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RESPONSE OF GROUNDNUT TO INTERCROPPING WITH MAIZE

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ABSTRACT

Two field experiments were conducted in 2015 and 2016 seasons at Kom Ombo, (latitude of 24°28'N, longitude of 32°57'E and altitude of 108 m), Aswan Governorate, Egypt. Each experiment contained nine treatments of intercropping groundnut (companion crop) with maize (main crop) on ridges at different plant densities of both crop i.e., P_1 = 100% main crop + 100% companion crop, P_2= 100% main crop + 75% companion crop, P_3= 100% main crop + 67% companion crop, P_4 = 100% main crop + 50% companion crop, P_5 =100% main crop + 33% companion crop P_6 =75% main crop + 100% companion crop, P_7 =67% main crop + 100% companion crop, P_8 =50% main crop + 100% companion crop, P_9 =33% main crop + 100% companion crop, beside pure stands of main crop and companion crop. Results indicated that maize and groundnut plants grown under intercropping showed significant variation in 100-grain weight, grain yield/plant, grain yield/fed., and crude protein for maize, as well as number of branches/plant, number of pods / plant, 100- seed weight, pods yield /fed., crude protein and oil percentage of groundnut during the two seasons. Grain yield/fed. of maize and pods yield/fed. of groundnut were significantly reduced by all intercropping systems. The least reduction was recorded at (P_2) ratio. The (P_2) ratio was the best for land utilization as indicated by land equivalent ratio and the most efficient intercropping ratio concerning relative crowding coefficient. The (P_1) ratio was more aggressive on maize. All intercropping ratios of groundnut with maize achieved higher economic return than pure maize and the most profitable ratio was (P_2).

INTRODUCTION

Intercropping can achieve higher yield per unit area than sole crops by using environmental resources more fully over time or more efficiently in space. Intercropping is defined as two crops differing in height, canopy, adaptation and growth habits grown simultaneously with least competition. Intercropping is an important practice to increase the total yield per unit area. It is recommended to increase total agricultural production in Egypt (Metwally, 1999). Maize (*Zea mays L.)* is the main summer cereal crop in Egypt, considering acreage and total production. In cereal-legume intercropping systems, the cereal benefits from the nitrogen fixed by the legume crops and from the decomposition of nutrient rich biomass from root and nodules of the legume, therefore, the increased yield of maize may be attributed to nitrogen fixing ability of legumes (Metwally *et al.,* 2007). Groundnut (*Arachis hypogaea*) cultivation occurs in 108 countries around the world, and is grown in all tropical and subtropical countries, up to 40° N and S. of the equator. It used as food and feed in the tropics. It contains about 50% oil, 25 to 30% protein, 20% carbohydrate and 5% fiber and ash which make a substantial contribution to human nutrition (Fageria *et al.,* 1997). Harb (1994) studied that the effect of ($^1/_2$: $^1/_2$), (1:1), (2:1), (2:2), (3:1), (3:2) and (4:2) intercropping systems of grain sorghum and maize, compared with pure stand of each, on grain yield per plant and per fed. of both grain sorghum and maize. Also, competition relationships, economic return and energy fixation/m^2 were computed. He found that the greatest values of grain yield per plant and per fed. of grain sorghum were produced form intercropping system (3:1). Intercropping system of ($^1/_2$: $^1/_2$) resulted, highest maize grain yield/ plant and per fed. Cultivating 70000 plants/fed. grain sorghum plant +12000 plants/fed. maize (4:4) intercropping system led to the maximum values of land equivalent ratio (LER), relative crowding coefficient (RCC), economic return and energy fixation/m^2. Addo – Quaye *et al.,* (2011) indicated that the relative time of planting and spatial arrangement are important factors determining the productivity of the maize-soybean intercropping system. Spatial arrangement of single rows of maize alternating with single rows of soybean gave the best yields; (LER) values were in general greater than unity, implying that it will be more productive to intercrop maize and soybean than grow them in monoculture. Dwomon and Quainoo (2012) showed that, generally, the sole crops of maize and groundnut recorded more crude protein and higher grain yields, while the spatial arrangement of 3 rows of maize alternating with 3 rows of groundnut, recorded the least yield. In general, the sole crops recorded higher LER, while the spatial arrangements (3:1, 3:2, 3:3) recorded LER values of 0.91, 0.92 and 0.84, respectively. Abdel-Galil and Abdel-Ghany (2014) showed that intercropping pattern 3

