.0 to 57.0 % in the first season and from 43.0 to 60.0 % in the second season (Table 2). Sprinkler irrigation was applied every three days intervals. Peanut variety Giza 5 and maize hybrids; SC 132 (white) and SC 176 (yellow) were used in the study. Calcium super phosphate (15.5% P_2O_5) at rate of 200 kg fad^{-1} (faddan (fad)= 4200 m^2), potassium sulfate (48.0% K_2O) at rate of 100 kg fad^{-1} and organic manure at rate of 20 m^3 fad^{-1} were applied during soil preparation in the two summer seasons.

Table (1): Soil mechanical and chemical properties of experimental site in 2015 and 2016 seasons.

Depth (0 – 30 cm)	Growing season	
	2015 season	2016 season
Mechanical properties		
Clay	9.68	9.62
Silt	1.60	1.55
Sand	88.72	88.83
Texture	Loamy sand	Loamy sand
Chemical properties		
pH	8.10	8.55
Available N ppm	10.6	11.7
Available P ppm	16.0	15.0
Available K ppm	78.0	63.0

Peanut seeds were planted on May 25 and 30 in 2015 and 2016 seasons, respectively. Maize was planted three weeks later. Peanut and maize were grown in accordance with recommendation agricultural practices. Peanut plants were thinned to one plant per hill distanced at 10 cm between hills under intercropping and solid cultures. Maize plants were thinned to one plant per hill distanced at 35 cm between hills under intercropping and solid cultures.

Table (2): Meteorological information data of Ismailia governorate, Egypt (May–September) in 2015 and 2016 summer seasons.

Month	Temperature			Relative humidity
	Max (°C)	Min (°C)	Average (°C)	(%)
2015 season				
May	34.0	26.0	30.0	48.0
June	35.0	27.0	31.0	53.0
July	38.0	30.0	34.0	54.0
August	40.0	31.0	35.0	55.0
September	38.0	30.0	34.0	57.0
Mean	37.0	28.8	32.8	53.4
2016 season				
May	35.0	27.0	31.0	43.0
June	39.0	31.0	35.0	45.0
July	39.0	30.0	34.5	56.0
August	38.0	29.0	33.5	60.0
September	36.0	28.0	32.0	59.0
Mean	37.4	29.0	33.2	52.6

Source: world weather online.

Calcium sulfate at rate of 500 kg fad^{-1}was applied for peanut after 35-40 days from peanut planting. Mineral N fertilizer was applied for peanut at rate 35 kg N/fad as ammonium nitrate (33.5%N) in two equal portions, the first half at sowing and the second after 30 days later. Mineral N fertilizer was applied for maize at rate 40 kg N/fad for 33% of maize plant density, 60 kg N/fad for 50% of maize plant density, 80 kg N/fad for 67% of maize plant density and 120 kg N/fad for 100% of maize plant density in eight equal doses, the first was applied a week after planting and the rest was added weekly. Nine cropping systems included two maize hybrids (white hybrid SC 132 and yellow hybrid SC176) were grown in intercropping patterns with peanut cv. Giza 5 in addition to solid cultures of both crops as follows:

1. Planting peanut in one side of all ridges and planting maize in the other side of first and second ridge and leaving third ridge and so on (100% peanut + 67% maize).
2. Planting peanut in one side of all ridges and planting maize in the other side of first ridge and leaving second ridge and so on (100% peanut + 50% maize).
3. Planting peanut in one side of all ridges and planting maize in the other side of first ridge and leaving second and third ridges and so on. This pattern was expressed as 100% peanut + 33% maize.
4. Solid culture of peanut by growing peanut in all ridges. This pattern was used for competitive relationships.

5. Solid culture of maize by growing one plant/hill distanced at 35 cm in ridges 60 cm width. This pattern was used for competitive relationships.

The treatments were laid out in a randomized complete block design (RCBD) with four replications. Plot area was 10.8 m^2, 6 ridges, 3.0 m in length and 0.6 m in width.

2.1 The studied traits

2.1.2 Maize grain yield and its attributes

Number of days from planting to 50% tasseling and silking, it was recorded on plot basis as number of days from planting to 50 % tasseling and silking. While, the following traits were measured on ten randomly guarded plants from each plot at harvest; plant height (cm), ear height (cm), number of ears $plant^{-1}$, leaf area of the topmost ear $plant^{-1}$ (cm^2) according to Alessi and Power (1975): leaf area = (leaf length x maximum width x 75%), number of green leaves $plant^{-1}$, ear length (cm), ear diameter (cm), cob diameter (cm), kernel depth (cm), number of rows ear^{-1}, number of kernels row^{-1} and 100 – kernel weight (g). Grain yield (ardab fad^{-1}) recorded on the basis of experimental plot area by harvesting all plants of each plot (one ardab = 140 kg, one fad = 4200 m^2).

2.1.3 Peanut pod yield and its attributes

The following traits were measured on ten randomly guarded plants from each plot at harvest; plant height (cm), numbers of branches and pods $plant^{-1}$, pod weight $plant^{-1}$ (g), 100 – pod weight (g) and 100 – seed weight (g), while pod yield of peanut (ardab fad^{-1}) was recorded on the basis of experimental plot area by harvesting all plants of each plot (one ardab = 75 kg).

2.1.4 Competitive relationships

2.1.4.1 Land equivalent ratio

Land equivalent ratio (LER) is the ratio of area needed under sole cropping to one of intercropping at the same management level to produce an equivalent yield (Mead and Willey, 1980). It is calculated as follows: LER = $(Y_{ab}/Y_{aa}) + (Y_{ba}/Y_{bb})$, where Y_{aa}= Pure stand yield of crop a (peanut), Y_{bb}= Pure stand yield of crop b (maize), Y_{ab}= Intercrop yield of crop a (peanut) and Y_{ba}= Intercrop yield of crop b (maize).

