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EFFECT OF INTERCROPPING PATTERNS OF TEOSINTE WITH COWPEA ON YIELD, QUALIITY AND THEIR COMPETITIVE RELATIONSHIPS

BY

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ABSTRACT

Two fields experiments were carried out at Sers-Elliyan Field Crops Research Station, Minufiya Governorate, Egypt during two summer seasons of 2004 and 2005 in order to study the effect of four intercropping patterns {(1:1), (2:1), (1:2) and (2:2)} of teosinte with cowpea as compared to their pure stands using a randomized complete block design (RCBD) in four replications.

Results indicated that teosinte and cowpea plant height decreased significantly at each of the four intercropping patterns as compared with their control.

The total fresh and dry forage yield of the intercropping pattern 2:2 was superior as compared to the other used mixtures of teosinte and cowpea and their relevant pure stands as well.

Forages mixtures were of more crude protein (CP) content than teosinte but less than cowpea in its pure stand, while crude fiber (CF) content was less in than teosinte and more in cowpea pure stands. Digestible protein (DP) content was more in cowpea and less in teosinte pure stands.

Feed units as total protein and digestible protein yields (kg fed^{-1}) of intercropping pattern 2:2 showed significant increase as compared with the other tested treatments.

Data of the observed competitive relationships indicated that teosinte crop was dominant and cowpea was not dominated. Teosinte had the highest values of relative crowding coefficient (RCC) and land equivalent ratio (LER), while cowpea crop had the lowest value in the two seasons.

The intercropping pattern of 2:2 gave the highest yield advantage and caused an increase in land usage of 36% and 34% in the two respective summer seasons, which could be of great advantage for the farmers of small holding areas in producing good quality and balanced summer forage for their livestock. This study could be beneficial to small scale farms for summer forage production under the Egyptian circumstances.

INTRODUTION

Green summer forage demand for rapidly expanding livestock requirement is increasing day by day in Egypt. Teosinte (*Zea mexicana* Schrad) is one of the most important summer forage crops which closely related to maize in most allelometric characters. It has the advantage of tillering and regeneration as a fodder crop (Lal *et al.*, 1980). It is also a good source of energy (carbohydrates) and crude fibers.

Forage cowpea (*Vigna unguciulata* L. Walp) commonly known as "forage lobya" is one of the leguminous fodder summer crop which is superior to grasses in crude protein and minerals contents. Moreover, cowpea could be considered a reasonable good forage material when grown with teosinte in respect of crude protein content for animal nutrition.

A grass-legume association has been used in many countries of the world (as sorghum : legume intercropping; Ahmad *et al.*, 2007) because of their higher forage productivity in respect of yield and quality as carbohydrate-protein balance and the other

well known biological, physiological, production and quality benefits of growing grass-legume mixtures. Moreover, competition of N reduced within a grass-legume mixture even when available soil N is initially at a low level (Zhang and Li, 2003).

Forage production potential of teosinte in mixture with cowpea has not quantitatively tested enough. However, Sarhan and Atia (2000) found that teosinte with local cowpea was always superior compared to its mono cropping with an increase in dry forage productivity and crude protein yield which could be roughly estimated to be 8% and 35%, respectively. Other investigators reported that over seeding pearl millet or sorghum with some legume forages crops increased fresh and dry forage yields productivity (Gabra *et al.*, 1994; Ali, 1992; Abd El-Shafy, 1991; Abd El-Gawad *et al.*, 1985 and Waghmare and singh, 1984).

As reported by Abd El-Shafy, (2002) teosinte and guar mixtures were significantly higher than those obtained from guar, but lower than those obtained from teosinte at the three cuts as well as total fresh and dry forage yield. It produced more crud protein (CP) and digestible protein (DP) contents than teosinte but less than guar monocultures, while crud fiber (CF) was less than teosinte and more than for guar monoculture.

Eisa *et al.* (1989) studied some intercropping patterns of soybean and maize. They found that planting maize on one ridge and soybean in 3 ridges (1:3) were the best which gave 16.8% more return than the other tested intercropping patterns. Many investigators found that land usage increased by intercropping sorghum with cowpea (Haggag *et al.*, 1984) and sorghum or sordan 79 with cowpea or guar (Ullah *et al.*, 2007; Abd El-Shafy, 1991).

