EFFECT OF INTERCROPPING PATTERN AND COWPEA ACCESSION ON FORAGE YIELD, QUALITY AND COMPETITION RELATIONSHIPS OF SORGHUM / COWPEA MIXTURES

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ABSTRACT

Two field trials were conducted at the Agricultural Research and Experiment Station of Cairo University in 1993 and 1994 seasons. The aim was to improve the quality of sorghum/cowpea mixture by intercropping five cowpea accessions (IT 84 E-1-108, IT 83 S-689, IT 84-840, IT83 S-872 and IT 83S-880) with forage sorghum (Giza 1) in three intercropping patterns (50% cowpea:50% sorghum, 75% cowpea: 25% sorghum and 25% cowpea: 75% sorghum) compard to solid cowpea and sorghum. Accession IT84E-1-108 gave the highest fresh and dry forage yields in 1993, but in 1994, IT84-840 was the best accession. The more sorghum in the mixture the more forage yield was obtained. Intercropping pattern 1: 3 (25% cowpea 75% sorghum) gave the greatest dry forage yield for both (cowpea and sorghum) when compared (50% cowpea: 50% sorghum and 75% cowpea: 25% sorghum). Intercropping IT84E-I-108 and IT84-840 with sorghum at 25% cowpea and 75% sorghum gave the highest seasonal dry forage yield in 1993 and 1994 seasons, respectively. The mixture (3 cowpea: 1 sorghum) gave the highest fodder protein. The best accession for protein yield was IT83S-872. Land equivalent ratio based on total fodder protein yield of cowpea and sorghum in 1994 season showed significant differences among intercropping patterns. In general, intercropping pattern of 75% cowpea and 25% sorghum significantly increased LER on basis of protein yield . Intercropping IT83S-872 accession at 75% with 25% sorghum gave the highest LER on basis of protein yield. The IT83 S-689, IT84-840 and IT83S-880 accessions showed a positive response for LER based on protein yield under all different intercropping patterns in 1994 season. The IT83S-872 accession exceeded all accessions in LER (1.38) followed by IT83S-880. IT84E-1-108 accession showed a lowest value of LER (protein) under different intercropping patterns. Significant differences were obtained for the competitive ratio of cowpea accessions under intercropping patterns for seasonal yield in 1993 and 1994 seasons.

INTRODUCTION

The forage yield per unit area can be increased by growing mixtures of legumes741 and grass plants where one component of the mixture may complement the other to mak better use of the edaphic and climatic environmental conditions. Also, in pure stand, the other component produces less when in mixture; a balanced nutritive value from mixture may be achieved. Cowpea is a predominantly warm-weather crop well adapted to the semi arid and forest margin tropics. It is frequently grown in mixtures with other crops like maize, millet, cassava and sorghum (Rachie and Robert, 1974).

