Some Nutritional Studies on Guar (Cyamopsis tetragonoloba L.) Grown Singly or Intercropped with Sweet Sorghum (Sorghum vulgar var. Saccharatum).

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Summary

This study was conducted to compare the effect of growing guar (Cluster bean) separatly or with sweet soeghum on the productivity and nutritive value. Results showed that the mixtures were significantly increased in green and dry yields than guar and sweet sorghum in pure stands by I6.73-24.74%. concerning the nutritive analysis and feeding values, guar as legume forage crop had higher CP and ash contents than sorghum. Mixing guar with sorghum improved the forage quality of the mixture especially in digestibility coefficients, nutritive values (TDN,SV and DCP), nutritive ratio and daily intake by bulls as compared with solid sorghum.

Introduction

Farmers and livestock breeders depend for feeding their animals on corn plant , Sudan grass and sweet Sudan grass in summer after the end of clover "berseem" season. Animals need green legume forage during summer to supply them with protein, so the problem is to find the suitable legume forage for summer.

Since the cultivated areas are limited and do not permit for the expansion of summer forages, the need for inclusion of forage legumes is urgent.- This could be achieved by interplanting forage lugunes with grasses, such as sorghum.

Continous efforts were directed to improve the summer forage crops by intercropping the leguminous forages such as alfalfa and cowpea with grasses (Farid and Ghobrial, 1976, Hassan and Gabra, 1982, Gabra, 1984 and Gabra and Sherif, 1985). More efforts should be directed to increase the available feads in summer using selected and improve local summer forages and / or trying to introduce more suitable forage crops such as guar (Cyamobsis tetragonoloba L.) which sowing in pure stand as legume forage or intercropped with grasses. Guar or culster bean, erect annual herb 1-2 m high , drought resistant and cultivated as grain, fodder or vegatable can be cut for fodder as soon as the pods begin to develop.

The main of this study is to produce a legume crop (guar) grown in pure stand or in comination with a summer forage grasses to obtain the balance diet for animals as far as possible.

Material and Methods

The study included five treatment, three treatments were sowing guar and sweet sorghum in pure stands with cutting sweet sorghum at 125 and 150 cm hights. The other two treatments were mixture in which sweet scrghum was the main forage crop mixed with guar. The sweet sorghum with rate 20 kg seed/ feddan was sown in lines with 30 cm apart.

However, guar was sown in hills 20 cm apart in lines with 30 cm apart by seed rate was 25 kg/fed. Guar in the mixture was sown alternated in lines of sweet sorghum was planted.

This study was conducted in Experimental Station Cairo Univ., Giza in 1983 and El-Marg Farm in 1985 using complete randomize block design with four replicates, the plot size was 10.5 m^2 . All normal agronomical treatments were used. Twinty units of nitrogen per feddan were added to sweet sorghum before the first irrigation. Three cuts from guar and four from sweet sorghum in pure stands were taken. Mixture was cut as sorghum and guar together. The green yield ofeach plot was recorded to the nearst 10 g.

Metabolism Trials : Half feddan at El-Marg farm was devided into equal plots, sown in plantation every 3 days to keep the suitable hights needed in the metabolism trials. Five metabolism trials were carried out to determine the digestibility coefficients and feeding value of guar, sweet sorghum (125 and 150 cm heights) and two trials with mixture of sweet sorghum and guar. Three Balladi cattle bulls about 246 kg body weight were used . Each trial composed of 10 days preliminary period followed by 8 days collection period. Faces were quantitavely collected using collection bags. The animals were fed on the green forage obtained from the first cut of each treatment.

The samples from forage and feces were chemically analysed according A.O.A.C., 1980. The energy was determined using a standard non adiabatic bomb colorimeter. Phosphorus was determined according to colormetric method of Fisk and Subbarow, 1925.

Feed calcium contents were determined using the Bye unican atomic absorption apparatus.

The date were statistically analysed according to steel and Torrie, 1060. Duncais multiple range test was applied whenever possible.

