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PRODUCTIVITY OF PURE STANDS AND INTERCROPPED FORAGE SORGHUM AND HYACINTH BEAN

Galal Ahmed EL Toum Mohammed

Department of Agronomy, Faculty of Agric. Sciences, University of Dongola, Sudan.
Corresponding Author E-mail: galaleltoum1234@gmail.com

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ABSTRACT

Enhanced biodiversity in intercropping systems can increase productivity, stability, resilience and resource-use efficiency of the intercropped species compared with sole-cropping. A randomized complete block design with four replications was used to compare the productivity of pure stand of fodder sorghum " Abu sabein" and hyacinth bean " Lubia afin" with the mixture of the two fodders. The analysis of variance showed significant differences in fresh and dry weight at plant age 30, 40, 50 and 60 days and leaves to stem ratio at 30 days. This study revealed that the contribution of green and dry weight of fodder sorghum was greater than that of hyacinth bean and leaf to stem ratio for both fodders was declined with plant age.

KEYWORDS

Pure stand, Mixture, fodder sorghum, hyacinth bean.

1. INTRODUCTION

Fodder sorghum (*Sorghum bicolor* L. (Moench) cv. "*Abu sabein*" is one of the most important native cereal crop in Africa and the fifth area-wise of the world cereals. The crop is grown in the tropical and sub-tropical regions of the world [1]. The crop is grown for green fodder and for grains. Hyacinth bean (*Lablab purpureus* L.) cv. "*Lubia afin*" is known in different parts of the world by different names, in the Sudan it is called "*Lubia afin* ". The most common commercial cultivars are Rongi and High worth [2]. Intercropping is the cultivation of two or more crops in the same area and at the same time. Accordingly intercropping promotes the interaction between the different plants [3]. Intercropping is becoming more important to increase crop productivity to satisfy food demands of increasing population, especially in developing countries [4]. Intercropping has long been practiced in the Sudan as a traditional system [5]. The productivity of forage crops in the Sudan is limited by the lack of hybrids with high yield and good quality. A researcher stated that very few efforts have been exerted to develop improved forage cultivars from the local stocks [1]. A scientist reported that shortage of forage seeds of sorghum, poor methods of production and preservation techniques such as hay and silage making are limiting the productivity of fodders in the Sudan [6].

2. MATERIALS AND METHODS

A pot experiment was carried out at Demonstration Farm of the Faculty of Agriculture, University of Khartoum (Latitude 15° – 40′ N and Longitude 32° 32 ′E) – Shambat-Sudan in season 2010. The climate of the locality is semi-desert with low relative humidity, maximum temperature is about 40 °C in summer and 20 °C in winter, but night temperatures are lower. The range of temperature varies from about 20–26MJ/m-2 day-1 [7]. A randomized complete block design(RCBD) with four replications was used to execute the experiment. Sowing was done in season 2010 with seed rate 50% of each crop. Four samples were taken during the growing period. The first sample was taken 30 days from sowing and the other three samples were taken at intervals of 10 days. The collected data include fresh and dry weight and leaves to stems ratio. The data were submitted to standard procedure of analysis of variance and means were separated by using least significant difference (LSD) as described in a study [8].

Land equivalent ratio (LER) was used to compare the dry weight yield resulting from the same crops in mixture and as a pure stand using the formula:

LER=Crop A yield in mixture/ crop A yield in pure stand + Crop B yield in mixture/ crop B yield in pure stand

3. RESULTS AND DISCUSSION

3.1 Fresh and dry weight

Results in table-1 and table-2 showed progressive increase in the fresh and dry weights of fodder sorghum and hyacinth bean as the plants grew from age 30 to 60 days after sowing. This trend is true for both sowing the crop as a pure stand and as a mixture with the other fodder. However, the pure stand attained greater fresh and dry weight at intervals of ten days for the four samples (30, 40, 50 and 60 days after sowing). The explanation for this fact is possibly due to competition of the mixed crops for moisture and also for possible shading of hyacinth bean by the taller fodder sorghum. The total yield of the mixture of fodder sorghum and hyacinth bean was greater than the yield of the pure stand of hyacinth bean, but the pure stand of fodder sorghum was greater than that of the mixture. The contribution of hyacinth bean based on green yield and dry weight is lower than fodder sorghum this is due to the lower moisture content of the stems of this legume, compared with the stems of the cereal fodder which is made of the folding of the base of leaves. Therefore, comparisons of the contribution of this legume when mixed with fodder sorghum based on the dry weight gives the real value of the share of this legume in the mixture. Similar results found by a group of researchers who all found the same result. Intercropping gave advantageous of land equivalent ratio of 1.19 when plant age at 40 days which means that an area planted as a pure stand would require 19% more land to produce the same yield as the same area planted in mixture combination [9-12].

Table 1: Fresh weight of fodder sorghum and hyacinth bean in tons/ha during the growing season.

Treatment	Plant age (days after sowing)			
	30	40	50	60

Pure stand of hyacinth bean	1.16c	4.87c	14.10c	20.37c
Hyacinth bean in mixture	0.65c	3.10c	6.10d	9.85d
Pure stand of fodder sorghum	21.81a	44.36a	62.96a	75.67a
Fodder sorghum in mixture	8.27b	24.34b	28.94b	35.33b
LSD	4.41	3.0	4.80	3.75
SE±	1.21	1.89	1.45	1.25
C.V%	11.49	24.67	14.59	10.01

Means followed by the same letters within each column for each treatment are not significantly different at 5% level of probability.

LSD= least significant difference. SE±= standard error C.V.%= coefficient variation

Table 2: Dry weight of fodder sorghum and hyacinth bean in tons/ha during the growing season

Treatment	Plant age (days after sowing)			
	30	40	50	60
Pure stand of hyacinth bean	0.37c	1.80c	6.34c	10.99c
Hyacinth bean in mixture	0.18c	0.96d	2.38d	4.83d
Pure stand of fodder sorghum	8.51a	19.51a	40.92a	58.27a
Fodder sorghum in mixture	3.14b	10.26b	16.21b	21.91b
LSD	1.51	3.54	2.13	2.18
SE±	0.94	2.22	1.33	1.31
C.V%	0.41	0.87	0.39	0.32
LER	0.94	1.19	0.89	0.95

Means followed by the same letters within each column for each treatment are not significantly different at 5% level of probability.

3.2 Leaves to stems ratio (LSR)

Table (3) shows that leaf to stem ratio for fodder sorghum and hyacinth bean grown as pure stand or as a mixture declined with age (from 30 to 60 days). This fact can be attributed to the increase in the fibre content of the stem with age. The leaves, however, decreased in weight after reaching full size due to senescence which results in loss of water and drying. Therefore, Leaf to stem ratio based on dry weight also decreased [13,14].

Table 3: Leaves to stems ratio (LSR) of fodder sorghum and hyacinth bean during the growing season.

Treatment	Plant age (days after sowing)			
	30	40	50	60
Pure stand of hyacinth bean	1.39b	1.27a	0.89a	0.69a
Hyacinth bean in mixture	1.34b	1.23a	0.81a	0.68a
Pure stand of fodder sorghum	1.51a	1.32a	0.94a	0.71a
Fodder sorghum in mixture	1.39b	1.25a	0.83	0.69a
LSD	0.11	0.31	0.14	0.04
SE±	0.05	0.19	0.09	0.02
C.V%	2.63	11.44	7.69	2.71

Means followed by the same letters within each column for each treatment are not significantly different at 5% level of probability.

4. CONCLUSION

The result of this study indicated that the contribution of green and dry weight of fodder sorghum was greater than the contribution of hyacinth bean in the mixture.

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