2.1.4.2 Relative crowding coefficient

Relative crowding coefficient (RCC) which estimates the relative dominance of one species over the other in the intercropping system (Banik *et al*., 2006) was calculated as follows: $K = K_a \times K_b$, $K_a = Y_{ab} \times Z_{ba} / [(Y_{aa} – Y_{ab}) \times Z_{ab}]$; $K_b = Y_{ba} \times Z_{ab} / [(Y_{bb} – Y_{ba}) \times Z_{ba}]$, where Y_{aa} = Pure stand yield of crop a (peanut); Y_{bb} = Pure stand yield of crop b (maize); Y_{ab} = Intercrop yield of crop a (peanut); Y_{ba} = Intercrop yield of crop b (maize); Z_{ab} = The respective proportion of crop a in the intercropping system (peanut); Z_{ba} = The respective proportion of crop b in the intercropping system (maize).

2.1.4.3 Aggressivity

Aggressivity (Agg) which represents a simple measure of how much the relative yield increase in one crop is greater than the other in an intercropping system (Willey, 1979) was calculated as follows: $A_{ab} = [Y_{ab} / (Y_{aa} \times Z_{ab})] - [Y_{ba} / (Y_{bb} \times Z_{ba})]$; $A_{ba} = [Y_{ba} / (Y_{bb} \times Z_{ba})] - [Y_{ab} / (Y_{aa} \times Z_{ab})]$, Where Y_{aa} = Pure stand yield of crop a (peanut); Y_{bb} = Pure stand yield of crop b (maize); Y_{ab} = Intercrop yield of crop a (peanut); Y_{ba} = Intercrop yield of crop b (maize); Z_{ab} = The respective proportion of crop a in the intercropping system (peanut); Z_{ba} = The respective proportion of crop b in the intercropping system (maize).

2.1.5 Economic evaluation

Farmer's benefit was calculated by determining the total costs and net return of intercropping culture compared to recommended solid culture of peanut. Total return of intercropping cultures = Price of peanut yield (L.E.) + price of maize yield (L.E.). Net return per fad = Total return – (fixed costs of peanut + variable costs of maize according to intercropping pattern). Monetary Advantage Index (MAI) suggests that the economic assessment should be in terms of the value of land saved; this could probably be most assessed based on the rentable value of this land. MAI was calculated according to the formula, suggested by Willey (1979). MAI= [Value of combined intercrops x (LER–1)]/LER. The average of peanut and maize prices presented by Bulletin of Statistical Cost Production and Net Return (2015 and 2016) was used. The price of peanut was L.E. 681 per ardab, meanwhile the price of maize was L.E. 322 per ardab.

2.2 Statistical analysis

Analysis of variance of the obtained results of each season was performed. The measured variables were analyzed by ANOVA using MSTATC statistical package (Freed, 1991). Mean comparisons were performed using the least significant differences (L.S.D) test with a significance level of 5% (Gomez and Gomez, 1984).

3. Results and Discussion

3.1 Maize grain yield and its attributes

Number of days to 50% tasseling and silking, plant and ear heights, ear leaf area, ear and cob diameter, kernel depth, 100 – kernel weight and grain yield fad^{-1} were significantly affected by the cropping systems in the two growing seasons, as well as, number of ears $plant^{-1}$ and number of kernels row^{-1} in the first season, and ear length and number of rows ear^{-1} in the second season (Tables 3 and 4). With regard to number of days from planting to 50% tasseling, it achieved the highest number of days by intercropping pattern 100% peanut + 67% white maize hybrid SC 132 which had no significant differences among intercropping pattern 100% peanut + 50% white maize hybrid SC 132, intercropping pattern 100% peanut +

33% white maize hybrid SC 132 and solid culture of white maize hybrid SC 132 compared with others in the first season (Table 3).

Table (3): Effect of the cropping systems on numbers of days from planting to 50% tasseling and silking, plant and ear heights, number of ears plant-1, ear leaf area and number of green leaves plant-1 of maize crop in 2015 and 2016 seasons.

Treatments / Characters	Number of days to 50% tasseling	Number of days to 50% silking	Plant height (cm)	Ear height (cm)	Number of ears $plant^{-1}$	leaf area of ear bearing leaf (cm^2)	Number of green leaves $plant^{-1}$
2015 season							
Solid culture of maize hybrid SC 132	58.0	59.3	284	131	1.00	681	13.0
100%peanut+67%maize hybrid SC 132	56.5	57.5	278	124	1.00	735	12.8
100%peanut+50%maize hybrid SC 132	59.8	61.3	272	121	1.03	712	12.8
100%peanut+33%maize hybrid SC 132	59.0	60.3	268	118	1.05	785	12.5
Solid culture of maize hybrid SC 176	58.8	58.0	276	122	1.00	649	12.3
100%peanut+67%maize hybrid SC 176	56.5	59.5	268	115	1.00	671	12.3
100%peanut+50%maize hybrid SC 176	58.3	59.5	263	112	1.01	677	12.3
100%peanut+33%maize hybrid SC 176	58.3	59.5	259	112	1.03	770	12.3
L.S.D. 0.05	2.1	1.8	9.3	12.1	0.03	6.8	ns
2016 season							
Solid culture of maize hybrid SC 132	59.3	60.5	286	138	1.00	694	12.5
100%peanut+67%maize hybrid SC 132	58.5	59.8	276	135	1.00	733	12.8
100%peanut+50%maize hybrid SC 132	60.5	61.8	275	125	1.01	708	13.3
100%peanut+33%maize hybrid SC 132	59.8	61.0	271	128	1.04	769	12.3
Solid culture of maize hybrid SC 176	60.0	61.0	278	136	1.02	621	12.3
100%peanut+67%maize hybrid SC 176	58.5	60.0	271	131	1.04	646	13.0
100%peanut+50%maize hybrid SC 176	59.8	61.0	265	128	1.01	647	12.5
100%peanut+33%maize hybrid SC 176	58.8	60.5	262	120	1.01	759	12.3
L.S.D. 0.05	0.7	1.0	7.1	8.0	ns	3.0	ns

