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Studies on the Fodder Yield and Quality of Sorghum Grown Alone and in Mixture with Ricebean

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Abstract

A field experiment was conducted at the Agronomic Research Area, University of Agriculture, Faisalabad, during 2001, to evaluate the effect on growth, yield and quality of sorghum fodder (*Sorghum bicolor* L.) sown alone and in mixture with ricebean (*Vigna umbellata*). The sorghum and ricebean were sown at proportions of 100:0, 0:100, 50: 50, 65:35, 75: 25, 35: 65 and 25: 75. The sole seed rate of sorghum and ricebean was 80 kg and 20 kg ha^{-1}, respectively. The mixture seed rates were made on that of pure stand. The seed proportions of sorghum and ricebean significantly affected the sorghum plant height, number of leaves of both sorghum and ricebean plants, green and dry matter yields. Height of ricebean plant, stem diameter of sorghum and crude fibre contents were not influenced significantly by seed proportions. Increasing the seed of ricebean in mixture increased crude protein and decreased crude fibre contents. Keeping in view both yields and quality of fodder the seed proportions 50:50 and 35:65 seems equally good under Faisalabad conditions.

Keywords: Sorghum, Ricebean, Seed proportion, Fodder yield quality

Introduction

Sorghum is grown through out the country under both irrigated and rainfed conditions. Its fodder is considered poor in quality due to low protein contents and presence of hydrocyanc acid (Hingra *et al.*, 1995). It is also low yielder due to non-ratooning ability. Therefore, a need was felt to improve the quality and quantity of sorghum fodder. Mixed cropping especially with legumes can improve both forage quality and yield because legumes are a good source of protein (Moreira, 1989). Growing of sorghum and maize in mixture with cowpeas and soybeans in 1:1 and 2:1 row proportions produced more fresh weight, dry weight and crude protein ha^{-1} than their sole crops (Chellaiah and Ernest, 1994).

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The growing of fodder crop in mixture with legumes enhanced fodder palatability and digestibility (Chaudhary and Hussain, 1985). The relative proportion of the components crops in mixture is an important factor determining yield, quality and production efficiency of a cereal-legume mixture (Willey and Osiru, 1972). High proportion of legumes is undesirable since they normally have a low dry matter contents and susceptible to lodging (Gillilan and Johntson, 1992). For obtaining a good fodder of improved quality, a correct balance of legumes and non-legumes in mixture is very essential. The present experiment was therefore, designed to study the growth, fodder yield and quality of sorghum and ricebean sown alone and mixture with each other in different proportions.

Materials and Methods

A field experiment to compare the growth, fodder yield and quality of sorghum and ricebean sown alone and in mixture with each other in different proportions was conducted at the Agronomic Research Area, University of Agriculture, Faisalabad, Pakistan. The experiment was laid out in factorial randomized complete block design with four replications and using a net plot size of 1.8m x 10m. The sorghum and ricebean were sown in the seed proportions of 100: 0, 0:100, 50:50, 65:35, 75:25, 35: 65 and 25:75. The seed rate for pure stands of sorghum was 80 kg ha^{-1} and for ricebean 20 kg ha^{-1}. The sowing rate of mixtures were based on that of pure stand. The sole crop and blended seed of mixtures were sown on July 20, 2001 with single row hand drill. The basal dose of 75 kg N and 65 kg P_2O_5 ha^{-1} was applied with first irrigation in the form of urea and single super phosphate, respectively. All the cultural practices were kept normal and uniform for all the treatments. Quality parameters like crude protein, crude fibre, and total ash percentage were determined using the methods given by AOAC (1984). The data on growth, yield and quality parameters were analyzed by using Fisher's analysis of variance technique and least significant difference test at 0.05 probability level was employed to compare the treatment means (Steel and Torrie, 1984).

Results and Discussion

Effect on yield attributes

Plant height of sorghum plant was influenced significantly by different seed proportions with ricebean (Table 1). The sorghum sown alone produced statistically similar plant height to 75:25 and 65:35 but significantly higher than other seed proportions. The maximum and minimum plant height was recorded at seed proportions of 100:0 and 75:25, respectively. These results are supported by the findings of Hong *et al.* (1987) but are contradictory to those of Ranbir *et al.* (2001). They reported that plant height of maize crop in maize + legume inter cropping system was significantly better as compared to pure maize. These contradictory results might have been due to differences in genetic traits of crop plants or fertility status of soil or legume species.

Plant height of ricebean was not influenced significantly by different seed proportions but the plots which were sown in mixture with sorghum have slightly more height than ricebean alone (Table 1). Marchiol *et al.* (1992) have also observed an increase in plant height of soybean when intercropped with maize. Although stem diameter was not influenced significantly but there has been an increase in stem diameter by increasing the seed rate of legume in mixture (Table1). Hong *et al.* (1987) have also observed lowest stem diameter for maize crop sown alone than sowing maize as an intercrop with soybean.

Sorghum sown in mixture at seed proportion of 25:75 produced significantly more number of leaves plant^{-1} than all other treatments, whereas, remaining all treatment have statistically similar number of leaves plant^{-1} (Table 1). The less number of leaves per plant of sorghum at seed proportions of 100:0 might have been due to early senescence as compared to other treatments. The results are in accordance with those of El-Hefni *et al.* (1984). The ricebean sown at seed proportions of 0:100, 50:50 and 25:75 remains at par with each other but produced significantly more number of leaves plant-1 than the remaining treatments. The seed proportions of 65:35 also produced statistically similar number of leaves plant^{-1} to 75:25 and 35:65. The results are contradictory to those of El-Hefni *et al.* (1984). They reported that when soybean was intercropped in maize, its number of leaves plant^{-1} increased with decreasing plant density. These contradictory results may have been due to differences in climatic conditions or species.

