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STUDIES ON INTERCROPPING PEANUT AND COWPEA ON GRAIN SORGHUM

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ABSTRACT

Tow field experiments were carried out in Randomized Complete Block Design 2017 and 2018 seasons at the Experimental Farm of Faculty of Agriculture, Al-Azhar University, Assuit Governorate, Egypt to study the effects of intercropping peanut (Giza-6) and cowpea (Carem-7) as a secondary crop with grain sorghum (Horus) as a main Crop. Each experiment consisted of five different intercropping systems. Sole grain sorghum crop (100%), grain sorghum and legume each in one side of ridge (100% for each) and tow spatial arrangements of 1:2, 2:1 and 2:2 rows for grain sorghum alternated with legume. Each experiment revealed that growth yield and yield components, competitive relationships and chemical analysis were computed.

In general, the results indicated that yield had significant differences among the intercropping systems. Intercropping system of T5 (2:2) gave the maximum yield/plant and the maximum yield (14.71&14.93ardab/fed.,) under cowpea than peanut plants compared to the other intercropping systems in both seasons. Moreover, intercropping system T5 (2:2) recorded the highest values of protein % with the combined cowpea (8.750&8.965) than with peanut (8.553&8.672).

Concerning the intercropping systems on growth and yield of cowpea and peanut, results reveal that the response was varied and differ with each intercropping system, but generally, intercropping system of T5 (2:2) gave the most effect of all growth and yield

Moreover, results indicated that intercropping system of T5 (2:2) was the best for Land Equivalent Ratio (LER) and most efficient intercropping system from Relative Crowding Coefficient (RCC) as well as Aggressiveness (A) revealed that cowpea was dominant component during all intercropping systems.

Keywords -Intercropping, Peanut, Cowpea, Sorghum, Land Equivalent Ratio

INTRODUCTION

The need for an intensive cropping system to raise the production per unit of phenomena among the small farmer is agricultural sector of Egypt is very important. Reasons for this popularity results in more profit and resource maximization and efficient water and soil utilization. Among many intercropping companions adopted successfully are those of grain sorghum (*Sorghum bicolor L*.) (as main cereal crop in Upper Egypt especially in Assiut Governorate) and peanut (as oil crop) and cowpea (as forage crop). This work aimed to find out the most effective system of intercropping with either peanut or cowpea for increasing total productivity per unit area in the same time as will as total content of protein in the grain of sorghum and oil content in peanut seeds. Many research workers reported about the effectiveness of intercropping sorghum and legume in increasing grain yield, El-Nagar *et al., (*2002), Nalatwadmath *et al., (*2002) and Zohary and Abd El-All (2003) and El- Aref *et. al.,* (2009) recorded significant effects of different intercropping systems between grain sorghum and mung bean on growth, yield and yield components, chemical analysis, competitive relationships and economic return. They concluded that intercropping mung bean at 30 cm on ridge sorghum at 20 cm between hills gave the best results of Land Equivalent Ratio (LER), Relative crowding Coefficient (RCC) and economic return. In another research paper, El- Aref *et al.,* (2009) reported that intercropping cow pea at 20 cm on ridge sorghum at 20 cm between hills were the best for (LER), (RCC) and economic return. Also, Plant protein ratio of cowpea decreased significantly compared with pure stand treatments. In a trail aimed to study the effect of intercropping groundnut (*Arachis hypogea L*.) with sorghum (*Sorghum bicolor L*. Monench) on yield and income, Langat *et al.,* (2006) revealed that the highest sorghum grain yield (3846 Kg/ha.) was obtained due to intercropping two ground rows alternated with two sorghum rows which considered the best combination (pattern) to use.

The present work aimed to find out the most effective system of intercropping (peanut and cowpea- as legume crops) with grain sorghum (as a main cereal crop in Upper Egypt) for increasing total productivity per unit area in the same unit time. The

MATERIALS AND METHODS

Two field experiments were carried out during summer seasons of 2017 and 2018 at the Experimental Farm of Faculty of Agricultural, Al-Azhar, Assuit branch. The trail aimed to study the effect of intercropping Pea nut and Cowpea on Grain Sorghum as main crop.