groundnut : 1 sesame recorded higher groundnut yield and its attributes (plant height, numbers of branches and pods per plant, seed index, seed yield per plant, seed yield per ha, crude protein and oil percentage) than 2:2 pattern, while, the highest sesame yield and its attributes(plant height, numbers of branches and capsules per plant, seed index and shelling %) was obtained by 2:2 pattern. Land equivalent ratio (LER) ranged from 1.22 to 1.44. LER Values of 2:2 pattern exceeded that of 3:1 pattern. The highest LER was obtained when growing sesame with groundnut in 2:2 pattern and using the highest rate of nitrogen The relative crowding coefficient (RCC) in 2:2 was associated with relatively heavier competition compared to 3:1 pattern. The lowest aggressivity was associated with 2:2 pattern. Begum *et al., (*2016) revealed that yield and yield components (1000-grain weight and grain yield) of maize were influenced significantly by different intercropping systems. Metwally *et al.,* (2018) showed that harvested maize plants for fodder produced the highest increment in yield/ha of groundnut plant (54.59 and 27.80% during the first and second seasons, respectively) as compared with intercropped groundnut plants with harvested maize for grains without defoliation. Maximum LER values (1.64 and 1.69) were obtained when the maize harvested for fodder and peanut plants were grown under low density (24000 plants/ha) during the two seasons, respectively. Maximum net return/ha (1696.2 and 836.9 US$) were recorded when the maize harvested for grains with defoliation and peanut plants were grown under 50% of full stand of maize plants (24000 plants/ha).

The objective of this study aimed at measuring the effect of intercropping groundnut on maize on yield and yield components, chemical analysis, competitive relationships and the economic return of both crops under Aswan Governorate conditions.

MATERIALS AND METHODS

Two field experiments were conducted in 2015 and 2016 seasons at Kom Ombo, (latitude of 24°28'N, longitude of 32°57'E and altitude of 108 m), Aswan Governorate, Egypt, to study the effect of intercropping of maize (*Zea mays, L.*) cv. Single cross Giza-154, as main crop, with groundnut (*Arachis hypogaea L.*) cv. Giza-6, as companion crop, on yield and yield components, chemical analysis of both crops, competitive relationships and the economic return.

Studied factors:

The experiment contained nine treatments as follows:

1- P_1 = 100% main crop + 100% companion crop (cultivate the secondary crop on all ridges of main crop)
2- P_2= 100% main crop + 75% companion crop (cultivate the secondary crop on three ridges and leave a ridge without planting)
3- P_3= 100% main crop + 67% companion crop (cultivate the secondary crop on two ridges and leave a ridge without planting),
4- P_4 = 100% main crop + 50%

companion crop (cultivate the secondary crop on every other of main crop ridge)

5- P_5 =100% main crop + 33% companion crop (cultivate the secondary crop on one ridge and leave two ridges without planting)

6- P_6 =75% main crop + 100% companion crop (cultivate the main crop on three ridges and leave a ridge without planting)

7- P_7 =67% main crop + 100% companion crop (cultivate the main crop on two ridges and leave a ridge without planting)

8- P_8 =50% main crop + 100% companion crop (cultivate the main crop on one ridge and leave a ridge without planting)

9- P_9 =33% main crop + 100% companion crop (cultivate the main crop on one ridge and leave two ridges without planting)

10- Pure stands of main crop.

11- Pure stand of companion crop.

Soil analysis:

Table (1): physical and chemical analyses of the experiments field soil.