Yield and Quality Parameters

The plots sown with ricebean alone produced significantly the lowest green fodder yield than all other treatments except seed proportion of 25:75 (Table 1). Whereas, remaining all seed proportions have statistically similar green fodder yield. The maximum green fodder yield was noted for seed proportions of 75:25. Significant effect of cereal legume mixture on green fodder yield has also been reported by Mohapatra and pradhan (1992) and Mishra *et al.* (1997). The ricebean sown alone produced significantly the lowest dry matter yield than sorghum sown alone and in mixture with ricebean. The maximum dry matter yield was recorded at seed proportion of 75: 25. The significant effect of seed proportions on dry matter yield have also been reported by Lee (1988).

The different seed proportions of sorghum and ricebean significantly influenced the crude protein yield (Table 2). The highest crude protein yield was recorded from plots sown with seed proportions of 25:75. The seed proportion 75:25 produced lowest crude protein yield but it was not significantly different from seed proportions 100:0 and 65:35. Higher crude protein yield from cereal-legume mixture than cereal alone has also been reported by Mishra *et al.* (1997). The seed proportion of 75:25 gave the highest dry matter percentage but it was statistically similar to seed proportions 100:0, 50:50, 65:35 and 25:75. The seed proportion 35:65 produced lowest dry matter percentage. Low dry matter percentage of cereal-legume mixture than cereal sown alone have also been reported by Thomas *et al.* (1984). The lower dry matter contents of cereal-legume mixture over the sorghum alone has been due to lower dry matter contents of ricebean.

The ricebean sown alone produced significantly higher crude protein contents than all other treatments and it was followed by seed proportions of 25:75, 35:65 and 50:50 (Table 2). The sorghum sown alone produced significantly lowest protein contents. The results are in line with those of Thomas *et al.* (1984). The higher crude protein contents of the mixture over the sorghum alone has been due to higher protein contents of the legume crop.

Although the crude fibre contents were not significantly influenced by different proportions of sorghum and ricebean seed rate but there has been a decreasing trend in crude fibre contents with increased seed rate of ricebean in mixture (Table 2). The ricebean and sorghum sown alone have lowest and highest crude fibre contents, respectively. The decrease in crude fibre contents of the mixture with increased seed rate of ricebean may be due to low fibre contents of ricebean than sorghum sown alone.

Ash contents were increased with increasing the proportion of ricebean in the seed rate (Table 2). The ricebean sown alone produced significantly the highest ash contents than all other treatments. The sorghum alone produced the minimum ash contents and it was statistically similar to seed proportions of 50:50, 65:35 and 75:25. The results are quite in line with those of Thomas *et al.* (1984). They reported that ash contents of cowpea and sorghum mixture were increased with increasing proportion of cowpea in the mixture.

Table 1: Growth characteristics and green fodder yield as influenced by different seed proportions of sorghum and ricebean.

Seed proportions Sorghum : Ricebean	Plant height of sorghum (cm)	Plant height of ricebean (cm)	Stem diameter of sorghum (cm)	No. of leaves plant^{-1} of sorghum	No. of leaves plant^{-1} of ricebean	Green fodder yield (t ha^{-1})
100:0	100.85 A	–	1.33	12.40 B	–	68.09 A
0:100	–	59.40 ns	–	–	104.55 A	40.92 B
50:50	92.05 BC	65.20	143 ns	12.88 B	96.75 A	61.97 A
65:35	96.20 AB	66.40	165	12.65 B	64.75 C	64.09 A
75:25	98.93 A	59.90	138	13.03 B	56.80 C	68.51 A
35:65	88.35 C	65.35	1.40	12.90 B	73.90 B	60.58 A
25:75	86.00 C	63.50	2.40	13.73 A	91.50 A	55.06 AB

Any two means not sharing a letter in common differ significantly from each other at 5% probability.

Table 2: Dry matter yield, crude protein yield and quality parameters as influenced by different seed proportions of sorghum and ricebean.

Seed proportions sorghum: ricebean	Dry matter Yield (t ha^{-1})	Crude protein yield (t ha^{-1})	Dry matter (%)	Crude protein (%)	Crude fibre (%)	Total Ash (%)
100: 0	13.28 A	6.30 C	19.59 AB	9.29 E	36.50 ns	8.25 DE
0: 100	6.89 B	8.72 A	18.61 BC	21.30 A	29.50	12.13 A
50: 50	11.97 A	8.21 AB	19.21 ABC	13.23 C	31.75	8.75 CD
65: 35	12.43 A	7.41 BC	19.29 AB	11.69 D	32.25	8.38 CDE
75: 25	13.58 A	6.96 C	19.77 A	10.28 E	34.00	7.63 E
35: 65	11.03 A	8.31 AB	18.24 C	13.70 C	32.00	9.12 C
25: 75	10.49 A	8.84 A	18.96 ABC	16.16 B	30.00	10.00 B

Any two means not sharing a letter in common differ significantly from each other at 5% probability.

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