In the second one, the highest value of this trait was recorded in intercropping pattern 100% peanut + 67% white maize hybrid SC 132 which had no significant differences with intercropping pattern 100% peanut + 33% white maize hybrid SC 132 compared with other treatments. For number of days from planting to 50% silking, the highest number of days for this trait was achieved by intercropping pattern 100% peanut + 67% white maize hybrid SC 132 which had no significant differences with intercropping pattern 100% peanut + 50% white maize hybrid SC 132 and intercropping pattern 100% peanut + 33% white maize hybrid SC 132 compared with other treatments in 2015 season (Table 3). However, the highest number of days from planting to 50% silking was observed in intercropping pattern 100% peanut + 67% white maize hybrid SC 132 which had no significant differences with intercropping pattern 100% peanut + 50% white maize hybrid SC 132, intercropping pattern 100% peanut + 33% white maize hybrid SC 132 and intercropping pattern 100% peanut + 50% yellow maize hybrid SC 176 compared with others in the second one. Generally, these results show that there was a similar effect on flowering of white maize hybrid SC 132 by increasing plant density of maize per unit area from 33 to 67% of the recommended solid culture compared with the yellow hybrid under sandy soil conditions in 2015 and 2016 seasons. These results reveal that plant density unit area^{-1} of yellow maize hybrid SC 176 played important role in the acceleration of phenology during the early growth stage. These results agree with those reported by Nofal and Attalla (2006) and El Mekser *et al.* (2008) who showed that yellow maize hybrids were the earliest, while the white maize hybrids were the latest in terms of number of days from planting to 50% tasseling and silking in both seasons. Also, Dawadi and Sah (2012) found that different tassel and silk days for two maize varieties. In another study, Shafi *et al.* (2012) reported that days to 50% tasseling and silking were significantly affected by maize varieties. However, they added that plant population and their interactions with varieties were non-significant.

Table (4): Effect of the cropping systems on ear characteristics and grain yield fad-1 of maize crop in 2015 and 2016 seasons.

Characters / Treatments	Ear length (cm)	Ear diameter (cm)	Cob diameter (cm)	Kernel depth (cm)	Number of rows ear^{-1}	Number of kernels row^{-1}	100 – kernel weight (g)	Grain yield fad^{-1} (ardab)
2015 season								
Solid culture of maize hybrid SC 132	21.3	4.46	2.90	0.83	15.3	39.5	37.1	26.0
100%peanut+67%maize hybrid SC 132	21.6	4.60	2.92	0.85	15.3	39.9	35.3	17.7
100%peanut+50%maize hybrid SC 132	22.0	4.62	2.88	0.87	15.3	40.2	33.0	14.1
100%peanut+33%maize hybrid SC 132	21.4	4.56	2.98	0.74	15.0	43.6	34.3	10.2
Solid culture of maize hybrid SC 176	16.1	4.28	2.78	0.77	14.7	39.2	36.3	23.7
100%peanut+67%maize hybrid SC 176	21.3	4.32	2.94	0.71	14.9	39.5	34.9	15.1
100%peanut+50%maize hybrid SC 176	21.1	4.31	2.86	0.72	14.8	39.2	34.4	13.8
100%peanut+33%maize hybrid SC 176	20.7	4.44	2.90	0.69	15.1	42.9	35.0	9.7
L.S.D. 0.05	ns	0.21	0.09	0.13	ns	2.6	0.8	2.5
2016 season								
Solid culture of maize hybrid SC 132	21.4	4.73	3.08	0.81	14.8	36.8	33.8	25.4
100%peanut+67%maize hybrid SC 132	21.6	4.73	3.07	0.76	14.8	43.9	30.6	19.3
100%peanut+50%maize hybrid SC 132	21.7	4.74	2.99	0.85	14.8	44.5	27.9	15.7
100%peanut+33%maize hybrid SC 132	21.3	4.71	3.00	0.70	15.1	42.5	29.4	11.8
Solid culture of maize hybrid SC 176	19.7	4.43	3.01	0.80	14.4	30.8	32.7	24.7
100%peanut+67%maize hybrid SC 176	19.7	4.50	3.07	0.72	14.7	40.6	26.8	18.2
100%peanut+50%maize hybrid SC 176	19.8	4.49	3.01	0.70	14.6	39.4	26.7	15.1
100%peanut+33%maize hybrid SC 176	19.3	4.46	2.93	0.72	14.7	38.4	26.9	11.2
L.S.D. 0.05	1.1	0.19	0.07	0.11	0.40	ns	1.7	2.6