		Seasons	
		2015	2016
Physical properties	Sand	44	45
	Silt	36	34
	Clay	20	21
Soil texture		Loamy	Loamy
Chemical properties	Organic matter %	1.50	1.65
	H Co_3	0.0	0.1
	So_4^{--}	5.3	5.1
	pH (sp 68.7)	8.27	8.15
	E.C (dsm-1)	2.19	2.11
	Total Ca CO3%	2.0	2.05

Experimental design:

-The maize plants were grown on one side of the ridge with the recommended plant spacing of 20 cm between hills and one plant/hill.

- Groundnut plants were grown on one side of the ridge with spacing of 15 cm between hills with two plants/hill.

Calcium super phosphate (15.5 % P_2O_5) was added during seed bed preparation at the rate of 150 kg/fed. The recommended dose of nitrogen fertilizer was added for intercropped groundnut with maize at the rate of 120 kg. N/fed. as Urea (46.5 % N). While in case of groundnut solid crop, nitrogen was applied at the rate of 30 kg N/ fed. for as a recommended dose for nitrogen fertilizer for each crop. The amount of nitrogen fertilizer was divided into two equal doses. The first was applied at 20 days from planting and the second one was applied at 60 days from planting. Seed were sown on April 24th and 22nd in 2015 and 2016 seasons, respectively. The preceding crop was faba bean for all experiments in both seasons. The

experimental design was randomized complete blocks design with four replicates. Area of each plot was 16.8 m^2 (5.6 m. in width and 3 m .in length). The plot consisted of 8 ridges spaced 70 cm apart. All other practices were uniformly applied as recommended for maize and groundnut production in the region.

Studied characters:

A- Yield and yield components:

At harvesting, the plants were harvested from the inner guarded ridges of each plot, in the two seasons, and the following data were recorded:

I - Main crop (maize):

1- 100-grains weight (g).

2- Grains weight/plant (g).

3- Average grain yield (ard./fed.), ardab = 140 kg of maize.

II . Companion crop (groundnut):

1- Number of branches/plants.

2- Number of pods / plants.

3- 100- seed weight (g).

4- Pods yield (Kg. /fed.).

B- Chemical analysis:

1- For main crop (maize) and companion crop (groundnut): Determination of crude protein (C P): total nitrogen content in grains and seeds were estimated using microkjeldahl method as described by A.O.A.C (1980) and percentage of protein was calculated by multiplying the nitrogen percentage by (5.75 for maize and 6.25 for groundnut).

2 - Companion crop (groundnut): Determination of oil percentage of seeds was determined according to A.O.A.C (1975) using a Soxhlet apparatus.

C - Competition relationships

1- Land equivalent ratio (LER) was determined according to Willey (1979).

2- Relative crowding coefficient (RCC) was calculated as described by De-Wit (1960).

3- Aggressivity (A) was determined according to Mc Gilchrist (1965).

D-The Economic return (L.E.):

Net income in Egyptian pounds/fed. for pure stands of maize and groundnut and intercropping systems groundnut with maize were estimated. Price of the yield and the cost of agriculture practices were considered according to the Ministry of Agriculture, Agriculture Research Center, Central Admen of Agric. in 2015 and 2016.

Statistical analysis:

The results were statistically analyzed according to Gomez and Gomez (1984) using the computer MSTAT-C statistical analysis package by Freed *et al.*, (1989). The least significant differences (LSD) test at probability level of 0.05 was manually calculated to compare the differences among means.

RESULTS AND DISCUSSION

Effect of intercropping at different plant densities on yield and yield components, chemical analysis, competitive relationships and the economic return/fed. of maize and groundnut are discussed as follows:

1. The effect on maize crop:

A- Yield and yield components:

Results in Table 2 showed that 100-grain weight, grain yield per plant and feddan of maize intercropped with groundnut at different plants densities

significantly varied during 2015 and 2016 seasons. 100-grain weight of maize was reduced of different intercropping patterns comport to solid planting. This is may be due to the highly competition between groundnut and maize because of close distances between groundnut. This result was in the same line with that reported by Begum *et al., (*2016).

Table (2): Effect of intercropping on 100-grains weight (g), grains weight/plant (g) and grain yield (ard./fed.) of maize intercropped with groundnut during 2015 and 2016 seasons.