Each one of the separate experiments contains five treatments as following:

T1 (Solid): Cultivation grain sorghum in one side as recommended which represented 100%. (Sole sorghum=100%)

T2 (ridge): Cultivation grain sorghum in one side as recommended which represented 100%, and intercropped (Cowpea or peanut) on the other side, which represented 100% for each crop.

T3 (1:1): Cultivation grain sorghum in one raw alternate with intercropped crop (Cowpea or peanut) in another raw in one side each, which represented50% for main and intercropped.

T4 (2:1): Cultivation grain sorghum in two rows and (Cowpea or peanut) in one row, which represented66% for main and 33% intercropped.

T5 (2:2): Cultivation grain sorghum in two rows alternate with two intercropped crop Cowpea or peanut, which represented50% for each main and intercropped.

The first experiment was conducted to intercrop cowpea on grain sorghum, as well as, the second experiment for intercrop peanut on grain sorghum. Chemical and physical analyses of the soil are shown in Table (1).

Table (1): Physical and chemical analysis of soil field experiments

Season		2017	2018
Physical analysis	Sand%	27.2	27.5
	Silt%	38.0	38.3
	Clay %	34.8	34.2
Soil texture		Clay Loam	Clay Loam
Chemical analysis	Organic matter %	1.27	1.32
	Available N (ppm)	79.0	84.0
	Available P (ppm)	10.0	12.0
	Available K (ppm)	366.0	410.0
	pH (1-1)	7.5	7.9
	Ec (1-1)	1.22	1.25

Main crop (grain sorghum, Horus var.) was grown in one side (ridge) as recommended with plant spacing of 15 cm between hills with two plants. Peanut and cow pea were in one side (ridge) with spacing of 20 cm between hills with two plants/hill, respectively.

Intercropped plants were cultivated at the 1st of May 2017 and 2018 about 15 days before main crop planted in both summer seasons of 2017 and 2018, respectively. Varieties of intercropped were Giza 6 var., of Peanut and Creem 7 var. of cowpea. Area of each plot was 10.5 m2 (0.6 m width and 3.5 m in length). The plot consisted of 5 ridges spaced 60 cm apart. The experimental design of each experiment was Randomized

Complete Block Design (RCBD) with three replicates.

All Agriculture operations including irrigation and fertilization were followed as recommended for sorghum. Cowpea cuttings were estimated three ages 40, 80 and 120 days from cultivation. Harvesting of sorghum was done after 115 days from cultivation.

At harvesting time, 5 plants of each crop were taken to determine the following characters in each crop: Vegetative characters for sorghum, peanut and cowpea included (Plant height (cm), No of leaves/ plant, Leaf area (cm^2), while, Sorghum yield characters included (Panicle weight (gm), Grain weight/panicle (gm)= grain weight per plant in (gm), 1000 - grain weight, in gm and average grain yield in Ardab per feddan (Ardab= 140kg). Peanut yield characters included (No of pods/plant, seed weight /plant, 1000 seed weight (gm) and peanut yield / feddan (Kg). Cowpea yield characters included (cutting weight (Kg/feddan) of each cutting)

Chemical analysis: Chemical analysis were made in sorghum grain and peanut pods to determine protein and oil contents in grain and pods, respectively. Protein and oil content were determined according A.O.A.C (1980).

Competition relationships and yield advantaged: included Land equivalent ratio (LER): was determined according to Willey (1979), Relative crowding coefficient (RCC): was determined according Wit (1960) and Aggressively (A): were determined according to MC-Gilchrist, C.A (1965).

STATISTICAL ANALYSIS:

The data were statistically analyzed as a Randomized Complete Block Design according procedures outlined by Steel and Torrie (1980). Comparisons among means of treatments were tested for significance against L.S.D values at 0.05 level of probability.

RESULTS AND DISCUSSION

Intercropping grain sorghum with cowpea and peanut

A: Growth characters:

Demonstrated data in Table (2) showed significant effects of different intercropping systems on plant height, number of leaves per plant of grain sorghum at 90 days from planting in 2017 and 2018 seasons. Grain sorghum plants grown as solid plants in T1 gave the maximum plant height (172.7 & 176.2 cm) and (175.0&182.6 cm) as well as No., of leaves/plant (9.82 & 9.93) and (9.33 & 9.67) for Cowpea and Peanut compared to all plants under intercropping systems in the 1st and 2nd seasons, respectively. Grain sorghum plants grown under the intercropping system of T5 (2:2) resulted in the tallest plant in comparison to the other intercropping systems during both seasons. On the other hand, the shortest grain sorghum plants were obtained from cultivating it under the intercropping system of T2 (ridge). These results held true either under cowpea or

peanut intercropped plants in both seasons.