For obtaining a good fodder of improved quality, an accurate balance of teosinte and cowpea in a mixture is very essential. The present experiment was designed to investigate the effect of different intercropping patterns of teosinte and cowpea on yield production, forage quality and their competitive relationships under Menufyia conditions.

MATERIALS AND METHODS

The present study was carried out at Sers-Elliyan Experimental Station, Minufiya Governorate, Egypt during 2004 and 2005 seasons to study the effect of four intercropping patterns of teosinte (*Zea mexicana*) with cowpea (*Vigna unguciulata*) and, their relevant pure stands on forage yield, quality and competitive relationships.

The studied four intercropping patterns were: single alternative side ridges of teosinte and cowpea SR+SR (1:1); two sides ridge (TSR) of teosinte alternative with single side ridge of cowpea TSR+SR (2:1); single side ridge of teosinte alternate with two sides ridge of cowpea SR+TSR (1:2); and alternative two sides ridge of teosinte and cowpea TSR+TSR (2:2), in addition to their pure stands (on the two sides ridge) of teosinte and cowpea.

Seeds were planted in hills of 25 cm apart, for all of the above six treatments. Planting dates were at June 9, 2004 and June 13, 2005 seasons. Randomized complete black design (RCBD) was used in four replicates.

Experimental land area was prepared and amended by super phosphate (15.5% P_2O_5) at rate of 150 kg fed^{-1}. Nitrogen fertilizer was added as ammonium nitrate at 90 k N fed^{-1} at three equal doses (before mohayat irrigation, and after the 1st and 2nd cuts). Three cuts were taken at 45, 90 and 135 days after planting.

The following paramcters were evaluated: Plant height (cm) of each cut was measured as a mean of five randomly selected plants before each cut; fresh forage yield (t/fed) was estimated from the obtained fresh forage yield of each experimental unit of each cut; dry yield was determined using air forced dry oven (70°C) of randomly selected fresh shopped forage samples of each experimental unit in each of the two cuts till constant

weight, then dry matter percentage and dry forage yield per fed were calculated accordingly.

Chemical analyses on dry matter basis for whole plants were conducted according to AOAC (1990). Digestible protein (DP) was calculated using the equation:
DP % = 0.9596 crude protein percentage (CP %) - 3.55 as reported by Bredon *et al.* (1963). Feed units as protein and digestible protein yields (kg fed^{-1}) were estimated by multiplying dry forage yield by CP and DP percentages, respectively.

The competitive relationships and yield advantage were determined as follows:
(1) Aggressivity (A):
$Aab = Y_{ab}/Y_{aa} \times Z_{ab} - Y_{ba}/Y_{bb} \times Z_{ba}$
(McGilchrist, 1965)

(2) Relative Crowding Coefficient (RCC):
$(RCC)_{ab} = Y_{ab} \times Z_{ba} / Y_{aa} - Y_{ab} \times Z_{ab}$.
$(RCC)_{ba} = Y_{ba} \times Z_{ab} / Y_{bb} - Y_{ba} \times Z_{ba}$
RCC for the mixture = $(RCC)_{ab} \times (RCC)_{ba}$
(De-wit, 1960)

(3) Land Equivalent Ratio (LER):
$Y_{ab}/Y_{aa} + Y_{ba}/Y_{bb}$ (Andrews and Kassam, 1976)

Where: Y_{aa}: Pure stand of species (a)
Y_{ba}: Pure stand of species (b)
Y_{ab}: Mixture of species (a)
Y_{bb}: Mixture of species (b)
Z_{ab}: Sown proportion of species(a) with (b)
Z_{ba}: Sown proportion of species (b) " (a)

The obtained data were statistically analyzed according the procedure outlined by Snedecor and Cochran, (1980). Treatments means were compared using LSD test at 0.05 level of significant.

RESULTS AND DISCUSSION

I- Plant height:

Data reported in Table (1) showed that the applied intercropping patterns had significant effect on the plant height of teosinte and cowpea for each of the three cuts in the two seasons as compared to their pure stands.