Intercropping systems	100-grains weight		grains weight/plant		grain yield (ard./fed.)	
	2015	2016	2015	2016	2015	2016
P_1	30.66	21.90	608.33	622.26	12.60	12.80
P_2	33.63	24.50	614.00	625.13	14.78	14.85
P_3	35.13	24.96	619.33	631.46	13.80	13.95
P_4	35.26	26.86	625.33	635.73	14.21	14.35
P_5	33.50	27.26	633.06	634.53	14.42	14.52
P_6	36.66	32.13	646.73	646.06	12.26	12.39
P_7	39.63	31.30	648.83	645.26	11.79	11.90
P_8	39.00	33.30	648.86	650.20	10.70	10.82
P_9	40.00	33.56	673.73	658.33	9.95	9.98
Pure maize	43.00	37.20	677.36	673.33	14.84	14.99
F test	*	*	*	*	*	*
L.S.D. at 0.05	3.93	3.59	29.12	7.52	0.24	0.05

Regarding to the grain yield/plant, results in Table 2 indicated that all intercropping patterns significantly affected grain yield/plant of maize as combined with groundnut during 2015 and 2016 seasons. However, the treatment (P_1) resulted in the highest reduction in grain yield/plant as compared with the other intercropping systems and pure stands in both seasons. Similar results were recorded by several investigators (Metwally *et al.,* 2018).

Concerning the grain yield/fed. of maize, results in Table 2 showed that there was a significant effect of intercropping patterns on grain yield/fed. of maize during 2015 and 2016 seasons. The pure stands of maize had the higher grain yield/fed. in both seasons, while the treatment of (P_9) recorded the lowest grain yield/fed. compared with the other intercropping patterns and pure stands in both seasons. However, the treatment (P_2) gave the heaviest grain yield/fed. This may attribute to the higher density of maize in that pattern. These data were in agreement with Addo – Quaye *et al.,* (2011).

B- Chemical analysis:

Concerning the crude protein of maize, results in Table 3 revealed significant differences in this trait with intercropping patterns compared with pure stand. The highest crude protein was recorded for pure stand maize, while the intercropped treatments reduced this trait. The lowest values for this trait resulted from (P1) while the highest values resulted from (P4) in both seasons.

Similar results were obtained by Dwomon and Quainoo (2012).

Table (3): Effect of intercropping on crude protein of maize with groundnut during 2015 and 2016 seasons.

Intercropping systems	Crude protein of maize	
	2015	2016
P_1	6.5	7.4
P_2	7.6	8.5
P_3	7.9	8.8
P_4	8.5	9.6
P_5	8.00	9.1
P_6	6.8	7.6
P_7	7.1	7.7
P_8	7.2	7.9
P_9	7.3	8.3
Pure maize	9.1	9.9
F test	*	*
L.S.D. at 0.05	0.63	0.53

II. The effect on groundnut crop:

A- Yield and yield components:

Results in Table 4 showed that number of branches/plants, pod number and 100-seed weight of groundnut significantly varied with intercropping patterns during 2015 and 2016 seasons. The highest values for the above-mentioned traits were recorded for pure stand of groundnut followed by intercropping pattern (P_9) in both seasons. This may be due to the decrease in interspecific competition between groundnut and maize. These results corroborate the earlier findings of Abdel-Galil and Abdel-Ghany (2014).

Concerning the pod yield/fed. of groundnut, results in Table 4 revealed that there was a significant effect of intercropping patterns on pod yield/fed. of groundnut during 2015 and 2016 seasons. The pure stands of groundnut had the highest pod yield/fed. in both seasons, while the treatment of (P_5) reduced the pod yield/fed. sharply as compared with the other intercropping systems and pure stands in both seasons. However, the treatment (P_2) which contained the plant population density of maize 30,000 plants/fed. with 60.000 plants/fed. of groundnut produced the maximum pod yield/fed., as compared with the other intercropping patterns in both seasons. The highest pod yield/fed. were 1278.00 and 1299.50 Kg/fed. during the first and second seasons, respectively. This may be attributed to more light penetration than those grown under heavy maize densities. These data were in agreement with these reported by Abdel-Galil and Abdel-Ghany (2014).