Restults and Discussion

Fodder yield: It is clear that from(Table 1), the average green and dry yields of sweet sorghum cut at 150 cm height in pure stand were significantly higher ($P < 0.05$) than pure stand guar or sorghum at 125 cm. height. On the other hand, intercropping guar with sorghum increased the green yield by 14.74 - 18.72 % and dry yield by 23.23 - 26.25 % higher thqn sorghum in pure stand.

Concerning the botanical analysis, the yield of guar in the mixture was higher with lower cut of sorghum (125 cm.) thqn higher cut (150 cm.) being in average 8.40 and 7.42 ton/fed., respectively compared with 13.84 ton/fed. in solid guar. This might be due to the increased shading with increasing the cutting height. Such shading is believed to be the main factor causing the decrease of guar yield. Competition between the species depended on plant height and sorghum leaf area which affected radiation, level in the plant canopy. In this connection, Gabra, 1984 and Gabra and Sherif, 1985 found that the green yields of berseem and alfalfa intercropped on napier grass and cowpea on sorghum were decreased than their yields in pure stands by 20-43 %.

Table (I) The average fodder yield(Ton/fed) and chemical analysis of guar, sweet sorghum and their mixtures(average 3 cuts guar,4cuts sweet sorghum and the mixtures)

Treatments	Fodder Yield	DM	CP	EE	CF	NFE	Ash	GE Kcal/ 100g.	Ca	P	Ca / P ratio : I
	Green				Fresh basis %						
Guar	13.84^{d}	22.83^{a}	3.94^{a}	0.50^{a}	5.17^{c}	9.61^{a}	3.61^{a}	85.16^{a}	0.39^{a}	0.07^{a}	5.57^{a}
Sorghum I25 Cm	36.48^{c}	20.63^{c}	2.23^{c}	0.39^{b}	6.34^{b}	8.69^{b}	2.71^{d}	78.33^{b}	0.09^{c}	0.04^{c}	2.25^{c}
I50 Cm	38.18^{b}	21.56^{b}	2.20^{c}	0.42^{ab}	7.15^{a}	9.14^{b}	2.65^{d}	79.77^{b}	0.09^{c}	0.04^{c}	2.25^{c}
Mixture I	44.88^{a}	22.73^{a}	2.80^{b}	0.45^{ab}	6.37^{b}	10.15^{a}	2.96^{c}	85.92^{a}	0.24^{b}	0.05^{b}	4.80^{b}
" II	45.60^{a}	23.51^{a}	2.64^{b}	0.48^{a}	7.26^{a}	9.93^{a}	3.00^{b}	88.40^{a}	0.23^{b}	0.05^{b}	4.60^{b}
	Dry				D M basis %						
Guar	3.16^{e}	100	17.25^{a}	2.19	22.65^{d}	42.08	15.83^{a}	373	0.73^{a}	0.32^{a}	-
Sorg. I25 Cm	7.53^{d}	100	10.83^{c}	1.89	30.74^{b}	43.38	13.16^{b}	371	0.45^{d}	0.20^{bc}	-
" I50 Cm	8.23^{c}	100	10.21^{c}	1.96	33.15^{a}	42.37	12.31^{c}	370	0.42^{d}	0.19^{c}	-
Mix . I	10.21^{b}	100	12.34^{b}	1.98	28.03^{c}	44.62	13.03^{b}	378	1.05^{b}	0.23^{b}	-
Mix. II	10.72^{a}	100	12.07^{b}	2.04	30.86^{b}	42.28	12.75^{c}	376	0.96^{c}	0.21^{bc}	-

Mix . I = sorghum I25 cm height +Guar Mix.II = sorghum I50 cm height + Guar

a , b , c , d Not followed by the same letter are significantly different at 0.05 level (Duncan's multiple rangetest) .

The average green and dry yields of sorghum in this study were lower than those found by Gabra, 1984. However, the yield of guar was lower than those obtained by Ghobrial et.al.,1982. Many factors affecting the fodder yield such as the soil, climate and weather, the stage of maturity and pasture manogement, sowing date and fertilization.