Plant height of teosinte decreased significantly and reached to the shortest heights which were 62.4, 126.0 and 108.1 cm at the three respective cuts during the first season. Similar trend was noticed in the second season for the three cuts.

Data showed that the maximum decrease of plant height was observed at the first intercropping pattern (1:1) for each of the three cuts in the two seasons as compared with the other patterns. These results showed that teosinte and cowpea were of different growth behaviors; however such pattern creates a combination which was able to complement each other in growth integration and make better overall set up for better use of environmental resources. These results are in agreement with those obtained by Eisa *et al.* (1989) and Awad, (1984) on maize and soybean plants. Whereas, Toaima *et al.* (2004) found that higher values of plant height were obtained by intercropping sweet sorghum with guar using intercropping pattern of 1:1.

II- Forage yield:

a- Fresh forage yield:

Results in Table (2) revealed that the second cuts of each of the two seasons for the 2:2 intercropping pattern produced the highest fresh forage yield of teosinte which was 12.57 and 13.22 t fed^{-1} for the respective two seasons without significant difference when compared with cowpea in pure stand for the same cuts. Whereas, such pattern (2:2) produced the highest total fresh forage yield for each of the two subsequent seasons which was 22.11 and 30.75 t fed^{-1}.

b- Dry forage yield:

Results of dry forage yield in Table (2) clearly indicate that intercropping pattern 2:2 gave the highest total dry yield of 6.34 and 7.00 t fed^{-1} for 2004 and 2005 seasons, respectively. This pattern was superior during the three cuts in forage production. The pattern of 2:1 was of the 2nd descending ranking order which produced total dry forage yield of 5.54 and 6.13 t fed^{-1} in the first and second seasons respectively. Both of the two patterns (2:2 and 2:1) were superior in dry yield production than the relevant pure stand of teosinte or cowpea.

Table (1): Effect of intercropping patterns of teosinte with cowpea on plant height (cm) for two summer seasons

Treat.	Intercropping patterns of T:C	1st Cut		2nd Cut		3rd Cut	
		T	C	T	C	T	C
				2004 Season			
1	1:1	67.22	56.81	132.08	58.28	118.30	50.00
2	2:1	62.36	57.72	126.00	59.97	108.12	56.00
3	1:2	69.21	64.87	128.10	70.70	123.00	61.00
4	2:2	67.97	66.49	129.0	76.05	110.16	58.00
5	Teosinte (pure stand)	70.09	-	130.16	-	124.09	-
6	Cowpea (pure stand)	-	77.96	-	78.07	-	77.91
	L.S.D. at 0.05	0.70	2.28	0.66	0.68	0.53	0.77
				2005 Season			
1	1:1	76.63	69.69	138.68	61.19	123.03	52.00
2	2:1	71.09	70.55	132.30	62.90	112.45	58.24
3	1:2	78.90	77.24	135.78	74.99	128.22	65.06
4	2:2	77.66	80.45	136.98	81.32	114.82	61.37
5	Teosinte (pure stand)	79.90	-	138.21	-	129.11	-
6	Cowpea (pure stand)	-	93.80	-	82.95	-	80.79
	L.S.D. at 0.05	0.76	2.03	1.07	0.78	0.88	2.08

T= teosinte & C= cowpea

Table (2): Effect of intercropping patterns of teosinte with cowpea on fresh and dry forage yield for the two summer seasons