Moursi et al. (1980) studied the effect of row direction on inter and inter specific competition between sorgo and cowpea on forage productivity and efficiency of solar conversion. They reported that physiological stress, i.e., reduction in yield of sorgo plants increased as intercropped cowpea density increased. On the other hand, the reduction in cowpea yield increased as accompanied sorgo plant density increased. The protein yield and solar conversion percentage followed the same trend of change. Planting sorgo-cowpea mixture showed that the highest forage yield was obtained. Rao et al. (1983) found that a cereal: legume vegetables combined in a 50:50 ratio (followed by 25:75) resulted in higher yields and net returns. The return declined if the legume component was reduced below 50%. The increase in returns due to different intercropping patterns were 19% to 55% over monoculture. All combinations were superior to solid planting in terms of income equivalent ratio. Patra et al. (1986) indicated that cereal/legume mixed cropping increased the N content, DM yield and N uptake of the cereal but decreased the N content and N uptake of the legume. Inoculation of cowpea with rhizobium in greenhouse increased DM yield and N uptake of maize as well as of cowpea. Abd El Gawad et al. (1990) intercropped forage sorghum (sordan) with cowpea. Results showed that intercropping significantly increased the measures of yield and yield components when compared with pure stand of cowpea. Barsoum et al. (1990) found that land equivalent ratio (LER) was greater than one by intercropping the forage haybird (sordan) with cowpea under pattern 2 sordan: 1 cowpea. Relative crowding coefficient (RCs) of sordan reached its maximum value with pattern 2:1 when sowing seeds of two species separately and with pattern 1:2 when seeds were mixed before sowing while pattern 2:1 gave the highest (RCc) value for cowpea in both methods of intercropping. Aggressivity values were not significant for sordan and cowpea for both methods. Positive aggressivity values for sordan were obtained under the pattern of 1: 1 and 1: 2, respectively, while the reverse was obtained by 2: 1 intercropping pattern. Odo (1991) studied physiomorphological differences between crops in binary mixtures that can influence grain yield. A two years field study considered intra-row mixtures of one short and one tall sorghum variety, with cowpea in Nigeria. The performance of the component crops depended largely on the relative proportion of cowpea and sorghum in mixtures. Comparison of actual and expected land equivalent ratio suggested that mutual compensation and cooperation prevailed within mixtures in most instances. The pattern productivity index of mixtures where the proportion of sorghum: cowpea was 1: 3 showed that their yield stability was greater than that of other sorghumcowpea mixtures Abd El-Gawad (1993) evaluated 13 entries of cowpea introduced from Nigeria under various intercropping patterns with sorghum and corn. Wide variation in relative dry yield of cowpea entries was found when associated with corn and sorghum. He recommended fodder cowpea IT81D-985 and TVX1948-OIF for intercropping with grain maize for fodder and grain production. Accessions that can be successfully intercropped with sorghum were IT84S-2231-15 and IT83S-880. Accession IT82D-927 showed a good response for seed and forage production when intercropped with either corn or sorghum. Choubey et al (1997) Found that Zea Mexicana

J. Agric. Sci. Mansoura Univ., 25 (12), December, 2000.

/cowpea (2:1) intercrop produced the highest forage yield of 52.6 t/ha, the highest Land equivalent ratio of 1.82 and the highest net return. Obuo *et al* (1998) found that land equivalent ratios were between 1.41 and 1.79 indicating high yield advantages from intercropping cowpea - sorghum. Yield in both crops was generally highest at 60×20 cm spacing both in pure stands and when intercropped. The aim of this study was to study the effect of cowpea on improving the quality of forage sorghum (Giza 1) by intercropping with cowpea when the different intercropping patterns and cowpea accessions are used.

MATERIALS AND METHODS

Two field trials were carried out at the Agricultural Research and Experiment Station, Cairo University, Giza, Egypt, during 1993 and 1994 seasons. The trials compared three intercropping patterns, including sorghum and five accessions of fodder cowpea (Vigna unguiculata). A pre-planting application of 100 kg P2O5 fad-1 as calcium superphosphate was incorporated into the soil. Nitrogen at 30 kg fad-1 as calcium ammonium nitrate (33.5%) was applied to sorghum in two doses, 21 and 60 days after planting. Cowpea accessions (IT 84 E-1-108, IT 83 S-689, IT 84-840, IT83 S-872 and IT 83S-880) with three intercropping patterns were used. There were five treatments: one sole sorghum, one sole cowpea and three different combinations of cowpea-sorghum arranged in replacement series within the rows, thus there were 1:3, 2:2 and 3:1 sorghum-cowpea combinations. A split-plot design with four replications was used in both years. Cowpea accessions were arranged in the main-plots and intercropping patterns were in the sub-plots. The sub-plot size was 10.5 m². Seeding date was May 28, 1993 and 1994 for sorghum and cowpea. Seeding rate was 15 kg fad⁻¹ for sorghum and 45 kg fad⁻¹ for cowpea. Fresh forage yield (t fad⁻¹), dry forage yield (t fad-1) and protein yield (kg fad-1) besides land equivalent and competitive ratios were measured. Three cuts were taken. The first cut was taken 60, days after seeding (DAS) the second one 30 days from the first and the last cut was after 30 days from the second. Cutting was done by a hand-sickle to stubble height of 15 cm. The forage yield of the three cuts was determined as green and dry weight. A sub sample of 500 g was taken to determine dry matter and protein content. The sub sample was dried in a

forced air oven at 60 C to a constant weight. Nitrogen content was determined in dry forage by using the micro-Kjeldahl method (A.O.A.C. 1980). Nitrogen content was multiplied by 6.25 to obtain protein content.