Nutritive analysis: Data in(table 1) showed that DM percentage was significantly higher($p<0.05$) in guar and the mixtures than sweet sorghum in pure stand. Increasing cutting height of sorghum increased DM content in the herbage. On green and DM basis, CP and ash contents were the highest in guar as legume forage than sorghum and mixtures and decreased significantly with increasing cutting height of sorghum. Mixing guar with sorghum improved the CP content in the mixture compared with sorghum in pure stand. EE % was highest in guar and the mixtures than solid sorghum. Guar contained lower CF percentages than sorghum and the mixtures and CF content increased with increasing the cutting height of sorghum. There were no significant differences among the treatments in NFE contents (DM basis), but on fresh basis NFE % was the highest in guar and the mixtures than solid sorghum. Results obtained here were in agreement with those mentioned by Ghobrial et,al, 1982 with guar, Gabra, 1984, shalaby et.al., 1984 and Gabra and Sherif, 1985 (with sorghum in pure stand and sorghum/legume mixtures).

The estimated calorific values for gross energy (GE), data in table I showed that GE ranged from 37o-378 K cal/IOO g. dry forage. The corresponding values of green forage were 78.o5-87.I6 K cal/IOO g. Fresh forage being significantly higher (P<o.o5) in guar and the mixtures than sorghum in pure stand.
At each treatment GE being positively correlated with DM% in green herbage. Results were agreament with Gabra, I984.

Regarding ca and P contents, results in table I indicated that guar had significalty higher (P<o.o5) ca and P contents either on green and dry basis . Mixing guar with sorghum improved ca and P contsnts and increased ca/P ratio significantly than sorghum in pure stand. In this line, sherif and Gabra, I985 showed the same results with legume /grass mixtures.

Digestibitly coefficients and nutritive value: Chemical analysis of the Ist cut eaten by bulls in metablism trials and the apparent digestibility coefficients of guar, sweet sorghum and their mixture are presented in table 2. Guar and the mixture contained higher DM,CP and ash and lower CF percentages than sweet sorghum in pure stand. NFE contents were similar in the five treatments. Gross energy ranged from 37I to 382 k cal/IOO g.dry herbage.

Concerning the digestibity coefficients (Table2) results showed that DM,OM, CP, EE and NFE digestibilities were significantly higher (P<o.o5) in guar than sweet sorghum and mixtures.

Table (2) : Chemical analysis (D M basis) and disgestibility coefficients of the I-st cut green forage fed in metabalism trials .

Treatments	chemical analysis (D M basis %)								Digestibility coefficients %						
	DM	OM	CP	EE	CF	NFE	ASH	GE Kcal/ IOOG.	DM	OM	CP	EE	CF	NFE	E
Guar	a 20.I3	b 84.08	a I8.23	2.0I	c 2I.35	42.49	a I5.92	373	a 66.I4	a 69.I3	b 7I.09	a 62.82	c 64.94	c 70.45	a 68.53
Sorghum I25 cm	c I8.2I	a 86.74	d II.63	2.I3	b 29.26	43.72	b I3.26	37I	b 64.58	c 67.25	a 72.3I	b 60.9I	a 67.42	a 73.I3	b 67.6I
Sorghum I50 "	b I9.53	a 87.97	e II.02	2.2I	a 3I.34	43.40	d I2.03	382	b 6I.63	d 64.9I	c 70.3I	b 60.24	d 64.03	c 70.59	c 64.58
Mixture I	a 20.27	a 87.44	b I2.54	I.98	b 29.07	43.85	c I2.56	376	c 65.03	b 68.I5	a 7I.84	a 62.3I	b 65.46	b 72.54	b 67.89
Mixture II	a 20.86	a 87.68	c I2.3I	2.03	a 30.82	42.52	c I2.32	380	b 64.76	c 67.42	c 70.58	a 62.05	c 64.6I	b 7I.85	b 67.73

a , b , c , d ; e Not followed by the same letter are significantly different at 0.05 level (Duncan's multiple range test) .

However, CF digestibility was higher in solid sorghum than the other treatments. Mixing guar with sorghum increased significantly DM,OM CP, EE and NFE digestibilities compared with sweet sorghum alone. On the other hand,digestibility coefficients of nutrients were decreased with increasing cutting hright of sorghum. Similar results were reported by Gabra , I984 (with six cultivars from sorghum) and Gabra and sherif, I985 (with sorghum/cowpea mixture).