B- Chemical analysis:

Concerning crude protein and oil percentage of groundnut seeds, the results showed significant differences in these traits with intercropping compared with pure stand in both seasons (Table5) The highest values for this trait were recorded for pure stand, while the highest values for this trait in intercropping patterns was for (P_8). On the other hand, the lowest values were recorded for treatment (P_1) in both seasons. Similar results were obtained by Abdel-Galil and Abdel-Ghany (2014).

Table (4): Effect of intercropping on number of branches/plants, number of pods/plants, 100-seed weight and pods yield (Kg/fed.) of groundnut intercropped with maize during 2015 and 2016 seasons.

Intercropping systems	Number of branches/plants		Number of **pods /plants**		100-seed weight		pods yield (Kg/fed.)	
	2015	2016	2015	2016	2015	2016	2015	2016
P_1	13.13	11.33	228.93	214.20	83.76	82.13	1107.94	1130.44
P_2	14.33	11.70	239.46	222.70	88.05	87.30	1278.00	1299.50
P_3	17.40	12.70	240.96	224.10	87.69	88.20	1012.62	1030.40
P_4	18.90	18.63	243.36	225.00	87.56	87.63	990.87	1015.91
P_5	19.33	19.46	247.13	227.16	88.55	88.36	976.63	995.50
P_6	21.36	21.06	255.06	246.53	89.94	88.53	1123.47	1145.67
P_7	22.13	22.46	264.86	248.30	90.97	91.20	1145.71	1189.88
P_8	26.60	26.36	281.06	251.66	91.92	92.40	1196.93	1219.85
P_9	27.70	27.60	283.16	255.50	93.64	93.53	1258.53	1282.25
Pure groundnut	27.83	27.36	287.86	257.00	96.12	95.36	1285.60	1306.75
F test	*	*	*	*	*	*	*	*
L.S.D. at 0.05	3.09	2.42	8.91	4.30	2.85	4.32	14.06	5.62

Table (5): Effect of intercropping on crude protein and oil percentage of groundnut with maize during 2015 and 2016 seasons.

Intercropping systems	Crude protein		Oil percentage	
	2015	2016	2015	2016
P_1	16.5	17.3	37.5	38.4
P_2	17.2	17.9	40.5	41.5
P_3	17.6	18.7	41.6	42.6
P_4	18.5	20.6	47.9	46.5
P_5	17.9	19.5	41.2	44.3
P_6	19.8	21.8	43.8	47.5
P_7	21.3	22.5	45.4	48.2
P_8	22.9	23.9	47.9	49.3
P_9	21.8	23.2	46.8	48.9
Pure groundnut	23.6	24.5	48.6	49.7
F test	*	*	*	*
L.S.D. at 0.05	0.39	0.62	1.19	0.86

COMPETITIVE RELATONSHIPS OF INTERCROPPING GROUNDNUT WITH MAIZE:

1. Land Equivalent Ratio (L.E.R):

Results in Table 6 showed that there was a considerable yield advantage resulting from intercropping groundnut with maize during 2015 and 2016 seasons.

Results in Table 6 showed that land equivalent ratio (LER) values were higher by intercropping groundnut with maize in different patterns during 2015 and 2016 seasons. The highest land equivalent ratio (LER) values were recorded for intercropping system (P_2) in both seasons, which population density of maize was 30,000 plants/ fed. combined with 60,000 plants/fed. of groundnut in both seasons. However, the lowest values of (LER) were recorded for intercropping pattern (P_9), which maize was 33% and groundnut was 100%. These results are in agreement with those obtained by Dwomon and Quainoo (2012).

2. Relative Crowding Coefficient (R.C.C):

Recorded results in Table 7 showed that the relative crowding coefficient (RCC) were also influenced by different treatments in a similar trend as land equivalent ratio (LER) behavior during 2015 and 2016 seasons.

The relative crowding coefficient (RCC) values exceeding unity indicated that net grain in yield was more than accepted from both components. The results also evidenced that increasing the plant density of maize and groundnut led to increase in the total (RCC), i. e., the highest total (RCC) resulted from growing 30,000 plants/fed., maize combined with 60,000 plants/fed. of groundnut at (P_2) intercropping pattern. The same of results was reported by Harb (1994).