Land equivalent ratio (LER), defined as the relative area of pure crops that would be required to produce the yields obtained by intercropping (IRRI, 1974). Competitive ratio (CR), the ratio of the individuals LERs of the two component crops after correcting for the proportions in which the crops where sown initially, were calculated as proposed by Willey and Rao (1980). The CR value gives the exact degree of competition by indicating the number of

Abd El-Gawad, K.I. et al.

times one crop is more competitive than the other. A (CR) value greater than unity demonstrates that one crop is more competitive than the other in the pattern. Data were statistically analyzed according to Gomez and Gomez (1984). Significance among treatments was tested using Duncan at 5% levels of significance (Duncan, 1955).

RESULTS AND DISCUSSION

Fresh forage yields:

Table 1 shows the seasonal fresh forage yield of cowpea accessions, sorghum and their mixtures in 1993 and 1994 seasons. In general, significant differences were obtained for seasonal fresh forage yield between intercropping patterns in both seasons. Cowpea or sorghum in solid stands gave the highest seasonal fresh forage yield in both seasons when compared with solid.

Table (1): Seasonal fresh forage yield (ton fad⁻¹) of cowpea accessions, sorghum and their mixtures of 1993 and 1994 seasons under different intercropping patterns.

Cowpea		1993			1994		
Accession	IP	Cowpea	Sorghum	Mixture	Cowpea	Sorghum	Mixture
	1:0	4.96 a		4.96 e	6.82 a		6.82 e
	2: 2	2.86 c	28.01 c	30.87 c	4.21 c	22.69 c	26.90 c
IT 84E-1-108	3:1	3.97 b	18.84 d	22.81 d	5.45 b	18.12 d	23.57 d
	1:3	1.78 d	40.65 b	42.43 b	3.07 d	30.62 b	33.69 b
	0:1		50.81 a	50.81 a		38.27 a	38.27 a
	1:0	4.75 a		4.75 e	6.11 a		6.11 e
	2: 2	2.79 c	27.02 c	29.81 c	3.81 c	23.52 c	27.33 c
IT 83S-689	3:1	3.80 b	15.44 d	19.24 d	4.90 b	14.93 d	19.83 d
	1:3	2.22 d	36.58 b	38.80 b	3.11 c	30.33 b	33.44 b
	0:1		45.72 a	45.72 a		37.91 a	37.91 a
	1:0	5.64 a		5.64 e	6.69 a		6.69 e
	2: 2	2.67 c	25.72 c	28.39 c	3.99 c	26.02 c	30.20 c
IT 84-840	3:1	4.52 b	16.39 d	20.91 d	5.35 b	14.48 d	19.83 d
	1:3	1.82 d	37.05 b	38.87 b	3.17 c	31.49 b	34.66 b
	0:1		46.31 a	46.31 a		39.31 a	39.31 a
	1:0	5.48 a		5.48 e	6.54 a		6.54 e
	2: 2	2.70 c	30.68 c	33.38 c	3.61 c	22.97 c	26.58 c
IT 83S-872	3:1	4.38 b	17.30 d	21.68 d	5.23 b	14.19 d	19.42 d
	1:3	2.05 d	38.46 b	40.51 b	2.96 d	31.13 b	34.09 b
	0:1		47.58 a	47.58 a		38.93 a	38.93 a
	1:0	4.96 a		4.96 e	6.91 a		6.91 e
	2: 2	2.59 c	30.26 c	32.85 c	4.37 c	25.36 c	29.73 c
IT 83S-880	3:1	3.97 b	16.80 d	20.77 d	5.53 b	13.00 d	18.53 d
	1:3	2.43 c	37.01 b	39.44 b	3.03 d	33.20 b	36.23 b
	0:1		46.26 a	46.26 a		41.50 a	41.50 a

In this and following tables means within accession followed by the same letter are not statistically different at 5% level of probability according to LSD.05

The highest seasonal fresh forage yield of cowpea was obtained with IP 3:1 (75% cowpea: 25% sorghum) in both seasons. Intercropping IT84E-1-

J. Agric. Sci. Mansoura Univ., 25 (12), December, 2000.

108 and IT84-840 accessions with sorghum at 25% percent cowpea and 75% sorghum gave the highest seasonal fresh forage yield in 1993 and 1994 seasons. The superiority of the intercropping pattern of this pattern in the fresh forage yield may be attributed to the high forage yield of sorghum when compared with the small quantity of forage of cowpea, and the higher competition between sorghum and cowpea plants in favour of sorghum plants.