Results in Table (3) indicated that intercropping systems had significant effects on LAI of grain sorghum plants under either cowpea or peanut plants in both seasons. Data observation reveals that LAI of grain sorghum intercropped with peanut plants significantly decreased with the other intercropping systems and even with T1 (Solid). The highest LAI values were resulted due to T5 (2:2) under both intercropped plants (cowpea and peanut) in comparison to the other intercropping systems in both seasons. Intercropping systems of T2 (ridge) gave the lowest LAI values) under cowpea and peanut plants in both seasons.

Regarding to 50% flowering of sorghum plants, results show that pure stand of grain sorghum T1 (Solid) gave the minimum days from planting to 50 flowering. On the other hand, intercropping system of T5 (2:2) gave the maximum 50% flowering under cowpea plants in both seasons. On the contrary of that, results indicated that 50% flowering of grain sorghum plants under peanut plants were insignificantly affected by all intercropping systems under peanut plants in both seasons. The superiority of 50 flowering character due to pure stand of grain sorghum T1 (Solid) may be due to the compatibility of plants away from competition which resulted from the high densities per unit area through intercropping systems. These results were supported by **Langat *et al.*,** (2006), El-Aref *et. al.*, (2009), Begum *et. al.*, (2016) and Molla, and Getachew (2018).

Table (2): Effect of intercropping cowpea or peanut systems on growth of grain sorghum during 2016 and 2017 seasons.

intercropping systems	Plant height 90 days				No. of leaves 90 days			
	Cowpea		Peanut		Cowpea		Peanut	
	2017	2018	2017	2018	2017	2018	2017	2018
T1(Solid)	172.7	176.2	175.0	182.6	9.82	9.93	9.33	9.67
T2 (ridge)	161.3	164.6	149.0	153.7	8.51	8.72	7.73	7.84
T3 (1:1)	164.7	167.9	162.0	167.2	9.23	9.43	8.60	8.76
T4 (2:1)	162.7	164.8	164.7	170.6	9.48	9.59	8.90	8.93
T5 (2:2)	167.0	170.3	171.0	176.2	9.61	9.72	9.13	9.24
L.S.D 0.05	2.51	1.86	6.30	4.35	0.23	0.25	0.22	0.21

B- Yield and yield components:

Results in Table (4) show that intercropping systems had significant effect on 1000 grain weight and grain yield/plant at the 1st and 2nd seasons, respectively. Data recorded that both characters decreased significantly (T2, T3 and T4) by intercropping comparing with solid stand treatment in T5 (2:2) in both seasons. The reduction in 1000 grain weight at the 1st and 2nd seasons were insignificant in T5 (2:2) compared to T1 (Solid). Also, T1 (Solid) expressed high values of 1000 grain weight which approaching the pure stand of T1

(Solid) under cowpea plants at the 1st and 2nd seasons.

Decreasing grain sorghum yield/plant with intercropping systems were varied. Intercropping system of T5 (2:2) gave the maximum yield/plant under cowpea than peanut plants compared to the other intercropping systems in both seasons. Many research workers reported about the effect of intercropping sorghum with legume on sorghum grain yields as El-Naggar *et al.,* (2002), Nalatwadmath *et al.,* (2002), Zohary and Abd El-All (2003), Begum *et al.,* (2016), Addo – Quaye *et al.,* (2011) and Dharend *et al.,* (2017).