The OM digestibility coefficients showed similar figures of GE. However, the OM digesttibility coefficients showed higher figures than DM digestibility . This was due to the fact DM of eaten forages had lower ash(I2 .o3-I5.92%) than fecal DM (22.64-34.o5%) having wide range among bulls.

The feeding values (TDN and SV) in table3 in dicated that as fed, the mixture contained highest TDN and SV% than guar and sweet sorghum in pure stands. However, on DM basis, cutting sweet sorghum at I5o cm height mixed with guar gave the highest nutritive values. The values of DCP% increased significantly ($P<o.o5$) in guar/sorghum mixture than sorghum in pure stand either on green or DM basis. The values on DM basis were lowest in sweet sorghum (7.73-7.96%) noticeably higher in the mixtures (8.88-8.98%). Results in this study were in agreament with those found by Gabra I984, and Gabra and sfreif, I985 with grass/ legume mixture.

Table (3) Feeding values and feed units yield of Gura , sorghum and their mixture .

Treatments	Feeding values: AS fed % TDN	AS fed % SV	AS fed % DCP	AS fed % E Kcal/100g	D M basis % TDN	D M basis % SV	D M basis % DCP	D M basis % E Kcal/100g	NR: I	Feed units yield ton/fed: D M	TDN	SV	DCP
Guar	b 11.90	a 10.38	a 2.61	a 51.43	d 59.11	c 51.56	a 12.96	255.59	c 3.55	d 3.16	d 1.86	c 1.62	c 0.40
Sorghum I25cm	c 11.48	b 9.59	c 1.45	b 45.68	b 63.04	b 52.66	c 7.96	250.85	a 6.92	c 7.53	c 4.74	b 3.96	b 0.59
" I50 "	b 12.00	b 9.72	c 1.51	ab 48.16	c 61.47	c 49.79	c 7.73	246.72	a 6.95	b 8.23	b 5.05	b 4.09	b 0.63
Mixture I	a 13.04	a 10.87	b 1.82	a 51.74	a 64.33	a 53.63	b 8.98	255.25	b 6.16	a 10.21	a 6.56	a 5.47	a 0.91
" II	a 12.91	a 10.55	b 1.81	a 53.69	c 61.89	c 50.57	b 8.68	257.38	b 6.13	a 10.72	a 6.63	a 5.42	a 0.93

a , b ; c , d , Not followed by the same letter are significantly different at 0.05 level (Duncan's multiple range test) .

It was also clear that the mixture had narrow values of nutritive ratio (1:6.13 - 1:6.16) than sweet sorghum in pure stand (1:6.92 - 1: 6.95). Improving the NR in the mixture due to the fact that mixing guar with sorghum raised both CP and DCP contents. Similar results were reported by Gabra and sherif, 1985 with bulls fed. sorghym/ cowpea mixture.

Daily intake of green guar, sweet sorghum and their mixture by bulls:

Intake of green forage (Table 4) by mature bulls per day decreased significantly ($P < 0.05$) with guar in pure stand followed by solid sorghum cut at 150 cm. height. This trend was reflexed also on DM/100 kg. body weight or per kgw. 0.75. Decreasing the daily intake from guar might be due to the fact that recorded by BoGöhl,1981 who mentioned that guar a poor forage for grazing because of its hairy and nettly leaves. On the other hand, animals consumed more forage from guar/sorghum misture being significantly higher ($P < 0.05$) with sorghum cut at 125 cm. height than 150 cm. height. The DM/kgw. 0.75 ranged from 90.09 to 103.46 g. in this study within the range obtained by Gabra and Sherif, 1985 (91.97 - 104.01 g. DM/kgw. 0.75) with bulls fed green sorghum/cowpea mixture. In this connection Laredo and Minson,1473, Gabra, 1984, Shalaby et,al., 1984 and Gabra and Sherif, 1985 reported that the intake from legume/grass mixture was higher than grasses in pure stands.