Dry forage yield:

Table 2 and (Fig 1) show the seasonal dry forage yield of cowpea accessions, sorghum and their mixtures in 1993 and 1994 seasons. Generally, significant differences were obtained for seasonal dry forage yield among the different intercropping patterns in both seasons. The same trends shown for the fresh forage yield appeared again for dry forage yield. The highest dry yield was obtained for sorghum or cowpea on solid plantings.

Intercropping pattern 1:3 (25% cowpea: 75% sorghum) gave the greatest dry forage yield for both cowpea and sorghum when compared with the IP's 2:2 (50% cowpea: 50% sorghum) and 3:1 (75% cowpea: 25% sorghum) (Fig 1). Intercropping IT84E-1-108 and IT48-840 with sorghum at 25% cowpea and 75% sorghum gave the highest seasonal dry forage yield in 1993 and 1994 seasons.

It was obvious from the data that intercropping did not reduce yields of sorghum whene intercropping with two cowpea accessions, but were enhanced when combined with three other accessions. Enhanced forage production of intercropped sorghum is not unexpected due to the favoirable light conditions created by the short cowpea intercrop. On the other hand, forage yielding capacity of all accessions was enhanced under the 1:3 intercropping pattern, while it was slightly reduced under the patterns containing more cowpea. This could be ascribed to the increased chance for trailing of cowpea on sorghum plants provided in the 1:3 patterns and the reducer light intensiity for cowpea in the other patterns (e.g. Moursi et al. 1980 and James and Robert, 1983). . Myaka (1995) found that sowing cowpea between paired rows of maize increased cowpea yields by 57% compared with in alternating single rows with maize. Yield of cowpea grown, as a pure stand was not affected by sowing date and cowpea. This was found by several workers The lower dry matter yield in the intercropping plots may have been due to competition between sorghum and cowpea components for light and nutrients (NPK). Mason et al. (1986) found that intercropping cassava and cowpe, (cassava and peanut removed more nutrients (NPK) than comparable solid crops, which lead to more rapid reduction of natural soil fertility.

Cowpea	п	1993			1994		
Accession	on ^{IF}	Cowpea	Sorghum	Mixture	Cowpea	Sorghum	Mixture
	1:0	1.75 a		1.75 e	2.57 a		2.57 e
	2:2	1.05 c	8.84 c	9.89 c	1.47 c	7.92 c	9.39 c
IT 84E-1-108	3:1	1.40 b	5.38 d	6.78 d	2.07 b	6.01 d	8.08 d
	1:3	0.53 d	14.20 b	14.73 b	0.97 d	11.91 b	12.88 b
	0:1		17.75 a	17.75 a		14.88 a	14.88 a
	1:0	1.72 a		1.72 e	2.35 a		2.35 e
	2:2	0.98 c	8.84 c	9.82 c	1.69 c	8.45 c	10.14 c
IT 83S-689	3:1	1.38 b	4.72 d	6.10 d	1.88 b	4.93 d	6.81 d
	1:3	0.72 d	12.71 b	13.43 b	1.44 c	12.01 b	13.45 b
	0:1		15.88 a	15.88 a		15.01 a	15.01 a
	1:0	2.33 a		2.33 e	2.54 a		2.54 e
	2:2	0.96 c	8.31 c	9.27 c	1.59 c	8.99 c	10.58 c
IT 84-840	3:1	1.87 b	4.74 d	6.61 d	2.03 b	4.87 d	6.90 d
	1:3	0.60 d	13.18 b	13.78 b	1.01 d	13.79 b	14.80 b
	0:1		16.47 a	16.47 a		17.23 a	17.23 a
	1:0	2.07 a		2.07 e	2.44 a		2.44 e
	2:2	0.88 c	9.33 c	10.21 c	1.26 c	8.02 c	9.28 c
IT 83S-872	3:1	1.65 b	5.25 d	6.90 d	1.96 b	4.65 d	6.61 d
	1:3	0.59 d	13.28 b	13.87 b	1.04 d	12.01 b	13.05 b
	0:1		16.60 a	16.60 a		15.01 a	15.01 a
	1:0	1.73 a		1.73 e	2.57 a		2.57 e
	2:2	0.86 c	9.43 c	10.29 c	1.51 c	8.84 c	10.35 c
IT 83S-880	3:1	1.39 b	5.06 d	6.45 d	2.06 b	4.46 d	6.46 d
	1:3	0.70 d	12.61 b	13.31 b	1.08 d	12.28 b	13.36 b
	0:1		15.76 a	15.76 a		15.35 a	15.35 a