Treat	Intercropping patterns of T:C	2004 Season				2005 Season			
		1st Cut	2nd Cut	3rd Cut	Total	1st Cut	2nd Cut	3rd Cut	Total
					Fresh forage yield (t fed^{-1})				
1	1:1	5.97	09.42	6.57	21.96	6.36	9.89	6.90	23.45
2	2:1	6.09	12.56	8.24	26.89	6.46	13.31	8.65	28.42
3	1:2	6.23	08.76	6.45	21.44	6.64	9.22	6.77	22.63
4	2:2	7.97	12.57	8.57	29.11	8.53	13.27	8.95	30.75
5	Teosinte (pure stand)	6.12	12.74	7.36	26.22	6.55	13.51	7.88	27.93
6	Cowpea (pure stand)	8.56	06.83	4.31	19.70	9.08	7.17	4.53	20.77
	L.S.D. at 0.05	0.42	0.98	1.07	1.54	0.44	1.03	1.13	1.64
					Dry forage yield (t fed^{-1})				
1	1:1	1.56	1.96	1.53	5.05	1.66	2.16	1.68	5.49
2	2:1	1.41	2.45	1.68	5.54	1.56	2.73	1.84	6.13
3	1:2	1.57	1.88	1.31	4.76	1.74	2.07	1.42	5.23
4	2:2	1.94	2.64	1.76	6.34	2.16	2.92	1.92	7.00
5	Teosinte (pure stand)	1.24	2.37	1.66	5.27	1.39	2.78	1.84	6.01
6	Cowpea (pure stand)	1.74	1.09	0.86	3.69	1.91	1.22	0.94	4.06
	L.S.D. at 0.05	0.09	0.19	0.23	0.32	0.10	0.21	0.25	0.35

T= teosinte & C= cowpea

Fresh and dry forage yield of the intercropping teosinte and cowpea forages where increased in the 2nd cut compared to the first and the third cut. Such trend could be explained by the limited growth behavior from sowing date to cutting time (45 days), where the plants establish their rooting system. Whereas, during the growth period for the 2nd cut, plants received more better and wormer conditions to improve their vegetative growth

which led to an increase in plant height, growth and yield (Table 1 & 2). However, plants at the 3rd cut growing period tended to initiate flowering and the more worm environmental conditions at that period of growth cause an extra expenditure of energy in flowering and seeds initiation as well as for extra respiration of plants rather than in vegetative growth.

III- Chemical Composition:

Data in Table (3) represent the percentages of crude protein (CP) and crude fiber (CF) of teosinte and cowpea in their pure stands and intercropped under the four intercropping patterns during each of obtained the three cuts in the two subsequent summer seasons.

It is clear that cowpea in its pure stand had more CP content than all of the other intercropped patterns and teosinte in its pure stand as well, while the highest crude protein content of intercropped forage, was obtained from sowing teosinte with cowpea in an alternating side ridges (2:2) in each of the two seasons. These results may be due to the riches of legumes protein content of cowpea in its alternative patterns and their pure stands as well.

Regarding crude fiber content, the three cuts of the four intercropped patterns had lower fiber content than teosinte and higher than cowpea in their pure stands. Similar results were obtained by Abd El-Shafy (1991) and Tomer and Singh, (1970) where they found that sorghum and sorghum or sordan 79 in pure stands had maximum values of CF % while guar and cowpea or guar pure stands had lowest values.

IV- Nutritive value:

Results in Table (3) represent the digestible protein percentages (DP %) for each of the three cuts in the two growing seasons for the applied alternative cropping patterns of teosinte and forage cowpeas.

It is clear that differences among the two forage crops in their pure stands and their four intercropped patterns that digestible protein (DP %) behaved in a similar manar as of crude protein content previously presented for cowpea as compared with teosinte in their relevant pure stands and the four alternative intercropped patterns as well. Such results are in agreement with those obtained by Abd El-Shafy, (1991) and Dzhumagatov, (1968) where the intercropped patterns showed that sorghum with legumes and sorghum or sordan 79 with cowpea or guar produced more DP content than grass monocultures. In this concern Miaki, (1968), reported that crude protein content was closely related to digestible protein of sudden-grass.

V- Feeding units:

Feeding units as crude protein and digestible protein yields of teosinte and cowpea in their pure stands and their relative alternative intercropping patterns are presented in Table (4).

Data showed that the total protein yield of intercropped pattern of teosinte and cowpea (2:2) significantly surpassed each of the other three sowing patterns and teosinte or cowpea in their pure stands in each of the two subsequent summer seasons. This result could be due to the increase of crude protein content of teosinte and cowpea mixtures as a result of symbiotic rhyzobial biological functions of legumes in fixing and supplying nitrogen to the companion grasses. This is in addition to creating better micro environment within plant canopies for better growth and quality. Similar results were obtained by many researchers who found that high protein yield was produced from the mixture of summer forage grasses with legumes as sorghum with cowpea (Haggag *et al.*, 1984 and Moursi *et al.*, 1980) and sordan 79 or sorghum with cowpea or guar (Abd El-Shafy, 1991).