Plant height was significantly affected by the cropping systems in the two seasons (Table 3). The maximum plant height was observed in solid culture of white maize hybrid SC 132 followed by intercropping pattern 100% peanut + 67% white maize hybrid SC 132 compared with others in the two seasons. With regard to ear height, the highest ear height in 2015 season was recorded in solid culture of white maize hybrid SC 132 which had no significant differences with intercropping pattern 100% peanut + 67% white maize hybrid SC 132, solid culture of yellow maize hybrid SC 176, intercropping pattern 100% peanut + 50% white maize hybrid SC 132 and intercropping pattern 100% peanut + 33% white maize hybrid SC 132 compared with others (Table 3). On the other hand, the highest ear height was observed in solid culture of the two maize hybrids, which had no significant differences with intercropping pattern 100% peanut + 67% maize hybrid SC 132 compared with others in 2016 season. With regard to ear height, the highest ear height in 2015 season was recorded in solid culture of white maize hybrid SC 132 which had no significant differences with intercropping pattern 100% peanut + 67% white maize hybrid SC 132, solid culture of yellow maize hybrid SC 176, intercropping pattern 100% peanut + 50% white maize hybrid SC 132 and intercropping pattern 100% peanut + 33% white maize hybrid SC 132 compared with others (Table 3). On the other hand, the highest ear height was observed in solid culture of the two maize hybrids, which had no significant differences with intercropping pattern 100% peanut + 67% maize hybrid SC 132 compared with others in 2016 season. It seems that there was more shading around canopy of maize plant hybrid SC 176 of solid culture which formed more amounts of plant hormones and resulted in an increase of the internode number and elongation compared with the others. These results clearly indicate that plants of yellow maize hybrid SC 132 suffered from mutual shading when grown in solid culture than in intercropping culture and this effect was increased by increasing the number of maize plants unit area^{-1} from 33 to 67% of the recommended solid culture under intercropping conditions. Mutual shading is known to increase the proportion of invisible radiation, which had a specific elongating effect upon plants (Chang, 1974). These results are in accordance with those obtained by El Mekser *et al.* (2008) who showed that maize hybrids with peanut reduced the plant height of all maize plants. For ear leaf area, intercropping pattern 100% peanut + 33% white maize hybrid SC 132 recorded the highest ear leaf area followed by intercropping pattern 100% peanut + 33% yellow maize hybrid SC 176 compared with others in the first season (Table 3). Also, the highest ear leaf area was recorded by intercropping pattern 100% peanut + 33% white maize hybrid SC 132 followed by intercropping pattern 100% peanut + 33% yellow maize hybrid SC 176 compared with other treatments in the second one. It is expected that white maize hybrid SC 132 had higher capacity of green leaves more than the yellow hybrid to assimilate photosynthates molecules that reflected positively on ear leaf area by decreasing maize plant density unit area-1 from 100 to 33% of the recommended solid culture. In general, this biological situation offers a logic explanation to behavior of photosynthates of maize hybrids SC 132 and SC 176 under intercropping conditions during growth and development stages. It seems that this variability of ear leaf area could be a successful strategy to crop improvement for different cropping systems. Certainly, differences in growth of maize cultivars were mainly due to their leaf area expansion rate (Akmal *et al*., 2010).

Consequently, crop canopy of maize hybrid SC 132 may by reflected positively on high capacity of root system that can make a larger volume of root system extraction of more water and nutrients compared to the yellow hybrid. Leaf area is usually influenced by genotype, planting density, climate and soil fertility (Shafi *et al.*, 2012).

