Effect of Intercropping Patterns and Plant Distribution of Guar with Maize

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ABSTRACT

The present study was carried out at the Agriculture Experimental Farm of Al–Azhar University at Assiut Governorate, Egypt, during 2016 and 2017 seasons to study the effect of intercropping maize {*Zea mays,* L.} cv. Three-way cross Nefertiti – 3, as the main crop with guar {*Cyamposis tetragonoloba* } cv. Local variety as secondary crop. The results could be summarized as follows: Pattern of (P_1) Sgnificantly increased plant height of maize as compared with pure stand and other intercropping patterns. The intercropping pattern of (P_9) maize produced the greatest values of 100-grain weight (g), grains weight / plant (g) and grain yield (ardab /fad.). Significant increase in plant height and leaf area index of guar at all intercropping patterns were detected as compared with the pure stand, While, the number of leaves/plant were of guar decreased at all intercropping patterns as compared with pure stand. The pure stand of guar produced the maximum forage yield/fad. as compared with other intercropping patterns in both seasons. Meanwhile, growing guar under the intercropping pattern of (P_2) produced the highest values of forage yield/fad., as compared with the other intercropping patterns in both seasons. The protein ratio/plant and total ash/plant of grown guar under intercropping pattern of (P_6) produced the maximum as compared with all the other intercropping patterns in both seasons. The highest value of crude fibers for the guar was recorded (P_4) intercropping pattern. Intercropping pattern (P_3) was the best for land utilization from land equivalent ratio (LER) and relative crowding coefficient (RCC). Maize (dominant) and guar had the lowest values for aggressivity. All intercropping patterns of guar with maize achieved higher economic return than pure maize and the most profitable pattern was (P_3).

Key words: Maize, Guar, Intercropping Patterns and Plant Distribution.

INTRODUCTION

Maize is one of the most important cereal crops in the world agricultural economic either as food or as feed. In Egypt, maize is one of the most important cereal crops for human consumption and animal feeding. In addition, several industries are based on products and by – products of maize. Planted area of summer forage crops in Egypt is not sufficient for meat animal's requirements. Farmers used to defoliate maize plants as green fodder for cattle, which resulted in reducing maize yield. The need for an intensive cropping system, to raise the production per land unit is a great target. Intercropping is becoming one of the most popular phenomena among the small young farmers in Egypt. Reasons for this popularity results in more profit and resource maximization and efficient water and soil utilization. Among the many intercropping companions adopted, successfully, are those of sorghum and bean varieties. Because of the importance of legumes in human and animal nutrition, in summer, we have no land to grow any of these legumes. Hitherto, intercropping was the most suitable guide in guar cultivation with maize in summer season.. Akbar *et al*. (2012) mentioned that in conclusion, to get better yield of quality fodder (crude protein – crude fibers - total ash), forage maize should be intercropped with forage legumes, preferably cow pea, under the planting pattern of 30 cm spaced lines in alternate rows. El - Aref *et al.* (2013) results indicated that the (P_5) system was the best for land utilization from land equivalent ratio (LER) and the most efficient intercropping system was obtained from relative crowding coefficient (RCC), although, it was more aggressive on maize. Mahdy and El-Said (2015) results of the economic return per fed. for intercropping forage crops with sesame revealed that all intercropping patterns under testing realized more net income and relative net income than the pure stands of forage crops or pure stand of sesame during the two experimental seasons, reaching their maximum with (P_2) cropping system in both seasons. Mahdy and El-Said (2017) results indicated that the the pure stands of the guar plants produced the maximum forage yield/fad as compared with the other intercropping patterns in both seasons. Meanwhile, growing guar under the intercropping pattern of (P_9) produced the highest values of forage yield/fad. as compared with the other intercropping patterns in both seasons. The protein ratio/plant grown soybean under intercropping pattern of (P_{11}), produced the maximum as compared with all other intercropping patterns. Meanwhile, growing soybean under the intercropping pattern of (P_2) produced the highest value of oil ratio of seeds/plant.Therefore, the main objective of this study was undertaken to examine the effect of intercropping patterns and plant distribution of guar with maize.