Table (2): Seasonal dry forage yield (ton fad⁻¹) of cowpea accessions, sorghum and their mixtures of 1993 and 1994 seasons under different intercropping patterns.

On the contrary Rao *et al.* (1983) found that a cereal: legume combination in a 50: 50 ratio (followed by 25: 75 ratio) resulted in a higher yields and net returns. Also, all combinations were superior to solid planting in terms of income equivalent ratio. Abdel-Gawad (1993) recommended IT83S-880 cowpea accession to be intercropped with sorghum.

Fodder protein yield:

Table 3 and (Fig 2) show the seasonal fodder protein yield of cowpea accessions, sorghum and their mixture in 1994 season. In general significant differences were obtained for total fodder protein yield between the different intercropping patterns. Intercropping pattern (3 cowpea: 1 sorghum) gave the highest average total protein yield. This may be attributed to cowpea percentage (75%) in the mixture, since protein percentage is high in cowpea and low in sorghum. Intercropping IT83S-872 accession (75%) with sorghum (25%) gave the highest figure of total protein yield.Intercropping pattern (3 cowpea: 1 sorghum) may be recommended since the goal of this study is to improve the quality of sorghum.

Fig (1): Dry forage yield (t/fed)

Fig (2): protein yield (kg/fed) 7427

Cowpea	IP	Cowpea	Sorghum	Mixture
Accession		-	-	
	1 : 0	413.6 a		413.6 c
	2:2	165.5 c	311.1 c	474.6 b
IT 84E-1-108	3 : 1	330.9 b	242.2 d	573.1 a
	1:3	128.8 d	503.7 b	632.5 a
	0:1		629.6 a	629.6 a
	1 : 0	535.2 a		535.2 b
	2:2	264.0 c	428.7 b	692.7 a
IT 83S-689	3 : 1	428.2 b	228.5 c	656.7 a
	1:3	156.4 d	450.5 b	606.9 a
	0 : 1		563.1 a	563.1 b
	1 : 0	454.8 a		454.8 c
	2:2	242.3 c	495.8 b	738.1 a
IT 84-840	3 : 1	363.9 b	258.4 c	622.3ab
	1:3	140.9 d	481.6 b	622.5 ab
	0 : 1		602.0 a	602.0 b
	1 : 0	637.2 a		637.2 b
	2:2	119.3 c	265.0 c	384.3 c
IT 83S-872	3 : 1	509.8 b	324.9 bc	834.7 a
	1:3	119.5 c	441.7 b	560.9 b
	0 : 1		552.1 a	552.1 b
	1 : 0	630.6 a		630.6 b
	2:2	169.2 c	342.7 b	511.9 b
IT 83S-880	3 : 1	504.5 b	257.8 c	762.3 a
	1:3	102.7 d	389.4 b	492.1 b
	0 : 1		486.7 a	486.7 b

Table (3): Seasonal fodder protein yield (Kg. Fad⁻¹) of cowpea accessions, sorghum and their mixtures of 1994 season under different intercropping patterns.

Land equivalent ratio, LER (basis on biological yield):

Land equivalent ratio based on biological yield (dry matter yield) of cowpea and sorghum in 1993 and 1994 seasons is presented in Table 4. Generally, significant differences were detected for LER in 1993 season among different intercropping patterns. The intercropping pattern cowpea 75% and sorghum 25% gave the highest value for LER of cowpea whereas, the intercropping pattern cowpea 25% and sorghum 75% gave the highest value for LER of sorghum for total dry forage yield in both seasons. Intercropping IT83S-689 25% cowpea with sorghum 75% gave the greatest figure of LER on basis of dry seasonal biological yield in 1993 and 1994 seasons (Table 4). All cowpea accessions showed a positive response when associated with sorghum under 3 cowpea: 1 sorghum pattern in both seasons. Some accessions had a positive response under different intercropping patterns like the IT84E-1-108 accession and IT84-840 accession. Other accessions such as IT83S-689, IT83S-872 and IT83S-880 had a little response for 2 cowpea: 2 sorghum intercropping pattern.