For ear length, it was not significantly affected by the cropping systems in the first season, while the reverse was true in 2016 season (Table 4). The highest value of this trait was recorded in intercropping pattern 100% peanut + 50% white maize hybrid SC 132 which had no significant differences with 100% peanut + 67% white maize hybrid SC 132, solid culture of white maize hybrid SC 132 and 100% peanut + 33% white maize hybrid SC 132 compared with others in the second one. These results could be due to genetic variability between the two hybrids which led to difference in ear length as a result of assimilates and it's partitioning to the cob. It seems that maize hybrid SC 132 was more effective in translocating photosynthates from leaves and stalks to the developing ears than SC 176 under sandy soil conditions. According to Valentinuz and Tollenaar (2006), it is likely that canopy architecture of white maize hybrid SC 132 influenced positively the interception and utilization of solar radiation which reflected on increase in dry matter accumulation and thereby ear length in the second season. These results reveal that there was higher intra-specific competition between plants of yellow maize hybrid SC 176 than the white hybrid for basic growth resource especially solar radiation with regardless to maize plant density unit area^{-1} in the second season. With respect to ear diameter, intercropping pattern 100% peanut + 50% white maize hybrid SC 132 produced the highest ear diameter which had no significant differences with 100% peanut + 67% white maize hybrid SC 132 and 100% peanut + 33% white maize hybrid SC 132 and solid culture of white maize hybrid SC 132 compared with others in the first season (Table 4). On the other hand, intercropping pattern 100% peanut + 50% white maize hybrid SC 132, 100% peanut + 67% white maize hybrid SC 132 or solid culture of white maize hybrid SC 132 and 100% peanut + 33% white maize hybrid SC 132 recorded the highest ear diameter compared with other treatments in the second one. These results could be attributed to the larger genetic make up variability of white maize hybrid SC 132 than the yellow hybrid to interact positively with different cropping systems which had stable effect on ear diameter. So, it may be possible that genetic potential of white maize hybrid SC 132 translated into suitable canopy architecture that induced a deeper root system and a faster horizontal root development, indicting efficient use of all nutrients by all parts of white maize hybrid SC 132 compared to the yellow hybrid. There were significant genetic differences for morphological parameter among maize genotypes (Ihsan *et al.*, 2005). The highest value of cob diameter was observed in intercropping pattern 100% peanut + 33% white maize hybrid SC 132 which had no significant differences with intercropping pattern 100% peanut + 67% yellow maize hybrid SC 176, intercropping pattern 100% peanut + 67% white maize hybrid SC 132 and solid culture of maize hybrid SC 132 or SC 176 compared with other treatments in the first season (Table 4). However, solid culture of white maize hybrid SC 132 produced the highest cob diameter which had no significant differences with intercropping pattern 100% peanut + 67% maize hybrid SC 132 or SC 176 compared with other treatments in the second one. It is noteworthy that cobs may be considered as temporary sink and the stored photosynthates were translocated to grains during their development. These results probably due to canopy architecture of yellow maize hybrid SC 176 of solid culture had adverse effects on the translocated photosynthates from the leaf to the different parts of the plant and this effect was decreased by decreasing maize plant density unit area^{-1} up to 33% of the recommended solid culture during growth and development stages in comparison with the other treatments. With respect to kernel depth, the highest number of this trait was observed in intercropping pattern 100% peanut + 50% white maize hybrid SC 132 which had no significant differences with intercropping pattern 100% peanut + 67% white maize hybrid SC 132, solid culture of white maize hybrid SC 132 and solid culture of yellow maize hybrid SC 176 compared with other treatments in 2015 and 2016 seasons. These results probably due to genetic potential between the two maize hybrids that regulated sink and source metabolism was differed in the cropping systems. It seems that white maize hybrid SC 132 tended to be interacted positively with decreasing maize plant density unit area^{-1} up to 33% of the recommended solid culture to achieve the highest kernel depth compared with the other treatments. For the number of rows ear^{-1}, it was not significantly affected by the cropping systems in the first season, while the highest value of this trait was observed in intercropping pattern 100% peanut + 33% white maize hybrid SC 132 which had no significant differences with 100% peanut + 50% white maize hybrid SC 132, 100% peanut + 67% white maize hybrid SC 132 and solid culture of white maize hybrid SC 132 compared with other treatments in 2016 season (Table 4). These results could be attributed to number of rows ear^{-1} depends mainly on the genetic effects of maize plant. These results reveal that yellow maize hybrid SC 176 interacted stability with the cropping systems to give low number of rows ear^{-1} among the studied cropping systems. With regard to number of kernels row^{-1} in the first season, the highest number of this trait observed in intercropping pattern 100% peanut + 33% white maize hybrid SC 132 which had no significant differences with intercropping pattern 100% peanut + 33% yellow maize hybrid SC 176 compared with others. On the contrary, number of kernels row^{-1} was not significantly affected by the cropping systems in the second one. Under the cropping systems, decreasing plant density of maize hybrid SC 132 or SC 176-unit area^{-1} from 67 to 33% the recommended solid culture resulted in largely balance in plant–to–plant competition for climatic and edaphic environmental conditions that enhanced ear leaf area for converting more solar energy to chemical energy and more translocation of photosynthates metabolites to the sink (ears). These results reveal that fertilized embryos ear^{-1} of maize hybrid SC 132 or SC 176 was likely to be much affected in the cropping systems. These results are in accordance with those obtained by Shafi *et al.* (2012) who indicated that grains ear-1 was not affected significantly by the maize cultivar x plant density. With respect to 100-kernel weight, the highest value of this trait was obtained in solid culture of white maize hybrid SC 132 followed by solid culture of yellow maize hybrid SC 176 compared with the others in the first season (Table 4). Also, solid culture of white maize hybrid SC 132 produced the highest 100-kernel weight which had no significant differences with solid culture of yellow maize hybrid SC 176 followed by intercropping pattern 100% peanut + 67% white maize hybrid SC 132 compared with other treatments in the second one. These results could be due to the variation in photosynthates partitioning of maize plant because of the differences in genetic structure (Ahmed *et al.*, 2015; Sadek *et al.*, 2006), and the effect of this variation had disappeared by decreasing yellow maize plant density unit area^{-1} from 67 to 33% of the recommended solid culture. With respect to grain yield fad^{-1}, the highest number of this trait was observed in solid culture of white maize hybrid SC 132 which had no significant differences with solid culture of yellow maize hybrid SC 176 compared with other treatments (Table 4). Also, the highest grain yield fad^{-1} was observed in solid culture of white maize hybrid SC 132 which had no significant differences with solid culture of yellow maize hybrid SC 176 compared with other treatments in the second one. Obviously, growth and development of different parts of the two maize hybrids were similar during growth and development stages under solid culture conditions. It is known that the population of plants square meter^{-1} and arrangement of individual plants within the square meter determine nutrient use and grain yield of maize (Wade *et al.*, 1988). These results suggest that light transmission inside maize canopy of solid culture was not changed between the two hybrids, and the reverse was true for intercropping culture. Plant dry matter production often shows a positive correlation with the amount of intercepted radiation by crops in sole cropping (Kiniry *et al.*, 1989). Certainly, grain yield unit area^{-1} increased with increasing plant density until the increase in yield attributable to plants is offset by decline in mean yield plant^{-1} (Tollenaar and Wu, 1999). These results are like those obtained by Shafi *et al.* (2012) who revealed that there were significant variations in grain yield due to plant population, varieties and their interaction. Also, Dahmardeh (2013) showed that the highest grain yield for maize cv. KSC 604 of solid culture recorded the highest grain yield ha^{-1} compared with the other treatments.

3.2 Peanut pod yield and its attributes

Plant height, the numbers of branches and pods plant^{-1}, pod yield plant^{-1}, 100 – pod weight, 100 – seed weight and pod yield fad^{-1} were significantly affected by the cropping systems in the two growing seasons (Table 5). With respect to plant height in the first season, the maximum plant height was recorded in intercropping pattern 100% peanut + 67% white maize hybrid SC 132 which had no significant differences with intercropping pattern 100% peanut + 67% yellow maize hybrid SC 176, meanwhile solid culture of peanut produced the shortest plant compared with other treatments.

Table (5): Pod yield of peanut and its attributes as affected by the cropping systems in 2015 and 2016 seasons.