MATERIALS AND METHODS

The present study was carried out at the Experimental Farm of Al–Azhar University at

Assiut Governorate, Egypt, during the summer of 2016 and 2017 seasons to study the effect of intercropping maize {*Zea mays,* L.} cv. Three way-cross Nefertiti – 3, as the main crop with guar {*/Cyamposis tetragonoloba* } cv. Local variety as secondary crop on growth, yield and yield components, chemical analysis, competitive relationships and the economic return. The preceding crop was field bean {*Vicia faba*, (L.)} for all experiments in the two seasons.

A split -plot design, with three replications, was used.

(A) The main plots were devoted to the following intercropping patterns of guar with maize.

1-The first pattern (S_1): 100 % main crop + 100 % secondary crop.

2- The second pattern (S_2): 100 % main crop + 75 % secondary crop (by growing secondary crop on three maize ridges and leaving one maize ridge without intercropping).

3- The third pattern (S_3): 100 % main crop + 50 % secondary crop (by growing secondary crop on one maize ridge and leaving one maize ridge without intercropping).

(B) The sub – plots were assigned to three plant distribution of guar with maize as follows:-

1- First plant distribution (T_1): Planting one plant / hill of guar 10 cm apart.

2- Second plant distribution (T_2): Planting two plants / hill of guar 20 cm apart.

3- Third plant distribution (T_3): Planting three plants / hill of guar 30 cm apart.

In all intercropping patterns and pure stand, maize (cv. Three way-cross Nefertiti – 3) was planted at 25 cm apart and growing one plant / hill on one side of the ridges, as well as guar pure stand (Local variety) which was planted at 10 cm apart and growing two plants / hill on two side of the ridges. Sub - plot area was 8.4 m^2 (2.8 m. width and 3 m. length).The plot consisted of 4 ridges spaced 70 cm apart of pure stands and intercropping patterns. The soil type was clay, with P H value of 7.6 and 25% organic matter.

Maize and guar were seeded on May 14 th and 22 th in 2016 and 2017 seasons, respectively.

Calcium superphosphate (15% P_2O_5) at a rate of 150 kg/fad. was applied during land preparation. Nitrogen, in the form of ammonium nitrate (33 % N) at a rate of 120 kg N / fad., was added in two equal doses, before the first and the second irrigations. Other normal practices were adopted, as usually done as a recommended.

Characters studied

(1) Maize (main crop): At harvesting, the ears were harvested from the middle ridge of each plot in the two seasons and the following data were recorded:

A- Plant height in (cm), was measured from soil surface to the top of the plant.

B - 100-grain weight (g).

C- Grains weight/plant (g).

D- Grain yield (Ardab/fad): Ardab = 140 kg (moisture 15.5%).

(2) Guar (secondary crop):

A- Plant height in cm, was measured from soil surface to the top of the plant.

B- Number of leaves/plant.

C- Leaf area index (LAI) as recorded for guar by disk method, which was recommended by Johanson (1967).

D- Forage yield (Ton/fad.) taking one cut after sixty days from sowing**.**

(3) Chemical analysis:

A- Determination of crude protein (C P): Total nitrogen content, in plant, was estimated by using microkjeldahl method, as described by A.O.A.C (1980) and percentage of protein was calculated by multiplying the nitrogen percentage by 6.25.

Table 1: plant density for both components of different treatments.