Table (6): Land equivalent ratio (LER)of maize and groundnut crops during 2015and 2016 seasons.

Intercropping systems	Land equivalent ratio (L.E.R)					
	2015			2016		
	main crop	secondary crop	L.E.R.	main crop	secondary crop	L.E.R.
P_1	0.849	0.862	1.711	0.854	0.865	1.719
P_2	0.996	0.994	1.990	0.991	0.994	1.985
P_3	0.930	0.788	1.718	0.931	0.789	1.719
P_4	0.958	0.771	1.728	0.957	0.777	1.735
P_5	0.972	0.760	1.731	0.969	0.762	1.730
P_6	0.826	0.874	1.700	0.827	0.877	1.703
P_7	0.794	0.891	1.686	0.794	0.911	1.704
P_8	0.721	0.931	1.652	0.722	0.933	1.655
P_9	0.670	0.979	1.649	0.666	0.981	1.647

Table (7): Relative crowding coefficient (R.C.C) of maize and groundnut crops during 2015and 2016 seasons.

Intercropping systems	Relative crowding coefficient (R.C.C)					
	2015			2016		
	main crop	companion crop	R.C.C	main crop	companion crop	R.C.C
P_1	0.081	0.089	0.007	0.084	0.092	0.008
P_2	3.547	2.421	8.589	1.527	2.581	3.942
P_3	0.191	0.053	0.010	0.193	0.054	0.010
P_4	0.325	0.048	0.016	0.323	0.050	0.016
P_5	0.494	0.046	0.022	0.445	0.046	0.020
P_6	0.068	0.099	0.007	0.069	0.102	0.007
P_7	0.056	0.118	0.006	0.055	0.147	0.008
P_8	0.037	0.194	0.007	0.037	0.202	0.008
P_9	0.029	0.669	0.019	0.029	0.754	0.022

3. Aggressivity (A):

Results in Table 8 showed that, in both growing seasons of this study, maize was dominant at all intercropping patterns.

Highest aggressivity value was obtained when groundnut was intercropped with maize at (P_1) intercropping system. However, it could be concluded that the inter specific competition between maize and groundnut were pronounced in all intercropping systems because of the differences in morphological characters of both crops. These results were also supported by Abdel-Galil and Abdel-Ghany (2014).

Table (8): Aggressivity (A) of maize and groundnut crops during 2015and 2016 seasons.

Intercropping systems	Aggressivity (A)			
	2015		2016	
	main crop	companion	main crop	companion
P_1	+ 0.109	- 0.109	+ 0.108	- 0.108
P_2	+ 0.105	- 0.105	+ 0.103	- 0.103
P_3	+ 0.103	- 0.103	+ 0.102	- 0.102
P_4	+ 0.107	- 0.107	+ 0.106	- 0.106
P_5	+ 0.088	- 0.088	+ 0.089	- 0.089
P_6	+ 0.085	- 0.085	+ 0.084	- 0.084
P_7	+ 0.080	- 0.080	+ 0.079	- 0.079
P_8	+ 0.068	- 0.068	+ 0.065	- 0.065
P_9	+ 0.059	- 0.059	+ 0.057	- 0.057

The economic return per (feddan)

The economic return evaluation for either intercropping maize + groundnut at different intercropping patterns compared with each pure stands of the crops under study are presented in Table 9 during 2015 and 2016 seasons. Intercropping systems for groundnut, as companion crop with maize, although they were of high production cost, but they achieved higher relative net profit than the pure stands of maize during the two experimental seasons. Also, results of the economic return per fed. for intercropping groundnut with maize revealed that all intercropping systems realized more net income than the pure stands of groundnut during the two seasons. In general, the comparison between the intercropping systems which realized the greatest grain yield of maize under intercropping groundnut with maize (P_2) also realized the highest net income per fed. during the two seasons. These results were in agreement with those obtained by Harb (1994) and Metwally *et al.*, (2018).