Characters / Treatments	Plant height (cm)	Number of branches plant^{-1}	Number of pods plant^{-1}	Pod yield plant^{-1} (g)	100 –pod weight (g)	100 –seed weight (g)	Pod yield fad^{-1} (ardab)
			2015 season				
Solid culture of maize hybrid SC 132	48.1	13.4	32.9	46.0	213.6	144.7	20.0
100%peanut+67%maize hybrid SC 132	66.6	9.4	19.3	27.9	161.7	94.6	10.8
100%peanut+50%maize hybrid SC 132	61.2	10.1	21.8	31.1	171.1	104.4	12.4
100%peanut+33%maize hybrid SC 132	54.4	11.1	26.0	41.0	193.7	123.9	17.9
Solid culture of maize hybrid SC 176	64.5	9.3	18.8	27.2	164.2	97.3	10.9
100%peanut+67%maize hybrid SC 176	61.9	11.2	26.5	35.1	178.9	109.5	12.6
100%peanut+50%maize hybrid SC 176	53.7	12.0	27.8	42.2	196.8	127.9	18.3
100%peanut+33%maize hybrid SC 176	3.2	0.9	1.4	2.5	6.2	4.5	0.8
L.S.D. 0.05	48.1	13.4	32.9	46.0	213.6	144.7	20.0
			2016 season				
Solid culture of maize hybrid SC 132	50.0	11.4	31.5	52.1	151.0	106.7	19.6
100%peanut+67%maize hybrid SC 132	58.8	7.8	18.4	23.3	107.3	64.6	9.1
100%peanut+50%maize hybrid SC 132	57.3	8.4	21.8	28.9	114.8	72.7	12.2
100%peanut+33%maize hybrid SC 132	54.0	9.6	24.1	41.2	133.8	84.1	16.3
Solid culture of maize hybrid SC 176	58.2	8.1	19.8	25.4	106.7	65.5	9.6
100%peanut+67%maize hybrid SC 176	54.4	9.5	24.6	32.4	116.1	76.7	13.8
100%peanut+50%maize hybrid SC 176	54.6	10.0	26.9	43.4	136.3	86.5	17.0
100%peanut+33%maize hybrid SC 176	4.3	1.2	2.5	4.0	4.0	3.2	0.9
L.S.D. 0.05	50.0	11.4	31.5	52.1	151.0	106.7	19.6

Also, intercropping pattern 100% peanut + 67% white maize hybrid SC 132 achieved the tallest plant of peanut which had no significant differences with intercropping patterns 100% peanut + 67% yellow maize hybrid SC 176 and100% peanut + 50% white maize hybrid SC 132 in 2016 season, but solid culture of peanut produced the shortest plant compared with other treatments. This effect may be due to genetic make-up of peanut cultivar. Such responses would be translated into alteration of plant height growth rate for helping the plant to reach enough light. With regardless to maize hybrid, it is expected that there were more shading around peanut plants of intercropping culture that suffered from mutual shading and this effect was increased by increasing maize plant density unit area $^{-1}$ from 33 to 67% of the recommended solid culture compared to those of peanut solid culture. These results are in accordance with those obtained by Hefny and Hemdan (2016) who showed that intercropping pattern 100% peanut + 25.0% maize decreased plant height by 6.16 and 10.66% compared to 100% peanut + 37.5% maize and 100% peanut + 50% maize, respectively. About number of branches plant^{-1}, the highest number of branches plant^{-1} was recorded in solid culture of peanut followed by intercropping pattern 100% peanut + 33% yellow maize hybrid SC 176 which had no significant differences with intercropping pattern 100% peanut + 50% yellow maize hybrid SC 176 in 2015 and 2016 seasons (Table 5). On the other hand, the lowest number of branches plant^{-1} was recorded in intercropping pattern 100% peanut + 67% white maize hybrid SC 132 which had no significant differences with intercropping pattern 100% peanut + 67% yellow maize hybrid SC 176 and intercropping pattern 100% peanut + 50% white maize hybrid SC 132 in 2015 and 2016 seasons. About white maize hybrid SC 132, increasing maize plant density unit area $^{-1}$ from 33 to 67% of the recommended solid culture could be formed unfavorable environmental conditions for peanut growth and development which increased shading and decreased light penetration to the peanut plants and ultimately increase in plant hormones of peanut. In other words, canopy architecture of yellow maize hybrid SC 176 would be suitable to decrease the adverse effects of shading on the peanut in case of increasing maize plant density unit area^{-1} from 33 to 50% of the recommended solid culture during peanut growth and development. These results show that peanut leaves could be associated with the adaptation of the low light environment resultant from yellow maize hybrid SC 176 to intercept more light energy under intercropping pattern 100% peanut + 50% maize. These results are in accordance with those obtained by El Mekser *et al*. (2008) who found that intercropping of different maize hybrids was linked to a significant decrease in number of branches plant^{-1} in peanut crop. Similar results were observed by Hefny and Hemdan (2016) who found that 100% peanut + 25.0% maize pattern had higher number of branches plant^{-1} than 100% peanut + 37.5% maize pattern or 100% peanut + 50% maize pattern. For number of pods plant^{-1}, the highest number of pods plant^{-1} was obtained in solid culture of peanut followed by intercropping pattern 100% peanut + 33% yellow maize hybrid SC 176 which had no significant differences with intercropping pattern 100% peanut + 50% yellow maize hybrid SC 176 in 2015 and 2016 seasons (Table 5). Also, the lowest number of pods plant^{-1} was observed in intercropping pattern 100% peanut + 67% white maize hybrid SC 132 which had no significant differences with intercropping pattern 100% peanut + 67% yellow maize hybrid SC 176 in 2015 and 016 seasons. Obviously, increasing maize plant density unit area^{-1} from 33 to 50% of the recommended solid culture increased adverse effects of shading on number of pods plant^{-1} and this negative effect was disappeared by intercropping peanut with yellow maize hybrid SC 176. Considering shading effects of maize, white maize hybrid SC 132 reduced number of pods plant^{-1} by 17.73% in the first season and 11.38% in the second season compared with the yellow hybrid under intercropping pattern 100% peanut + 50% maize. Accordingly, these results probably due to peanut plants of solid culture benefited greatly from available environmental resources that enhanced efficiency of biological nitrogen fixation of peanut which where this biological process is dependent on the legume's ability to intercept light (Fujita and Ofosu-Budu, 1996). These results reveal that canopy architecture of yellow maize hybrid SC 176 was more compatible with peanut to increase maize plant density unit area^{-1} from 33 to 50% of the recommended solid culture under intercropping conditions. Similar results were observed by El Mekser *et al*. (2008) who found that intercropping of different maize hybrids was linked to a significant decrease in pod weight plant^{-1}. The highest pod yield plant^{-1}, 100 – pod weight and 100 – seed weigh was observed in solid culture of peanut followed by intercropping pattern 100% peanut + 33% yellow maize hybrid SC 176 compared with the others in 2015 and 2016 seasons (Table 5). These results probably due to canopy architecture of the two maize hybrids interacted differently with number of maize plants unit area^{-1} to influence negatively on peanut growth and development under intercropping conditions. This influence was deceased by growing yellow maize hybrid SC 176 with 6600 plants fad^{-1} instead of white maize hybrid SC 132 under intercropping conditions. It is important to mention that canopy architecture of yellow maize hybrid SC 176 was more compatible with canopy architecture of peanut cultivar than the other hybrid by increasing maize plant density from 33 to 67% of the recommended solid culture. With respect to pod yield fad^{-1}, the highest pod yield fad^{-1} was observed in solid culture of peanut followed by intercropping pattern 100% peanut + 33% yellow maize hybrid SC 176 compared with the others in 2015 and 2016 seasons (Table 5). These results could be due to maize plant density unit area^{-1} and maize hybrid played a major role in peanut growth and development under sandy soil conditions. Increasing plant density of maize hybrid SC 132 from 33 to 67%-unit area^{-1} affected negatively the response of peanut plant to intercept more solar radiation compared to those grown with the yellow hybrid, as well as, increase in competition of water and nutrients such as nitrogen and other treatments. Conversely, it seems to be that low plant density unit area^{-1} interacted positively with canopy architecture of yellow maize hybrid SC 176 and furnished suitable above – ground conditions for peanut growth and development and thereby more translocation of photosynthates metabolites to the seed. Accordingly, it is expected that growth resources were more completely absorbed and converted to crop biomass by the intercrop in 100% peanut + 33% yellow maize hybrid SC 176 over time and space because of differences in competitive ability for growth resources between the component crops (Tsubo *et al*., 2001) compared with the other intercropping patterns. Similar results were observed by El Mekser *et al*. (2008) found that intercropping of different maize hybrids was linked to a significant decrease in pod yield fad^{-1}.