Table (3): Effect of intercropping cowpea or peanut systems on growth of grain sorghum during 2016 and 2017 seasons.

intercropping systems	LAI				50% flowering			
	Cowpea		Peanut		Cowpea		Peanut	
	2017	2018	2017	2018	2017	2018	2017	2018
T1(Solid)	16.73	17.67	16.50	16.78	71.67	72.33	74.00	73.67
T2 (ridge)	14.40	15.65	13.03	13.24	73.00	74.23	73.33	72.33
T3 (1:1)	15.61	16.67	14.64	14.81	73.33	73.76	73.00	72.00
T4 (2:1)	16.18	17.26	15.02	15.37	73.67	74.68	73.33	73.36
T5 (2:2)	16.71	17.86	15.53	15.76	75.00	76.23	74.00	73.67
L.S.D 0.05	0.572	0.423	0.355	0.241	1.41	1.32	—	—

Table (4): Effect of intercropping cow pea or peanut systems on weight of 1000 seed and yield/plant of grain sorghum during 2016 and 2017 seasons.

intercropping systems	1000 seeds weight				Yield/plant			
	Cowpea		Peanut		Cowpea		Peanut	
	2017	2018	2017	2018	2017	2018	2017	2018
T1(Solid)	23.96	24.05	23.09	23.17	84.66	91.23	80.16	83.25
T2 (ridge)	19.94	19.97	19.34	19.64	37.84	38.46	33.04	36.17
T3 (1:1)	22.21	22.46	20.96	21.23	48.62	53.25	42.73	46.23
T4 (2:1)	23.19	23.34	22.37	22.64	52.97	56.23	37.97	41.86
T5 (2:2)	23.81	23.93	23.00	23.32	69.62	73.22	53.04	57.32
L.S.D 0.05	0.28	0.26	0.33	0.36	3.53	2.76	3.81	2.76

Concerning to grain sorghum yield/fed., in Table (5) resulted that yield/fed., decreased with intercropping systems as mentioned before. The grain sorghum plants grown in combination with cowpea plants under intercropping system of T5 (2:2) gave the maximum yield (14.71&14.93ardab/fed.,) compared to the other intercropping systems. These results explained the superiority of T5 (2:2) which led to produce grain yield/plant under cowpea (69.62&73.22 gm/plant) and under peanut (53.04&57.32gm/plant) in both seasons.

Regarding the effect of intercropping systems on grain

sorghum Protein%, results indicated that grain sorghum cultivation in pure stand in T1(Solid) gave the highly Protein% compared to all intercropping systems. Meanwhile, intercropping system T5 (2:2) recorded the highest values of protein % with the combined Cowpea (8.750&8.965) than with Peanut (8.553&8.672). Similar results were obtained by Azraf *et al.,* (2007), Elena and Roman (2010), Akbar *et al.,* (2012), Begum *et al.,* (2016) and Mollaand Getachew (2018).

Table (5): Effect of intercropping cow pea or peanut systems on yield/fed. and protein contents of grain sorghum during 2016 and 2017 seasons.

intercropping systems	Yield (ard /fed)				Protein%			
	Cowpea		Peanut		Cowpea		Peanut	
	2017	2018	2017	2018	2017	2018	2017	2018
T1(Solid)	19.34	19.64	19.21	19.67	9.14	9.42	9.07	9.16
T2 (ridge)	11.58	11.75	11.36	11.71	7.67	7.78	7.24	7.42
T3 (1:1)	9.25	9.46	7.93	8.13	8.22	8.45	7.87	7.94
T4 (2:1)	9.61	9.89	13.84	13.97	8.37	8.76	8.16	8.24
T5 (2:2)	14.71	14.93	9.13	9.46	8.75	8.96	8.55	8.67
L.S.D 0.05	0.32	0.24	0.43	0.36	0.11	0.08	0.21	0.32

In summary, results concluded that grain sorghum cultivation in pure stand in T1(Solid) gave the highest values of growth, yield and its components and its content of Protein% compared to all intercropping systems. Meanwhile, intercropping system T5 (2:2) recorded the highest values of protein % with the combined Cowpea (8.75 &8.96) than with Peanut (8.55 &8.67) in both seasons.

The effect on cowpea crop:

Growth characters: Plant height of cowpea:

Intercropping systems in Table (6) significantly affected plant height of cowpea and on the 1st cutting after 40, 80 and 120 days from cultivation during 2017 and 2018 seasons. Cultivation of cowpea in association with grain sorghum plants is more favorite to increase cowpea plant height especially under intercropping system T2 (ridge) which sorghum cultivated in one ridge and cowpea in the other ridge. The increased plant height of cowpea may be due to density of plants in a unit area which led to elongate as a result of shading. Plant height of cowpea decreased gradually with increasing growth period after each cutting. The reduction in plant height during growth period could attribute to the increased competitiveness of both plants. These results were agreement with those reported by El-Aref *et al.,* (2009).