Treatments	Intercropping patterns secondary crop			Plant population density / fad.		
				Maize	Guar	Total
P_1	(S_1) 100%	(T_1)	One plant / hill of guar a10 cm apart.	22858	57142	80000
P_2		(T_2)	Two plants / hill of guar 20 cm apart.	22858	57142	80000
P_3		(T_3)	Three plants / hill of guar 30 cm apart.	22858	57142	80000
P_4	(S_2) 75 %	(T_1)	One plant / hill of guar 10 cm apart.	22858	42857	65715
P_5		(T_2)	Two plants / hill of guar 20 cm apart.	22858	42857	65715
P_6		(T_3)	Three plants / hill of guar 30 cm apart.	22858	42857	65715
P_7	(S_3) 50%	(T_1)	One plant / hill of guar 10 cm apart.	22858	28571	51429
P_8		(T_2)	Two plants / hill of guar 20 cm apart.	22858	28571	51429
P_9		(T_3)	Three plants / hill of guar 30 cm apart.	22858	28571	51429
P_{10}	Solid maize			22858	-	22858
P_{11}	Solid guar			-	114285	114285

B- Determination of total ash content (TAC): The total ash content was determined by heating the samples (0.5 – 2.0g) in an about 600 + 10 ^{0}C for 3 hr until they were completely ashes A.O.A.C (1975).

C- Determination of crude fibers (C F): The crude fibers content was determined according to the official method A.O.A.C (1975).

4- Competitive relationships and yield advantages of intercropping:

A- Land equivalent ratio (LER) was estimated according to **Willey (1979).**

B- Relative crowding coefficient (RCC) was calculated as described by Hall (1974).

C- Aggressively (A) was determined according to Mc-Gilchrist (1965).

5 - The Economic return:

Net income, in Egyptian pounds/fad., for pure stands of maize and guar as well as intercropping patterns guar with maize, was estimated. Price of the yield and the cost of agricultural practices were considered, according to the Ministry of Agriculture, Agricultural Research Center, Central Admen of Agric. in 2016 and 2017.

6 - Statistical analysis:

The data were statistically analyzed according to procedures outlined by Steel and Torrie (1980). Least significant difference (L.S.D.), at 5 % level of probability, was used to compare among treatment means.

RESULTS AND DISCUSSION

1. The effect of intercropping on maize crop: The effect of applied intercropping patterns on yield and yield components of maize, as combined with guar during 2016 and 2017 seasons, is presented in Table 2.

Maize, grown under the intercropping pattern of (P_1) resulted in the tallest plant as compared to the pure stand or the other intercropping patterns, during the two experimental seasons. On the other hand, the shortest maize plants were produced from planting the pure stand, during the two seasons.

Results in Table 2 show that the intercropping pattern of (P_9) which contained the plant population density of maize, 22858 plants/fad. combined with 28571 plants/fad. of guar, produced the highest values of 100-grain weight (g), grain weight / plant (g) and grain yield (ardab /fad.) as compared to the intercropping patterns during 2016 and 2017 seasons. The competition between maize and guar was high because of close distances between guar. As the number of increased guar sides, the competition was not too much to reduce 100-grain weight (g), grains weight / plant (g) and grain yield (ardab /fad.) of maize.

The pure stand of maize had the highest 100-grain weight (g), grains weight / plant (g) and grain yield (ardab /fad.) of maize in both seasons.

Generally, the results in Table 2 clarify that the maize planting under the intercropping pattern (P_1) which contained the plant population density of maize, 22858 plants/fad. combined with 57142 plants/fad. of guar, led to decrease the values of No. of branchs/plant, 100-grain weight (g), grain weight / plant (g) and grain yield (ardab /fad.) as compared with the pure stand or all the other intercropping patterns during in both seasons. These results are in agreement with Kamal - Eldin (2010), Haruna *et al.* (2013), Abdel – Galil and Abdel – Chany (2014), Puste *et al.* (2014) and Oyeogbe *et al.* (2015).

2- Effect of intercropping on guar:

A- Growth characters and forage yield (ton/fad.):

Results in Table 3 showed the effect of intercropping patterns on average plant height, number of leaves/plant and leaf area index of guar during 2016 and 2017 seasons.

Table 2: Effect of intercropping on yield and some agricultural characters of maize.