Table (6): Competitive relationships and yield advantages of intercropping peanut with two maize hybrids in 2015 and 2016 seasons.

Treatments \ Characters	Land equivalent ratio			Relative crowding coefficient			Aggressivity	
	L_p	L_m	LER	K_p	K_m	K	Agg_p	Agg_m
2015 season								
100%peanut+67%maize hybrid SC 132	0.54	0.68	1.22	0.78	3.18	2.50	-0.47	+0.47
100%peanut+50%maize hybrid SC 132	0.62	0.54	1.16	0.81	2.36	1.93	-0.46	+0.46
100%peanut+33%maize hybrid SC 132	0.89	0.39	1.28	2.81	1.95	5.50	-0.29	+0.29
100%peanut+67%maize hybrid SC 176	0.54	0.63	1.18	0.80	2.62	2.10	-0.40	+0.40
100%peanut+50%maize hybrid SC 176	0.63	0.58	1.21	0.85	2.78	2.37	-0.53	+0.53
100%peanut+33%maize hybrid SC 176	0.91	0.40	1.32	3.55	2.09	7.45	-0.32	+0.32
2016 season								
100%peanut+67%maize hybrid SC 132	0.46	0.75	1.22	0.58	4.72	2.74	-0.66	+0.66
100%peanut+50%maize hybrid SC 132	0.62	0.61	1.24	0.82	3.23	2.66	-0.61	+0.61
100%peanut+33%maize hybrid SC 132	0.83	0.46	1.29	1.63	2.62	4.28	-0.57	+0.57
100%peanut+67%maize hybrid SC 176	0.48	0.73	1.22	0.64	4.17	2.68	-0.60	+0.60
100%peanut+50%maize hybrid SC 176	0.70	0.61	1.31	1.18	3.14	3.74	-0.51	+0.51
100%peanut+33%maize hybrid SC 176	0.86	0.45	1.32	2.15	2.51	5.42	-0.50	+0.50

3.3 Competitive relationships

3.3.1 Land equivalent ratio

The values of Land equivalent ratio (LER) were estimated by using data of recommended solid cultures of both crops. LER of more than 1.00 indicates yield advantage, equal to 1.00 indicates no gain or no loss and less than 1.00 indicates yield loss (Vendemeer, 1989). It can be used both for replacement and additives series of intercropping. The results obtained were strongly coincided with the definition of LER. The total LER values were greater than one in all the studied treatments. LER ranged from 1.16 by intercropping 100% peanut + 50.0% white maize hybrid SC 132 to 1.32 by intercropping 100% peanut + 33.0% yellow maize hybrid SC 176 in the first season, meanwhile it ranged from 1.22 by intercropping 100% peanut + 67.0% white maize hybrid SC 132 to 1.32 by intercropping 100% peanut + 33.0% yellow maize hybrid SC 176 in the second one (Table 6). LER of 1.32 indicates that the planted area to solid cultures would need to be 32 % greater than the planted area to intercrop to produce the same combined yields (*i.e*. 32 % more land would be required as a solid crop to produce the same yield as intercropping). The advantage of the highest LER by intercropping 100% peanut + 33.0% yellow maize hybrid SC 176 may be due to canopy structure of yellow maize hybrid SC 176 was more compatible with peanut growth and development by decreasing inter and intra-specific competition between the intercrops for basic growth resources compared with the other treatments. This positive effect was enhanced by decreasing plant density of yellow maize hybrid SC 176 from 67 to 33% of the recommended solid culture indicating low competitive ability between the intercrops for basic growth resources. This biological situation led to an increase in relative yield of peanut and consequently LER than the other treatments. In other words, yield advantage of the yellow maize hybrid SC 176 intercropped with peanut may be attributed to the shorter yellow maize hybrids that had less vegetative growth than the white hybrids and therefore the competition of yellow hybrids to peanut is less than the white hybrids. These findings reveal that intercropping maize with peanut enhanced the efficient utilization of sunlight which reflected on intercropping advantages (Jiao *et al*., 2013). Similar results were recorded by Nofal and Attalla (2006) and El-Mekser *et al*. (2008).