No. of Leaves/plant of cowpea:

Results in Table (7) show that No of Leaves/plant significantly affected with intercropping systems. No of Leaves/plant of cowpea decreased gradually with increasing growth period after each cutting. The maximum values of Leaves/plant of

cowpea were occurred due to the intercropping system of T5 (2:2) after each cutting except after 80 days from cultivation.

Table (6): Effect of intercropping systems on plant height of cowpea on the 1st cutting after 40, 80 and 120 days from cultivation during 2016 and 2017 seasons.

Intercropping systems	plant height (cm)					
	After 40 days from cultivation		After 80 days from cultivation		After 120 days from cultivation	
	2017	2018	2017	2018	2017	2018
T2 (ridge)	104.3	107.2	90.00	94.26	62.33	63.74
T3 (1:1)	81.00	82.6	68.00	71.36	60.33	61.67
T4 (2:1)	86.67	89.24	68.33	72.53	61.33	62.35
T5 (2:2)	87.33	90.12	68.67	74.65	57.67	58.62
L.S.D 0.05	2.50	1.31	3.37	2.65	2.01	2.13

Table (7): Effect of intercropping systems on No.of Leaves/plant of cowpea on the 1st cutting after 40, 80 and 120 days from cultivation during 2016 and 2017 seasons**.**

Intercropping systems	No. of Leaves/plant					
	After 40 days from cultivation		After 80 days from cultivation		After 120 days from cultivation	
	2017	2018	2017	2018	2017	2018
T2 (ridge)	38.33	39.56	31.00	33.21	26.33	27.65
T3 (1:1)	43.00	44.23	35.00	37.00	28.33	29.35
T4 (2:1)	38.33	39.65	26.33	27.67	22.00	23.25
T5 (2:2)	45.33	45.65	33.67	35.36	30.33	31.33
L.S.D 0.05	3.29	1.86	2.44	1.86	1.694	1.242

Leave Area Index (LAI) of cowpea:

Results recorded in Table (8) revealed that intercropping systems had significant effects on Leave Area Index (LAI) of cowpea during both seasons. Data show clearly that intercropping system of T5 (2:2) gave the highest values of Leave Area Index (LAI) of cowpea after 40, 80 and 120 days from cultivation.

Green yield ton/fed. of cowpea:

Obtained data in Table (9) show that intercropping systems had significant effect on Green yield (ton/fed)., of cowpea. Data show clearly that intercropping system of T5 (2:2) gave the highest values of Green yield (ton/fed)., of cowpea after 40, 80 and 120 days from cultivation. This intercropping might be more effective than row intercropping systems in nitrogen transfer from legume plants to sorghum through roots intermingling, which increased mixed forage yield Reza et al.(2012)and Sharma *et al.*, (2009) suggested that cowpea might be intercropped with sorghum for obtaining higher forage yields.

Table (8): Effect of intercropping systems on Leave Area Index (LAI) of cowpea on the 1st cutting after 40, 80 and 120 days from cultivation during 2017 and 2018 seasons

Intercropping systems	Leave Area Index (LAI)					
	After 40 days from cultivation		After 80 days from cultivation		After 120 days from cultivation	
	2017	2018	2017	2018	2017	2018
T2 (ridge)	2.740	2.863	2.220	2.351	2.137	2.247
T3 (1:1)	3.140	3.345	2.643	2.743	2.423	2.543
T4 (2:1)	2.940	2.986	2.377	2.456	2.140	2.243
T5 (2:2)	3.220	3.462	2.720	2.821	2.567	2.675
L.S.D 0.05	0.141	0.123	0.129	0.113	0.099	0.083

Table (9): Effect of intercropping systems on Green yield (ton/fed) of cowpea on the 1st cutting after 40, 80 and 120 days from cultivation during 2017 and 2018 seasons

intercropping systems	Green yield (ton/fed)					
	After 40 days from cultivation		After 80 days from cultivation		After 120 days from cultivation	
	2017	2018	2017	2018	2017	2018
T2 (ridge)	7.394	7.654	4.724	4.823	3.693	3.723
T3 (1:1)	6.668	6.752	4.634	4.735	3.197	3.254
T4 (2:1)	6.215	6.421	4.395	4.523	3.068	3.125
T5 (2:2)	8.338	8.435	5.856	5.963	4.664	4.752
L.S.D 0.05	0.129	0.133	0.163	0.124	0.115	0.095

Generally, Cowpea growth and yield as intercropped crop with grain sorghum were significantly affected with intercropping systems. Intercropping system T5 (2:2) significantly affected plant height, No. of Leaves/plant, Leave Area Index (LAI) and Green yield (ton/fed)., after 40, 80 and 120 days from cultivation during in both seasons.