Treatments			Plant height (cm.)		100-grain weight (g)		Grains weight / plant (g)		Grain yield (ardab/fad.)	
			2016	2017	2016	2017	2016	2017	2016	2017
P_1	S_1	T_1	277.21	280.56	35.07	34.11	175.24	175.94	20.21	19.85
P_2		T_2	268.47	269.94	40.92	41.33	185.14	186.55	22.00	22.33
P_3		T_3	256.00	257.90	45.27	44.00	195.23	194.83	23.70	23.91
P_4	S_2	T_1	271.54	273.88	37.55	36.15	178.56	177.16	21.34	21.67
P_5		T_2	264.35	267.00	41.66	42.00	189.66	190.18	22.46	22.20
P_6		T_3	252.77	250.98	46.94	47.42	197.70	196.00	23.97	23.50
P_7	S_3	T_1	268.44	270.00	38.39	39.28	180.57	182.27	21.90	21.34
P_8		T_2	260.91	261.11	43.55	42.74	192.00	193.99	23.12	23.00
P_9		T_3	250.24	253.61	48.38	48.98	203.11	201.87	24.39	24.10
P_{10}	Soled maize		244.69	248.26	51.17	54.69	207.82	209.45	24.81	25.28
L.S.D. 5%			2.11	1.97	2.43	2.88	3.29	4.13	2.19	2.54

Table 3: Effect of maize– guar intercropping patterns on growth character of guar during 2016 and 2017 seasons.

Treatments			Plant height (cm)		Number of leaves / plant		Leaf area index (LAI)		Forage yield (ton/fad.)	
			2016	2017	2017	2017	2017	2017	2016	2017
P_1	S_1	T_1	88.75	89.56	30.55	31.91	2.25	2.37	14.197	14.065
P_2		T_2	80.94	82.19	38.66	38.00	2.77	2.59	14.930	14.746
P_3		T_3	72.25	73.66	44.15	43.84	3.11	3.00	14.541	14.370
P_4	S_2	T_1	85.66	87.28	33.94	34.11	2.29	2.50	12.377	12.109
P_5		T_2	78.42	78.84	40.00	41.55	2.85	2.91	12.711	12.900
P_6		T_3	69.11	71.47	46.33	45.70	3.33	3.20	12.406	12.611
P_7	S_3	T_1	84.22	86.35	35.24	36.67	2.38	2.47	8.924	9.224
P_8		T_2	75.33	76.94	41.85	43.00	2.90	2.99	9.842	10.017
P_9		T_3	67.80	68.00	48.74	47.94	3.69	3.64	9.333	9.780
P_{10}	Soled guar		65.17	64.34	52.86	54.18	1.88	1.90	16.517	17.000
L.S.D. 5%			2.33	2.71	1.88	1.64	0.18	0.25	2.75	2.44

Results, in Table 3 showed that the intercropping patterns had a significant effect on guar plant height during 2016 and 2017 seasons. The guar grown under intercropping pattern of (P_1) which contains the population density of maize, 22858 plants/fad. combined with 57142 plants/fad. of guar, gave the tallest plants as compared with the pure stand and all the other intercropping patterns in both seasons.

Results in Table 3 showed that intercropping patterns had significant effect on number of leaves per plant of guar in both seasons. Generally, it is clear that number of leaves/plant of guar tended to decrease when grown under the different intercropping patterns as compared with the pure stand. The guar crop sown under the intercropping pattern (P_9) which contains the population density of maize 22858 plants/fad., combined with 28571 plants/fad. of guar showed a highest number of leaves/plant as compared with the other intercropping patterns in 2016 and 2017 seasons. While, the intercropping pattern of (P_1) was the lowest number of leaves/plant as compared with the other intercropping patterns.

Concerning the effect of the applied intercropping patterns on LAI, results recorded in Table 3 showed a significant effect on the leaf area index (LAI) for guar plants during 2016 and 2017 seasons.

The intercropping pattern (P_9) of guar produced the highest values of LAI as compared with the pure stand or the other intercropping patterns in both seasons, While, the intercropping pattern of (P_1) of guar led to reduction in the LAI of guar as compared with other intercropping patterns during 2016 and 2017 seasons. The lowest values of LAI were recorded for pure stand of guar, as compared with all the other intercropping patterns in both seasons. These results are in agreement with those obtained by Adeniyan *et al*. (2011) and Akbar *et al*. (2012).