Cowpea		1993			1994		
Accession	IP	Cowpea	Sorghum	LER	Cowpea	Sorghum	LER
	2:2	0.60 b	0.49 b	1.09 a	0.57 b	0.53 b	1.10
IT 84 E-1-108	3:1	0.80 a	0.30 c	1.10 a	0.80 a	0.44 b	1.24
	1: 3	0.30 c	0.80 a	1.10 a	0.38 c	0.80 a	1.18
	2:2	0.57 b	0.55 b	1.12 b	0.72 a	0.56 b	1.28
IT 83S-689	3:1	0.80 a	0.29 c	1.09 b	0.80 a	0.33 c	1.13
	1: 3	0.42 b	0.80 a	1.22 a	0.61 b	0.80 a	1.41
	2:2	0.41 b	0.51 b	0.92 b	0.63 b	0.52 b	1.15
IT 84-840	3:1	0.80 a	0.29 c	1.09 a	0.80 a	0.28 c	1.08
	1: 3	0.26 c	0.80 a	1.06 a	0.40 c	0.80 a	1.20
	2:2	0.42 b	0.56 b	0.98 b	0.52 b	0.53 b	1.05
IT 83S-872	3:1	0.80 a	0.32 c	1.12 a	0.80 a	0.30 c	1.11
	1: 3	0.29 c	0.80 a	1.09 a	0.43 c	0.80 a	1.23
	2:2	0.50 b	0.59 b	1.09 a	0.59 b	0.57 b	1.16
IT 83S-880	3:1	0.80 a	0.32 c	1.12 a	0.80 a	0.29 c	1.09
	1: 3	0.40 b	0.80 a	1.20 a	0.42 c	0.80 a	1.22

Table 4: Land equivalent ratio of cowpea associated with sorghum obtained from seasonal biological yield under different intercropping patterns in 1993 and 1994 seasons.

Land equivalent ratio (basis on of fodder protein yield):

Land equivalent ratio based on fodder protein yield of cowpea and sorghum in 1994 season presented in Table 5. There were significant differences among intercropping patterns for total yield. In general, intercropping 75% cowpea and 25% sorghum significantly increased LER on basis of fodder protein yield for most of the total yield. Intercropping 75% of the IT83S-872 accession with 25% sorghum gave the highest figure of LER on basis of seasonal fodder protein yield while IT84E-1-108 accession showed a lowest value of LER under different intercropping patterns. The IT83S-689 and IT84-840 accessions showed a positive response under all different intercropping patterns.

Table (5): Land equivalent ratio of cowpea and sorghum obtained from seasonal fodder protein yield under different intercropping patterns in 1994 season

30	,03011			
Cowpea Accession	IP	Cowpea	Sorghum	LER
IT 84F-1-108	2:2 3·1	0.39 b 0.80 a	0.49 b 0.39 c	0.88 b 1 19 a
11 042-1-100	1:3	0.31 b	0.80 a	1.13 a
	2:2	0.49 b	0.76 a	1.25 a
IT 83S-689	3:1	0.80 a	0.41 b	1.21 a
	1:3	0.29 c	0.80 a	1.09 a
	2:2	0.53 b	0.82 a	1.35 a
IT 84-840	3:1	0.80 a	0.43 b	1.23 a
	1:3	0.31 c	0.80 a	1.11 a
	2:2	0.19 b	0.48 c	0.67 b
IT 83S-872	3:1	0.80 a	0.58 b	1.38 a
	1:3	0.18 b	0.80 a	0.98 b
	2:2	0.27 b	0.70 b	0.97 b
IT 83S-880	3:1	0.80 a	0.53 c	1.33 a
	1:3	0.17 c	0.80 a	0.97 b

Competitive ratio, CR (on basis of biological yield)

Table 6 shows the CR of cowpea and sorghum obtained from biological yield of cowpea and sorghum under different intercropping patterns. Significant differences were obtained at all cuts of both seasons and seasonal yield in 1993 and 1994 seasons.