3.3.2 Relative crowding coefficient

Data presented in Table (6) indicate that Relative crowding coefficient (RCC) had higher than the unit advantage in all intercropping patterns in both seasons. The best results for K were achieved by the intercropping pattern 100% peanut + 33% yellow maize hybrid SC 176 which were 7.45 and 5.42 in 2015 and 2016 season, respectively. A yield advantage occurred because the component crops differed in their utilization of growth resources in such a way that when they are grown in association, they are able to complement each other and to work better overall use environmental resources than when they were grown separately. Similar results were recorded by Sherif *et al*. (2005).

3.3.3 Aggressivity

Data in Table (6) Show that maize hybrid was the dominant intercrop component in all intercropping patterns in both seasons. The best results for Aggressivity (Agg) were achieved by intercropping patterns which including 100% peanut + 33% yellow maize hybrid SC 176 which were 0.32 and 0.50 in 2015 and 2016 seasons, respectively. Peanut was the dominated component. The present results indicate clearly that the competition of yellow maize hybrid SC 176 to peanut is less than the white maize hybrid SC 132. Similar results were obtained by Nofal and Attalla (2006) and El-Mekser *et al*. (2008).

3.4 Economic evaluation

3.4.1 Total and net returns

The financial return of intercropping maize with peanut as compared with solid culture of peanut is shown in Table (7). Total return of intercropped maize with peanut varied between treatments from L.E. 12285 to 15585 fad^{-1} as compared with solid culture of peanut (L.E. 13620 fad^{-1}) in the first season. Also, total return of intercropped maize with peanut varied between treatments from L.E. 12398 to 15183 fad^{-1} as compared with solid culture of peanut (L.E. 13347 fad^{-1}) in the second one. Net return of intercropped maize with peanut varied between treatments from L.E. 6245 to 10257 fad^{-1}

as compared with solid culture of peanut (L.E. 8982 fad^{-1}) in the first season. Also, net return of intercropped maize with peanut varied between treatments from L.E. 6358 to 9855 fad^{-1} as compared with solid culture of peanut (L.E. 8709 fad^{-1}) in the second one. Net return of intercropping pattern 100% peanut + 33.0% yellow maize hybrid SC 176 recorded the highest net return in comparison with the other treatments in the two growing seasons.

Table (7): Economic advantages of intercropping peanut with two maize hybrids in 2015 and 2016 seasons.

Treatments \ Characters	Economic return (L.E. fad^{-1})					MAI
	Peanut	Maize	Total	Costs	Net	
Season			2015 season			
100%peanut+67%maize hybrid SC 132	7354	5699	13054	6040	7014	2360
100%peanut+50%maize hybrid SC 132	8444	4540	12984	5685	7299	1813
100%peanut+33%maize hybrid SC 132	12189	3284	15474	5328	10146	3453
Mean	9329	4507	13837	5684	8153	2542
100%peanut+67%maize hybrid SC 176	7422	4862	12285	6040	6245	1892
100%peanut+50%maize hybrid SC 176	8580	4443	13024	5685	7339	2280
100%peanut+33%maize hybrid SC 176	12462	3123	15585	5328	10257	3816
Mean	9488	4142	13631	5684	7947	2662
Solid culture of peanut	13620	---	13620	4638	8982	---
Season			2016 season			
100%peanut+67%maize hybrid SC 132	6197	6214	12411	6040	6371	2272
100%peanut+50%maize hybrid SC 132	8308	5055	13363	5685	7678	2591
100%peanut+33%maize hybrid SC 132	11100	3799	14899	5328	9571	3404
Mean	8535	5022	13557	5684	7873	2755
100%peanut+67%maize hybrid SC 176	6537	5860	12398	6040	6358	2290
100%peanut+50%maize hybrid SC 176	9397	4862	14260	5685	8575	3419
100%peanut+33%maize hybrid SC 176	11577	3606	15183	5328	9855	3687
Mean	9170	4776	13947	5684	8262	3132
Solid culture of peanut	13347	---	13347	4638	8709	---

Prices of main products are that of 2016: 322 L.E. for maize ardab and 681 L.E. for peanut ardab.

These results reveal that intercropping pattern 100% peanut + 33.0% maize is more profitable especially yellow maize hybrids than solid culture of peanut for Egyptian farmers. These findings are parallel with those obtained by Metwally *et al.* (2005) who concluded that intercropping maize with peanut was more profitable than solid culture of peanut.

3.4.2 Intercropping Economic Advantage

The economic performance of the intercropping was evaluated to determine if maize and peanut combined yields are high enough for the farmers to adopt this system. The averages of monetary advantage index (MAI) values of intercropping peanut with yellow maize hybrid SC 176 were higher than the other treatments (Table 7). Differences between the highest and the lowest values were L.E. 2003 in the first season and L.E. 1415 in the second season. The lowest plant density of white maize hybrid SC 132 achieved the highest MAI compared to the others. Moreover, there were gradual and consistent decreases in MAI values with increasing plant density of yellow maize hybrid SC 176 from 33 to 67% of solid culture. Growing peanut with yellow maize hybrid SC 176 was mainly influenced by the price of harvested economic yield, resulted in high MAI and could be recommended.

4. Conclusions

Our results reveal that the combined effect of yellow maize hybrid SC176 with planting density of 6600 plants fad^{-1} (100% peanut + 33.0% maize) produced high land usage and agro-economic feasibility under sandy soil conditions.

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