Table (9): Effect of intercropping systems of groundnut with maize on the economic return/fed. (Egyptian pounds) during 2015 and 2016 seasons.

Intercropping systems	2015			2016		
	Price of the yield	Cost	Net income	Price of the yield	Cost	Net income
P_1	24068.28	9750	14318.28	27420.94	10450	16970.94
P_2	27972.9	9750	18222.9	31650.75	10450	21200.75
P_3	23950.44	9750	14200.44	27162.9	10450	16712.9
P_4	24039.99	9750	14289.99	27347.29	10450	16897.29
P_5	24048.66	9750	14298.66	27233.25	10450	16783.25
P_6	23963.94	9750	14213.94	27237.05	10450	16787.05
P_7	23828.97	9750	14078.97	27368.38	10450	16918.38
P_8	23511.66	9750	13761.66	26746.98	10450	16296.98
P_9	23609.61	9750	13859.61	26791.38	10450	16341.38
Pure maize	12688.20	5050	7638.20	14240.5	5850	8390.50
Pure groundnut	15427.20	4437	10990.20	17641.13	4770	12871.13

CONCLUSION AND RECOMMENDATION

The results showed that the intercropping of maize and peanut under various intercropping systems was more costly but achieved higher economic return compared to the single cultivation of maize. Therefore, the study recommends the (P2) intercropping system for crops under study to achieve the highest economic return under the conditions of study area.

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استجابة الفول السوداني للتحميل على الذرة الشامية

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أجريت تجربتان حقليتان في موسمى2015 و2016 بمنطقة كوم امبو بمحافظة أسوان – مصر (دائرة عرض 24.28 درجة شمالاً وخط طول 32.57 درجة شرقاً وارتفاع 108 متراً عن سطح البحر).

وكان الهدف هو دراسة تحميل محصول الفول السوداني علي محصول الذرة الشامية تحت نظم تحميل مختلفة بكثافات نباتية مختلفة لكلا المحصولين وعلاقة ذلك بالمحصول ومكوناته والتحليل الكيميائي لكل منهما وكذلك العلاقات التنافسية والعائد الاقتصادي لنظم التحميل المختلفة تحت الدراسة مقارنة بالزراعة المنفردة. أوضحت النتائج أن نباتات الذرة والفول السوداني التي تزرع تحت أنظمة التحميل المختلفة كان لنظم التحميل تأثيرا معنويا كبيرا على وزن 100 حبة، ومحصول الحبوب/نبات ومحصول الحبوب/الفدان، ونسبة البروتين بالنسبة للذرة، وعدد الفروع / النبات، وعدد القرون / النبات ووزن 100 بذرة، وإنتاجية القرون / الفدان، نسبة البروتين ونسبة الزيت في البذور للفول السوداني خلال الموسمين. محصول الحبوب اردب/فدان للذرة ومحصول القرون كجم/فدان للفول السوداني نقصت بشكل كبير في جميع أنظمة التحميل، بينما أمكن الحصول علي اعلي القيم تحت نظام التحميل (P_2) في كلا الموسمين. أثبتت النتائج أن تحميل الفول السوداني على الذرة الشامية أدى إلى زيادة كفاءة إستغلال وحدة المساحة في كل نظم التحميل حيث حقق نظام التحميل(P_2) أكبر إستفادة من كفاءة إستغلال وحدة المساحة وأيضا نجد نفس الاتجاه سائدا عند تطبيق معامل الحشد النسبي، بينما أعطي نظام التحميل (P_1) اعلي قيم للعدوانية وقد أعطى محصول الذرة الشامية أكبر قيم للعدوانية (سائد) بينما أعطى محصول الفول السوداني أقل قيم للعدوانية (مسود) خلال الموسمين.

توصي الدراسة بتحميل نباتات الفول السوداني علي الذرة وإتباع نظام تحميل زراعة المحصول الرئيسي بنسبة 100% (ذرة) وزراعة المحصول الثانوي (فول سوداني) بنسبة 75% (P_2) وذلك لتحقيق اعلي عائد اقتصادي من المحصول تحت ظروف منطقة الدراسة.