The effect of applied intercropping patterns on forage yield (ton/fad.) of guar as grown with maize in 2016 and 2017 seasons is presented in Table 3.

The pure stand, of the guar plants, produced the maximum forage yield (ton/fad.) as compared with the other intercropping patterns in both seasons. Meanwhile, the guar, grown under the intercropping pattern of (P_2) when plant population density of maize, 22858 plants/fad., combined with 57142 plants/fad. of guar, produced the highest values of forage yield (ton/fad.) as compared with the other intercropping patterns in both seasons. On the other hand, the guar plants grown under the intercropping pattern of (P_7) which had the plant population density of maize, 22858 plants/fad. combined with 28571 plants/fad. of guar, produced the lowest forage yield (ton/fad.) as compared with the pure stand and the other intercropping patterns in both seasons. Similar results were obtained by Dahmardeh *et al. (*2010), Adeniyan *et al.* (2011), Akbar *et al*. (2012), Mahdy and El-Said (2015) and Mahdy and El-Said (2017).

3- Chemical analysis:

Concerning the protein ratio/plant and total ash /plant of guar, results in Table 4 revealed that the above mentioned characters were decreased significantly by intercropping as compared with the pure stand during the two seasons. Guar crop, grown under intercropping pattern (P_6) which contains the population density of maize, 22858 plants/fad. combined with 42857 plants/fad. of guar, had the highest value of protein content/plant and total ash/plant as compared with all the other intercropping patterns during both seasons. while, the intercropping pattern of (P_1) which contain the population density of maize, 22858 plants/fad. combined with 57142 plants/fad. of guar, was the lowest values for these traits as than with the other intercropping patterns in both seasons.

Table 4: Effect of intercropping on protein ratio / plant, total ash ratio / plant and crude fibers ratio / plant of guar during 2016 and 2017 seasons.

Treatments			Protein ratio / plant		Total ash ratio / plant		Crude fibers ratio / plant	
			2017	2017	2017	2017	2016	2017
P_1	S_1	T_1	26.96	26.34	19.60	19.85	12.46	12.27
P_2		T_2	28.81	28.54	22.12	22.29	11.85	11.55
P_3		T_3	29.91	29.72	23.30	23.11	9.51	9.94
P_4	S_2	T_1	27.39	27.83	21.64	21.93	12.72	12.87
P_5		T_2	29.62	29.40	22.77	22.40	10.90	10.49
P_6		T_3	30.75	30.59	24.53	24.79	9.66	9.42
P_7	S_3	T_1	27.00	27.15	20.35	20.58	12.11	12.00
P_8		T_2	29.17	29.28	22.41	22.00	10.25	10.62
P_9		T_3	30.24	30.11	23.85	23.61	9.15	9.33
P_{10}	Soled guar		31.17	31.99	25.57	26.33	8.70	8.20
L.S.D. 5%			0.41	0.35	0.54	0.75	0.19	0.28

The highest value of crude fibers for the guar, was obtained at (P_3) intercropping patterns at maize, population density of 22858 plants/fad. combined with 57142 plants/fad. of guar, while the lowest values of crude fibers from planting guar at the intercropping pattern of (P_7) in both seasons. Similar results were obtained by Elena and Roman (2010), Dahmardeh *et al. (*2010), Akbar *et al*. (2012) and Mahdy and El-Said (2017).

4– Competitive relationships of intercropping guar with maize:

A. Land Equivalent Ratio (LER):

Results in Table 5 show that there was a considerable yield advantage as results of intercropping guar with maize during 2016 and 2017 seasons. Results in Table 5 show that land equivalent ratio (LER) was increased over one by intercropping guar with maize in different patterns during 2016 and 2017 seasons. The highest LER values were obtained by intercropping pattern of (P_3) at which maize population density of 22858 plants/fad. combined with 57142 plants/fad. of guar in both seasons. These results are in agreement with those obtained by Ahmad *et al* (2010), Dahmardeh *et al. (*2010), Chivas *et al*. (2011), Addo – Quaye *et al.* (2011) and Quainoo1 *et al*. (2012), El - Aref *et al.* (2013) and Mahdy and El-Said (2017).