Also mixing guar with sorghum increased the intake from the feed units (TDN,SV and DCP) by bulls. The intake from SV and DCP in this study were higher than those recorded by Abou-Raya et.al.,1980.(25g.SV and 2-4 g.DCP/kgw 0.75)

Table 4 . Daily intakes from green guar , sorghum and their mixture by bulls

Treatments	body weight Kg	D.I %	Daily intake Frish Kg	Dry g.	DM/100 Kg.b.w. Kg	intake /Kg $W^{0.75}$ DM g.	TDN g.	SV g.	DcP g.
Guar	246	20.I3	27.80 d	5596 d	2027 d	90.09 c	53.25 c	46.45 c	II.67 a
Sorghum I25 cm	248	I8.2I	33.50 a	6I00 c	2.46 c	97.6I b	6I.53 b	5I.40 b	7.76 d
" I50 "	246	I9.52	30.40 c	5934 d	2.4I c	95.53 b	58.75 b	47.56 bc	7.38 d
Mixture I	247	20.27	3I.80 b	6446 a	2.6I a	I03.46 a	66.55 a	55.48 a	9.29 b
Mixture II	248	20.86	30.I0 c	6279 b	2.53 b	I00.47 ab	62.I8 b	50.80 b	8.72 c

a , b , c ; d Not followed by the same letter are significantly different at 0.05 level (Duncan's multiple range test) .

The intake from SV and DCP could cover the maintenance requirements of animals from energy and protein with surplus for production.

Feed units yield: The feed units yield (TDN, SV and DCP) were calculated from average composition of each treatment, average digestion coefficients of nutrients known from feeding trials with bulls(Tables 2 and 3).Results in table 3 showed that the mixtures were significantly higher (P<o.o5) in the feed units yield than sorghum and guar in pure stands. Intercropping guar with sorghum and cut the two crops together at I25 cm or I5o cm height (for sorghum increased the feed units yield of the mixture by 25.8o, 26.II and 56.53% for TDN, SV and DCP, respectively than sweet sorghum in pure stand.

In Egypt, during the summer perico when the farmer sows one kirrat(I75 m2, ¼ of afedden) with sweet sorghum in the field heading from the area of maize and grain sorghum (about 2. 32 million fed), the total area planted from sweet sorghum equalsabout 96667 feddans and cut the forage at I25 cm or I5o cm height gave in average about 0.48, 0.38 and 0.06 million ton TDN, SV and DCP, respectively. However, intercropping guar on sorghum in96667 feddan and cut the two forages together gave about 0.63, 0.53 and 0.o9 million ton TDN, SV and DCP, respectively. In other words, the SV yield obtained from sorghum/guar mixture (0.53 million ton) to equal about 7.6o% (the total feed units yield/year about 6.97 million ton SV recorded by Gabra, I984). However, the SV yield of sweet sorghum now avery low

share being only C.I4% (Gabra, I984).

Agriculture extensive system, it can infered whenever possible increase the yield under similar studied conditions. This can be obtained without increasing the area under cultivation in the loam soil. This might solve the problem of imported hybrids and contribute for increasing the green forage in summer.

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بعض دراسات غذائية على الجوار المنزرع منفردا أو محملا على الذرة السكرية

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أجريت هذه الدراسة لمقارنة تأثير زراعة الجوار منفردا أو محملا على الذرة السكرية على الانتاجية والقيمة الغذائية . أظهرت النتائج أن مخلوط العلف الاخضر الناتج من تحميل الجوار على الذرة السكرية يزيد معنويا بنسبة ١٦٫٧٣ ٪ ، ٢٤٫٧٤ ٪ عن محصول الجوار والذرة السكرية المنزرعان فى حالة فردية على التوالى . وبالنسبة للتحليل الغذائى والقيم الغذائية فان النتائج أظهرت أن الجوار كمحصول بقولى يزيد فى البروتين الخام والرماد عن الذرة السكرية . كما أن خلط الجوار مع الذرة السكرية أدى الى تحسين خواص العلف فى المخلوط خاصة فى معاملات الهضم والقيمة الغذائية والنسبة الغذائية كما أدى الى زيادة المتناول اليومى من العلف الاخضر المأكول بواسطة الشيران .