In respect to the digestible protein yield, data in the Table (4) showed that the four alternative forage patterns exceeded that of cowpea in its pure stand, and the pattern of double alternative ridges exceeded that of teosinte in its pure stand as well. Within the four forage patterns, it can be noticed that the mixture pattern 2:2 produced the highest significant digestible protein yield for each of the three cuts as well as the total forage yield in each of the two seasons. This may be due to the increase in DP content as shown Table (3).

Table (3): Effect of intercropping patterns of teosinte with cowpea on crude protein, digestible protein and crude fiber percentage in the two summer seasons

Treat	Intercropping patterns of T:C	2004 Season				2005 Season			
		1st Cut	2nd Cut	3rd Cut	Mean	1st Cut	2nd Cut	3rd Cut	Mean
		Crude Protein (CP %)							
1	1:1	11.71	11.71	11.29	11.57	12.06	12.15	11.63	11.95
2	2:1	11.24	11.65	10.94	11.31	11.68	12.00	11.27	11.65
3	1:2	12.04	12.54	11.84	12.14	12.40	12.92	12.17	12.50
4	2:2	13.21	11.94	12.44	12.63	13.61	12.30	12.81	12.91
5	Teosinte (pure stand)	8.86	8.19	8.16	8.40	9.13	8.44	8.40	8.66
6	Cowpea (pure stand)	16.88	16.83	14.06	15.92	17.69	17.63	14.48	16.60
		Crude Fiber (CF %)							
1	1:1	26.07	29.06	28.51	27.88	25.40	28.48	27.94	27.30
2	2:1	26.12	28.90	28.80	27.94	25.59	28.32	28.22	27.38
3	1:2	26.24	28.74	28.73	27.90	25.72	28.17	28.15	27.35
4	2:2	25.44	28.44	28.80	27.56	24.93	27.87	27.94	26.91
5	Teosinte (pure stand)	27.96	31.18	31.92	30.35	27.40	30.56	30.96	29.64
6	Cowpea (pure stand)	25.30	25.66	26.60	25.85	24.97	25.15	25.80	25.25
		Digestible Protein (DP %)							
1	1:1	7.69	7.69	7.28	7.55	8.02	8.11	7.61	7.91
2	2:1	7.33	7.63	6.94	7.30	7.66	7.97	7.26	7.63
3	1:2	8.01	8.48	7.79	8.09	8.35	8.85	8.13	8.44
4	2:2	9.13	7.91	8.39	8.48	9.51	8.25	8.74	8.83
5	Teosinte (pure stand)	4.95	4.31	4.28	4.57	5.21	4.55	4.51	4.76
6	Cowpea (pure stand)	12.64	12.60	9.94	11.73	13.43	13.37	10. 35	12.38

Table (4): Effect of intercropping patterns of teosinte with cowpea on crude protein yield and digestible protein yields in the two summer seasons

Treat	Intercropping patterns of T:C	2004 Season				2005 Season			
		1st Cut	2nd Cut	3rd Cut	Total	1st Cut	2nd Cut	3rd Cut	Total
		Crude Protein Yield (Kg fed^{-1})							
1	1:1	182.96	229.52	172.74	585.22	199.90	362.14	194.80	656.89
2	2:1	159.89	285.14	183.79	628.82	182.21	327.60	206.80	716.61
3	1:2	189.94	235.75	154.55	597.33	215.14	267.44	173.12	655.71
4	2:2	255.95	315.22	218.95	790.11	293.98	359.16	245.97	899.11
5	Teosinte (pure tand)	109.64	194.11	135.46	439.20	126.91	234.84	154.35	516.09
6	Cowpea (pure stand)	293.71	183.03	120.56	597.31	336.99	214.20	136.48	687.67
L.S.D. at 0.05		12.42	23.59	25.07	37.72	13.61	27.31	28.44	41.91
		Digestible Protein Yield (Kg fed^{-1})							
1	1:1	120.16	150.73	111.39	382.27	132.93	174.97	127.47	435.37
2	2:1	103.35	186.74	116.59	406.69	119.49	217.58	133.22	470.29
3	1:2	125.76	159.42	101.86	387.04	144.88	183.20	115.65	443.73
4	2:2	176.89	208.83	147.66	533.38	205.42	240.9	167.81	614.13
5	Teosinte (pure tand)	61.25	102.15	71.05	234.45	72.42	126.61	82.87	281.90
6	Cowpea (pure stand)	219.94	137.03	85.14	442.09	255.84	162.45	97.55	515.84
L.S.D. at 0.05		8.72	16.21	16.08	25.26	9.66	19.00	18.48	28.09