B. Relative crowding coefficient (RCC):

Results in Table 6 showed that the relative crowding coefficient (RCC) was also influenced by different intercropping patterns this measurement took treatments imposed in a similar trend as land equivalent ratio (LER) behavior during 2016 and 2017 seasons. The RCC values exceeded the unity indicating that net grain in yield was more than accepted from both components. The results, also, evidenced that increasing the plant density of maize and guar led to increase the total (RCC); i. e. , the highest total (RCC) resulted from growing 22858 plants/fad. of maize, combined with 57142 plants/fad. of guar, at (P_3) intercropping pattern. The same trend was reported by Chivas *et al*. (2011), Quainoo1 *et al*. (2012), El - Aref *et al.* (2013) and Mahdy and El-Said (2017).

Table 5: Land equivalent ratio (LER) of maize and guar crop during 2016 and 2017 seasons.

Treatments	Intercropping patterns with Secondary crop		Land equivalent ratio (LER)					
			2016			2017		
			Main crop	Secondary crop	L.E.R.	Main crop	Secondary crop	L.E.R.
P_1	(S_1) 100%	T_1	0.81	0.85	1.66	0.78	0.82	1.60
P_2		T_2	0.88	0.90	1.78	0.88	0.86	1.74
P_3		T_3	0.95	0.88	1.83	0.94	0.84	1.78
P_4	(S_2) 75 %	T_1	0.86	0.74	1.60	0.85	0.71	1.56
P_5		T_2	0.90	0.76	1.66	0.87	0.75	1.62
P_6		T_3	0.96	0.75	1.71	0.92	0.74	1.66
P_7	(S_3) 50%	T_1	0.88	0.54	1.42	0.84	0.54	1.38
P_8		T_2	0.93	0.59	1.52	0.90	0.58	1.48
P_9		T_3	0.98	0.56	1.54	0.95	0.57	1.52

Table 6: Relative crowding coefficient (RCC) and Aggressivity (A) of maize and guar crop during 2016 and 2017 seasons.

Treatments	Intercropping patterns secondary crop		Relative crowding coefficient (RCC)						Aggressivity (A)			
			2016			2017			2016		2017	
			Main crop	Secondary crop	R.C.C	Main crop	Secondary crop	R.C.C	Main crop	Secondary crop	Main crop	Secondary crop
P_1	(S_1) 100%	T_1	1.75	15.30	26.77	1.46	12.05	17.59	15.25	15.25	14.66	14.66
P_2		T_2	3.20	23.63	75.61	3.12	15.54	48.48	15.69	15.69	18.12	18.12
P_3		T_3	8.45	18.40	155.4	6.97	13.58	94.65	14.24	14.24	13.35	13.35
P_4	(S_2) 75 %	T_1	2.46	7.51	18.47	2.41	6.14	14.79	11.57	11.57	10.56	10.56
P_5		T_2	3.90	8.34	32.52	3.08	7.89	24.30	11.64	11.64	11.64	11.64
P_6		T_3	11.36	7.58	86.10	5.30	7.20	38.16	10.41	10.41	10.57	10.57
P_7	(S_3) 50%	T_1	3.04	2.94	8.93	2.17	2.96	6.42	5.35	5.35	5.86	5.86
P_8		T_2	5.71	3.69	21.06	4.21	3.62	15.24	6.37	6.37	6.44	6.44
P_9		T_3	23.71	3.25	77.06	8.15	3.37	27.49	4.87	4.87	5.54	5.54

C. Aggressivity (A):

Results in Table 6 showed that in both growing seasons of this study, maize was dominant at all intercropping patterns. Aggressivity values were the highest when guar was intercropped with maize at (P_1) intercropping pattern. It is also indicated that both maize and guar dominated. However, it could be concluded that the interspecific competition between maize and guar was pronounced in all intercropping patterns because of the differences in morphology of both crops. These results were also supported by Chivas *et al*. (2011), Quainoo1 *et al*. (2012), El -Aref *et al.* (2013) and Mahdy and El-Said (2017).