In general the intercropping pattern 25% cowpea with 75% sorghum gave the highest significant figure of CRs . Whereas intercropping Pattern 75% cowpea with 25% sorghum gave the highest significant value of CRc at all cuts and seasonal yield. Intercropping the IT84-840 and IT84E-1-108 accessions gave the highest figure of CRs in 1993 and 1994 seasons, respectively. While intercropping the IT83S-689 and IT84-840 accessions in 1993 season and the IT84-840 and IT83S-880 accessions in 1994 season gave the highest figure of CRc

Table (6): Competitive ratio of cowpea and sorghum obtained from seasonal biological yield of cowpea and sorghum under intercropping patterns in 1993 and 1994 seasons.

Cowpea	IP	19	93	1994		
Accession		CRc	CRs	CRc	CRs	
	2:2	1.23 b	1.63 b	1.08 b	1.32 b	
IT 84E-1-108	3 : 1	7.99 a	0.12 b	5.45 a	0.18 b	
	1 : 3	0.13 b	15.99 a	0.16 b	8.57 a	
	2:2	1.04 b	1.96 b	1.30 b	1.06 b	
IT 83S-689	3 : 1	8.28 a	0.12 b	7.27 a	0.14 b	
	1 : 3	0.18 b	11.43 a	0.25 b	5.22 a	
	2:2	0.80 b	2.32 b	1.21 b	0.98 b	
IT 84-840	3 : 1	8.28 a	0.12 b	8.57 a	0.12 b	
	1 : 3	0.11 b	18.46 a	0.17 b	5.45 a	
	2:2	0.75 b	2.43 b	0.98 b	1.39 b	
IT 83S-872	3 : 1	7.50 a	0.13 b	7.74 a	0.13 c	
	1 : 3	0.12 c	15.00 a	0.18 b	7.27 a	
	2:2	0.85 b	2.27 b	1.04 b	1.29 b	
IT 83S-880	3 : 1	7.50 a	0.13 b	8.27 a	0.12 c	
	1 : 3	0.17 c	10.91 a	0.18 b	7.74 a	

Competitive ratio (on basis of fodder protein yield):

Table 7 shows the effect of intercropping patterns on competitive ratio of cowpea and sorghum on basis of protein yield of each. Significant differences in CRc and CRS were obtained at all cuts and seasonal yield in 1994 season.

Cowpea Accession	IP	CRc	CRs
	2:2	0.79 b	1.26 b
IT 84E-1-108	3 : 1	6.15 a	0.16 b
	1:3	0.13 b	7.74 a
	2:2	0.52 b	1.40 b
IT 83S-689	3 : 1	5.85 a	0.17 b
	1:3	0.12 b	7.27 a
	2:2	0.64 b	1.55 b
IT 84-840	3 : 1	5.58 a	0.18 b
	1:3	0.13 b	7.74 a
	2:2	0.39 b	2.52 b
IT 83S-872	3 : 1	4.14 a	0.24 b
	1:3	0.07 b	13.33 a
	2:2	0.38 b	2.59 b
IT 83S-880	3 : 1	4.53 a	0.22 b
	1:3	0.07 b	14.12 a

Table (7): Competitive ratio of cowpea and sorghum obtained from seasonal fodder protein yield of cowpea and sorghum under intercropping patterns in 1994 season.

In general, intercropping patterns cowpea 25% with sorghum 75% gave the highest value of CRs, whereas, intercropping pattern cowpea 75% with sorghum 25% gave the highest value of CRc. Intercropping the IT83S-880 accession gave the highest figure of CRs based on seasonal yield and the IT84E-1-108 accession gave the highest figure of CRc based on seasonal yield.

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تأثير نظام التحميل ومستجلبات لوبيا العلف على حاصل وجودة العلف وبعض العلاقات التنافسية لخليط السورجم ولوبيا العلف قرني إسماعيل عبد الجواد' ، رفيعة ابراهيم الزناتى' ، سهير عليان دسوقى عليان' احمد محمد عبد المنعم حجاج'

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أجريت تجربتان بمحطة التجارب والبحوث الزراعية التابعة لكلية الزراعة جامعة القاهرة بالجيزة في موسمي ١٩٩٣ و ١٩٩٤ بهدف تقييم ومقارنة لبعض أصناف لوبيا العلف المستجلبة تحت نظم تحميل مع السورجم العلفي ومدى تاقلمها مع الظروف المصرية بهدف تحسين العلف الناتج وشملت زراعة خمسة أصناف من لوبيا العلف مستجلبة من نيجيريا هي :