T= teosinte & C= cowpea

It is evident from Table (4) that crude protein and digestible yields of the two pure cropping patterns and their four patterns decreased at the third cut than the second and first cuts but were in parallel with the obtained dry forage yield previously presented.

VI- Competitive relationships and yield advantages:

Values of Aggressivity (A), Relative Crowding Coefficient (RCC) and Land Equivalent Ratio (LER) of the four intercropping patterns of teosinte and cowpea are presented in Table (5).

Data indicated that aggressivity values of teosinte were positive for the four sowing patterns, while it was negative for cowpea. Such results indicate that teosinte was dominant while the cowpea was not dominated during each of the two seasons. These results were expected since the teosinte had the tallest plants and often have a faster growth rate and partial shading for cowpea. In this concern Toaima *et al.*, 2004 and Abd El-Shafy, 2002 found that intercropping teosinte with guar and sweet sorghum with guar in all different plant densities and all intercropping systems gave positive value of (A) for grasses and negative values for legumes.

Regarding relative crowding coefficient (RCC) data in Table (5) indicate that the values of RCC for teosinte were higher than cowpea for all of the applied sowing patterns. This indicates that teosinte crop had competitive ability and produced more yield than expected as compared to the cowpea crop.

The relative crowding coefficient RCC values for the applied sowing patterns indicated that the mixture patterns exerted yield advantages especially the mixture of sowing pattern 2:2 which had 5.59 and 4.66 in the two seasons, respectively. Such obtained results confirmed those of Toaima *et al.* (2004) and Abd El-Shafy (2002).

Regarding land equivalent ratio (LER), data revealed that intercropping cowpea with teosinte at the four sowing patterns produced less LER for each crop than unity. In other wards the dry forage yield of each crop at any intercropping pattern was less than its pure stand. This depression is expected owing to the inter competition between different species plants on light, water, nutrients and the other biophysical requirement for growth and yield.

The four intercropping patterns of 1:1; 2:1; 1:2 and 2:2 (teosinte: cowpea) yielded more than pure stand of either teosinte or cowpea on the basis of the actual cultivated area which caused a respective increase in land use which reached to about 11, 15, 8 and 36% (in the 1st season) and 8, 13, 6 and 34% (in the 2nd season) as cleared in Table (5). These results were true for all cuts and the total yield in the tested seasons.

Many previous investigators found that land usage was increased by intercropping maize and soybean (Ullah *et al.*, 2007 and Eisa *et al.*, 1989), teosinte and guar (Abd El-Shafy, 2002) sweet sorghum and guar (Toaima *et al.*, 2004) and sorghum with clusterbean (Ahmad *et al.*, 2007). From the basis of LER values, it can be concluded that the land use efficiency increased more than for monoculture by using any sowing intercropping mixture patterns especially for teosinte and cowpea on two side ridges in an alternative intercropping pattern 2:2.

The competitive relationships indicated that teosinte crop was dominant and cowpea was not dominated. Teosinte had the highest values of relative crowding coefficient (RCC) and land equivalent ratio (LER), while cowpea crop had the lowest value in the two seasons.

So, the obtained results could be recommended that the 2:2 or 2:1 intercropping patterns of teosinte with cowpea are the most balanced and profitable patterns to achieve highest fresh and dry forage yield. In addition to attaining high forage quality characteristic in CP %, DP % and CF % contents. These finding could be of great importance for small farm holding practices for more production of feed especially in summer season in Egypt.