5- Economic return per L.E.

The economic return evaluation for either intercropping maize + guar at different intercropping patterns, compared with pure stand of maize were recorded in Table 7 during 2016 and 2017 seasons. It is clearly that all intercropping patterns for guar, as a companion crop with maize, although they were expensive, but they achieved a higher relative net profit than the pure stand of maize during the experimental seasons.

Results of the economic return per fad., for intercropping guar with maize revealed that all intercropping patterns under testing realized more net income and relative net income than the pure stand of maize or pure stand of guar during the two experimental seasons. In general, the comparison between, the intercropping pattern, which realized the highest grain yield of maize under intercropping guar with maize (P_3), also, realized the highest net income per fad. during the two experimental seasons. The results are in agreement with those obtained by Egbe and Idoko (2012), Mahdy and El-Said (2015) and Mahdy and El-Said (2017).

Table 7: Effect of intercropping patterns of guar with maize on the economic return/fed. Egyptian pounds during 2016 and 2017 seasons.

Treatments			2016			2017			Relative net income	
			Price of the yield	Cost	Net income	Price of the yield	Cost	Net income	2016	2017
P_1	S_1	T_1	16795	9740	7055	18.240	10950	7290	136.0	132.3
P_2		T_2	18072	9740	8332	19.974	10950	9024	160.6	163.8
P_3		T_3	18851	9740	9111	20813	10950	9863	175.6	179.0
P_4	S_2	T_4	16688	9740	6948	18449	10950	7499	133.9	136.1
P_5		T_5	17603	9740	7863	19125	10950	8175	151.6	148.4
P_6		T_6	18146	9740	8406	19775	10950	8825	162.0	160.2
P_7	S_3	T_7	15615	9740	5875	16955	10950	6005	113.2	109.0
P_8		T_8	16653	9740	6913	18308	10950	7385	133.3	134.0
P_9		T_9	17.148	9740	7408	18861	10950	7911	142.8	143.6
Soled maize			13.646	8460	5186	15168	9660	5508	100.00	100.00

CONCLUSION AND RECOMMENDATION

The application of intercropping patterns and plant distribution improved yield and yield components of maize and guar. Therefore, the study recommends treatment (P_9) of maize and treatment (P_2) of guar in order to improve the production under the conditions of Assiut Governorate, Egypt.

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الملخص العربي

تأثير تحميل وتوزيع نباتات الجوار مع محصول الذرة الشامية

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نفذت تجربة حقلية خلال موسمي ٢٠١٦ ، ٢٠١٧ بالمزرعة البحثية لمركز البحوث الزراعية جامعة الأزهر فرع أسيوط لدراسة إستجابة الجوار للتحميل مع محصول الذرة الشامية وعلاقة ذلك بالمحصول ومكوناته والتحليل الكيميائي لكل من المحصولين وكذلك العلاقات التنافسية والعائد الإقتصادي لنظم التحميل والكثافة النباتية المختلفة تحت الدراسة مقارنة بالزراعة المنفردة لكل محصول، كانت أصناف الذرة الشامية و الجوار المستخدمة في الدراسة هي هجين ثلاثي نفرتيتي – ٣ والصنف المحلى على الترتيب. وقد إشتملت الدراسة خلال كل موسم زراعة الذرة الشامية على جميع الخطوط فى الفدان بالمعدلات الموصى بها والمسافة بين الجور ٢٥سم وزراعة نبات بالجورة على ريشة واحدة وزراعة الجوار على الريشة الأخرى للذرة الشامية بنظم تحميل مختلفة ١٠٠%، ٧٥% و٥٠% وكثافة نباتية مختلفة ١٠ سم و زراعة نبات بالجورة،١٥ سم وزراعة نباتين بالجورة و٣٠ سم وزراعة ثلاث نباتات بالجورة. وأستخدم تصميم القطاعات كاملة العشوائية في القطع المنشقة مرة واحدة فى ثلاث مكررات و وزعت نظم التحميل في القطع الرئيسية بينما وزعت مسافات الزراعة في القطع المنشقة.