Effect of peanut- grain sorghum intercropping systems

On growth characters of peanut

The results in Table (10) revealed that peanut yield and its attribute significantly affected by intercropping systems. In both seasons, results show that No. of pods/plant, Pods weight/plant and Seeds weight/plant increased from T2 to T5 in both seasons. This mean that changing intercropping system led to significantly increased all the before mentioned characters until T5 (2:2). Intercropping system of T5 (2:2) gave the highest values of all yield attribute (Shelling% and 100-seed weight.as shown in Tables 10 and 11 compared to the other intercropping systems.

These results were agreement with Abou-Kerisha *et al.,* (2008), Addo – Quaye, *et al.,* (2011), Da Silva *et al.*, (2015), Metwally, *et al.,* (2018), Abdel-Galil, and Abdel Ghany (2014) and Dharend, *et al.,* (2017).

Regarding peanut yield, Table (11) show clearly that the intercropping system of T5 (2:2) gave the highest peanut yields in both seasons. These results held true in oil and protein contents in peanut seeds.

In conclusion, results of intercropping systems on growth and yield of cowpea and peanut reveal that the response was varied and differ with each intercropping system, but generally, intercropping system of T5 (2:2) gave the most effect of all growth and yield

Competitive relationships of intercropping:

Land Equivalent Ratio (LER): Results in Table (12) indicate that Land Equivalent Ratio (LER) for all intercropping systems had more yield advantage. The maximum values of LER were 1.409-1.409 for T5 (2:2) under both intercropped crops and seasons. Also, cultivation grain sorghum in two rows alternate with two intercropped crop (Cowpea or (Pea nut), which represented50% for each main and intercropped could be recommended. Similar results were reported by El-Araf (1995), El-Araf *et al., (*2009), Austin, *et al.,* (2013).

Relative Crowding Coefficient (RCC): Results in Table (12) indicate that intercropping system of T5 (2:2) achieved the highest RCC for cowpea (8.36 and 7.56) during the 1st and 2nd seasons, respectively. This result indicates that this system had the best yield advantage of cowpea than peanut crop. On the other hand, the lowest system of intercropping peanut under intercropping system T3 (1:1) since the RCC (0.603 and 0.577) during the 1st and 2nd seasons, respectively. Similar results were reported by Ghoh *et al., (*2006), Toaima (2006), EL-Aref *et al.,* (2009) and Abdel Galil (2014)

Aggressiveness **(A):** Data presented in Table (12) indicate that cowpea was dominant component during all intercropping systems. The value of A under Cowpea plants were the highest values of Aggressiveness (A) under all intercropping systems in both seasons. These results are in agreement with those obtained by Ghosh *et al.,* (2006), and Toaima (2006), ElAref *et al.,* (2009), Hatuna, *et al.,* (2013) and Yilmaz, *et al.*, (2008) and Abdel Ghany (2014)

RECOMMENDATIONS

In order to obtained maximum yield from sorghum, the crop pattern T5 (2:2) (2 rows of sorghum alternated with 2 rows cowpea) would the best to use as long as all agricultural procedures will made as recommended.

Table (10): Effect of intercropping systems on growth characters of peanut during 2016 and 2017 seasons

intercropping systems	No. of pods/plant		Pods weight/plant		Seeds weight/plant		Shelling %		100 seed weight	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
T2 (ridge)	28.00	29.26	58.31	62.43	28.49	29.56	34.67	34.00	55.70	57.62
T3 (1:1)	33.00	34.35	63.25	64.67	33.08	35.16	34.33	33.67	63.73	65.23
T4 (2:1)	37.00	39.23	67.43	69.63	37.96	39.86	33.00	32.33	60.52	61.76
T5 (2:2)	39.67	42.33	70.92	71.86	30.92	31.86	35.67	34.33	78.52	79.82
L.S.D 0.05	2.10	1.86	2.59	1.32	2.34	1.78	1.41	1.23	1.48	1.21