Table (5): Effect of intercropping patterns of teosinte with cowpea on the competitive relationships and yield advantages during two summer seasons

Treat.	Intercropping patterns of T:C	2004 Season			2005 Season		
		T	C		T	C	
				Aggressivity			
1	1:1	+ 0.15	- 0.15		+ 0.08	- 0.08	
2	2:1	+ 0.15	- 0.15		+ 0.10	- 0.10	
3	1:2	+ 0.59	- 0.59		+ 0.54	- 0.54	
4	2:2	+ 0.60	- 0.60		+ 0.53	- 0.53	
				Relative Crowding Coefficient			
		T	C	T×C	T	C	T×C
1	1:1	1.47	1.07	1.57	1.28	1.08	1.38
2	2:1	2.06	1.10	2.27	1.77	1.10	1.95
3	1:2	2.04	0.72	1.47	1.78	0.71	1.26
4	2:2	4.86	1.15	5.59	4.02	1.16	4.66
				Land Equivalent Ratio			
		T	C	T+C	T	C	T+C
1	1:1	0.59	0.52	1.11	0.56	0.52	1.08
2	2:1	0.80	0.35	1.15	0.78	0.35	1.13
3	1:2	0.49	0.59	1.08	0.47	0.59	1.06
4	2:2	0.83	0.53	1.36	0.80	0.54	1.34

T= Teosinte, C= Cowpea

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تأثير بعض نظم تحميل الذرة الرياتة مع لوبيا العلف على المحصول والجودة والعلاقات التنافسية

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أجريت تجربتان حقليتان فى محطة بحوث المحاصيل الحقلية بسرس الليان، محافظة المنوفية لموسمين صيفيين (٢٠٠٤ ، ٢٠٠٥) لدراسة تأثير أربعة نظم تحميل للذرة الرياتة مع لوبيا العلف (١:١ ، ١:٢ ، ٢:١ ، ٢:٢) على صفات النمو والمحصول والجودة والعلاقات التنافسية مقارنة بالمحصول المنفرد لكل منهما. واستخدم تصميم قطاعات كاملة العشوائية في أربعة مكررات لتنفيذ التجربتين وتحليل النتائج احصائياً. أظهرت النتائج ما يلى:

- نقص معنوي في ارتفاع نباتات الذرة الرياتة ولوبيا العلف تحت ظروف التحميل مقارنة بالزراعات المنفردة.
- زيادة معنوية في المحصول الأخضر والجاف لنظام التحميل ٢:٢ مقارنة ببقية النظم الأخرى، وكذلك زيادة المحصول المنفرد لكل من الذرة الرياتة ولوبيا العلف عن المخاليط الأربعة، حيث أوضحت النتائج زيادة معنوية عن محصول اللوبيا المنفردة . بينما تفوق المحصول الجاف.
- زيادة نسبة البروتين الخام بالمخاليط الأربعة عن الذرة الرياتة المنفردة والتى كانت أقل من لوبيا العلف المنفردة، هذا وكانت نسبة الألياف بالمخاليط أعلى من لوبيا العلف المنفردة وأقل من الذرة الرياتة المنفردة.
- وحدات الغذاء الناتجة من نظام الزراعة ٢:٢ كمحصول بروتين ومحصول بروتين مهضوم أظهرت زيادة معنوية عن النظم الثلاثة للتحميل وكذا المحاصيل المنفردة لكل من الذرة الرياتة ولوبيا العلف.
- أوضحت العلاقات التنافسية أن السيادة كانت للذرة الرياتة والتى أظهرت قيم عالية من معامل الحشد النسبي، ونسبة المكافئ الأرضي في كلا الموسمين.

هذا ويمكن التوصية بأن أفضل طرق تحميل الذرة الرياتة مع لوبيا العلف هو نظام ٢:٢ ، ١:٢ والتي تعطي أفضل محصول أخضر وجاف ذو صفات جودة عالية من محتوى البروتين الخام، ومحتوى المهضوم الخام، ومحتوى الألياف الخام.

وهذه النتائج ذات أهمية عالية للفلاحين ذوي الحيازات الصغيرة، إذ يمكن بإتباعها زيادة إنتاج الأعلاف وخصوصاً في الموسم الصيفي وتحت الظروف المصرية.