وتتلخص أهم النتائج فيما يلي:-

١- تفوقت الزراعة تحت نظم التحميل المختلفة لمحصول الذرة الشامية معنويا على الزراعة المنفردة في طول النبات ودليل مساحة الأوراق مقارنة بالزراعة المنفردة خلال موسمي ٢٠١٦، ٢٠١٧.

٢- أظهرت النتائج أن الزراعة المنفردة لمحصول الذرة الشامية قد أدت إلى إعطاء أعلى القيم لوزن المائة حبة ومحصول النبات من الحبوب ومحصول الفدان من الحبوب مقارنة بنظم التحميل المختلفة خلال الموسمين ٢٠١٦، ٢٠١٧.

٣- أدى تطبيق نظام التحميل (P_1) لمحصول الذرة الشامية إلى نقص في وزن المائة حبة ومحصول النبات من الحبوب ومحصول الفدان من الحبوب خلال الموسمين مقارنة بنظم التحميل المختلفة وعلى النقيض أدى النظام (P_9) إلى إعطاء أعلى القيم للذرة الشامية خلال الموسمين لهذه الصفات مقارنة بنظم التحميل المختلفة.

٤- أعطى نظام التحميل (P_1) للجوار أعلى قيمة لارتفاع النبات مقارنة بالزراعة المنفردة ونظم التحميل المختلفة.

٥- تفوقت الزراعة المنفردة للجوار معنويا في عدد الأوراق بالنبات لنظم التحميل المختلفة خلال الموسمين بينما أعطى نظام التحميل (P_9) أعلى قيمة لدليل مساحة الأوراق خلال الموسمين مقارنة بالزراعة المنفردة ونظم التحميل المختلفة.

٦- أدت الزراعة تحت نظام التحميل (P_2) الحصول على أعلى محصول علف أخضر بالفدان مقارنة بنظم التحميل المختلفة خلال الموسمين.

٧- تفوقت الزراعة المنفردة للجوار معنويا لنسبتي البروتين والرماد / نبات على نظم التحميل المختلفة بينما أعطى النظام (P_6) خلال موسمي ٢٠١٦ ، ٢٠١٧ أعلى قيمة لنسبة البروتين والرماد للجوار بينما أعطى نظام التحميل (P_4) أعلى قيم لنسبة الألياف الخام لمحصول الجوار مقارنة بنظم التحميل المختلفة خلال موسمي ٢٠١٦ ، ٢٠١٧.

٨- أثبتت النتائج أن تحميل الجوار على الذرة الشامية أدى إلى زيادة كفاءة استغلال وحدة المساحة في كل نظم التحميل حيث حقق نظام التحميل (P_3) أكبر استفادة من وحدة المساحة مقارنة بزراعة الذرة الشامية منفردة بينما نجد أيضا نفس الاتجاه سائدا عند تطبيق معامل الحشد النسبي لكلا المحصولين وقد أعطى محصول الذرة الشامية أكبر قيم للعدوانية (سائد) بينما أعطى محصول الجوار أقل قيم للعدوانية (مسود) .

العائد الاقتصادي للفدان (بالجنية المصرى):

١- أظهرت النتائج أن الزراعة المحملة لكل من الذرة الشامية + الجوار تحت نظم التحميل المختلفة كانت أكثر تكلفة إلا إنها قد حققت أعلى عائد إقتصادي مقارنة بالزراعة المنفردة لمحصولي الذرة الشامية والجوار.

٢- حققت الزراعة المحملة للذرة الشامية + الجوار تحت نظام التحميل (P_3) أعلى عائد إقتصادي خلال الموسمين ٢٠١٦ ، ٢٠١٧ مقارنة بنظم التحميل الأخرى