Table (11): Effect of intercropping systems on yield components of peanut and protein content during 2016 and 2017 seasons

Intercropping systems	Yield (ard/fed)		LAI		Oil %		Protein %	
	2017	2018	2017	2018	2017	2018	2017	2018
T2 (ridge)	7.95	8.12	3.396	3.426	45.73	45.46	24.20	24.36
T3 (1:1)	7.53	7.76	4.462	4.567	44.40	44.86	23.33	23.10
T4 (2:1)	6.57	6.76	4.180	4.265	43.07	43.23	24.03	24.16
T5 (2:2)	9.13	9.34	4.727	4.923	46.79	46.43	24.37	24.43
L.S.D 0.05	0.33	0.27	0.207	0.186	0.29	0.18	0.152	0.123

Ardab = 75 kg pods= 155 kg seeds.

Table (12): Competitive relationships and yield advantage of either sorghum and total cowpea cuttings or peanut yield during 2016 and 2017.

intercropping systems	Land Equivalent Ratio LER				Relative Crowding Coefficient (K)				Aggressively (A)			
	Cowpea yield		Peanut yield		Cowpea yield		Peanut yield		Cowpea yield		Peanut yield	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
T2 (ridge)	1.349	1.349	1.349	1.344	4.47	4.37	1.37	1.31	-0.15	-0.14	0.104	0.124
T3 (1:1)	1.166	1.166	1.166	1.160	2.01	1.96	0.60	0.57	-0.41	-0.39	-0.100	-0.070
T4 (2:1)	1.391	1.391	1.391	1.391	5.86	5.82	1.73	1.58	-0.79	-0.75	-0.145	-0.129
T5 (2:2)	1.409	1.409	1.409	1.409	8.36	7.56	1.15	1.07	-0.83	-0.82	-0.169	-0.122

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دراسات على تحميل الفول السوداني ولوبيا العلف على الذرة الرفيعة

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اجريت تجربتان حقليتان في تصميم القطاعات الكاملة العشوائية بمزرعة كلية الزراعة بجامعه الازهر بأسيوط –مصر لدراسة تأثير تحميل محصول الفول السوداني (جيزة –6) ولوبيا العلف (كريم – 7) كمحاصيل سنوية على محصول الذرة الرفيعة (حورس) كمحصول رئيس. كل تجربه اشتملت على خمسه نظم تحميل مختلفة ثم زراعه الذرة الرفيعة وكذلك المحصول المحمل منفردا كما هو موصي به وزراعه الذرة الرفيعة على ريشة والمحصول المحمل على الريشة الأخرى – زراعه خط بالذرة الرفيعة وخط اخر بالمحصول المحمل – زراعه عدد 2 خط بالذرة الرفيعة وخط بالحصول المحمل – زراعه عدد 2خط بالذرة الرفيعة وعدد 2خط بالمحصول المحمل – كل تجربه قدر بها صفات النمو والمحصول ومكوناته والعلاقات التنافسية والتحليل الكيميائي.

وتتلخص أهم النتائج فيما يلي:

- أشارت النتائج إلى أن هناك اختلافات معنوية كبيرة في مكونات محصول الذرة الرفيعة بين أنظمة التحميل .حيث أعطى نظام تحميل الذرة الرفيعة باللوبيا مقارنة بالفول السوداني في نظام تحميل 2صف لكل منهما (2 :2) T5أقصى إنتاجية لمحصول الحبوب /نبات والحد الأقصى(14.71) و (14.93) اردب /فدان في كلا الموسمين مقارنة بجميع الأنظمة تحت الدراسة.
- أشارت النتائج إلى أن نظام التحميل (2 :2) T5كان الأفضل بالنسبة لنسبة كفاءة استغلال الأرض (LER) وأكثر أنظمة التحميل كفاءة من معامل الحشد النسبي (RCC)، حيث اوضحت النتائج أن لوبيا العلف هو المحصول السائد.
- سجل نظام التحميل (2 :2) T5أعلى قيم البروتين ٪ في حبوب الذرة الرفيعة خصوصا تحميل الذرة الرفيعة مع لوبيا العلف (8.750) و(8.965) مقارنة مع التحميل مع الفول السوداني(8.553) و (8.672).