IT 84 E-1-108, IT 83S-689, IT 84-840, IT 83S-872 and IT 83S-880. مع صنف سورجم العلف (جيزة ١) في ٣ نظم تحميل هي: ٢ خط لوبيا : ٢ خط سورجم ، ٣ خط لوبيا : ١ خطُّ سورجم ، ١ خطُّ لوبيا : ٣ خط سورجم بجانب زراعة اللوبيا والسورجم في صورة منفردة. واستخدم تصميم القطع المنشقة في ٤ مكررات ، حيث الأصناف في القطع الرئيسية ، و نظم التحميل في القطع المنشقة. وأعطت زراعة السورجم منفردا أعلى حاصل علف أخضر وجاف ، بينما أقل حاصل علف أخضر وجاف كان في حالة زراعة اللوبيا منفردة، كلما زادت نسبة السورجم في الخليط زاد حاصل العلف الأخضر والجاف للخليط. أعطى الصنف IT84E-1-108 أعلى حاصل علف أخضر وجاف في موسم ١٩٩٣، بينما أعطى الصنف 1998-1784 أعلى حاصل علف أخضر وجاف في موسم ١٩٩٤ . أعطى نظام تحميل (٣ لوبيا : ١ سورجم) أعلى حاصل للبروتين في النبات ، وأعطى الصنف IT83S-872 أعلى حاصل بروتين في موسم ١٩٩٤ ، أعطت أصناف اللوبيا إستجابة موجبة عند خلطها مع السورجم تحت نظام التحميل (٣ لوبيا : ١ سورجم) في كلا الموسمين مثل الأصناف IT84E-1-108 وIT84-840 ووجدت فروق معنوية بين مختلف نظم التحميل بالنسبة لمكافئ الأرض للحاصل الجاف في موسم ١٩٩٣ ، ، أعطى الصنف -IT83S 689 أكبر نسبة مكافئ أرضى في موسمي ١٩٩٣ و١٩٩٤ تحت نظام تحميل (٢٥% لوبيا : ٧٥% سورجم) ، وجد أن هناك فروق معنوية في نسبة مكافئ الأرض لحاصل البروتين في الخليط لموسم ١٩٩٤ تحت نظم التحميل المختلفة وكانت أعلى نسبة مكافئ أرضى في حاصل البروتين تحت نظام التحميل (٧٥% لوبيا : ٢٥% سورجم) وأفضل الأصناف هو الصنف IT83S-872 الذي أعطى أعلى نسبة مكافئ أرضى لحاصل البروتين ، أعطت الأصناف مثل IT83S-880 وIT83S-689 وIT84-840 وIT83S-689 إستجابة موجبة تحت مختلف نظم التحميل لنسبة مكافئ الأرض لحاصل البروتين ، ووجدت فروق معنوية في معدل التنافس لأصناف اللوبيا تحت نظم الخلط المختلفة لكلا الموسمين ، بصفة عامة أعطى نظام التحميل (٢٥% لوبيا : ٢٥% سورجم) أعلى قيمة معنوية لمعدل التنافس للسورجم في موسمي ١٩٩٣ و١٩٩٤ بينما أعطى نظام التحميل (٢٥% لوبيا : ٢٥% سورجم) معنوية لمعدل تنافس اللوبيا في موسمي ١٩٩٣ و ١٩٩٤ . كانت أفضل الأصناف التي أعطت أعلى معدل تنافس للسورجم مع اللوبيا في كلا الموسمين هي -1784 840 و1184E-1-108 أما الأصناف التي أعطت أعلى معدل تنافس للوبيا مع السورجم في موسم ١٩٩٣ معنى موسم ١٩٩٣ معنى معدل تنافس للوبيا مع السورجم في موسم ١٩٩٣ أعطت الأصناف 183-880 او 184-840 أعلى معدل تنافس للوبيا ، ووجد أن هناك فروق معنوية في معدل التنافس لحاصل البروتين في موسم ١٩٩٤ سواء. في معدل تنافس اللوبيا والسورجم في نظم التحميل المختلفة.