Intercropping Studies with Different Cereal and Legume Crops

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ABSTRACT

An intercropping study was carried out with three legumes (field beans, cowpeas, and soybeans) and three cereals (sorghum, corn, and pearl millet) in all combinations to define the most appropriate intercropping under near optimum irrigation. The sorghum x soybean intercropping was chosen as the most appropriate for the environment.

INTRODUCTION

The lack of rain, which produces significant decreases in grain yield or even total yield losses, is one of the main problems in semi-arid regions. To diminish the risk of total loss of yield, the farmers adopt intercropping, the growing of two or more crops simultaneously on the same area of ground. This is the main cropping pattern in the developing countries, generally a cereal x legume combination. Much research needs to be done on intercropping. One of the most important aspects is to define the best intercropping system for specific areas, as well as the genotypes best adapted to the drought conditions in those areas.

MATERIALS AND METHODS

In 1985, three cereals (sorghum, corn, and pearl millet) and three legumes (field beans, cowpeas, and soybeans) were tested in intercropping, which gave nine cereal x legume combinations. This study was planted on June 25, 1985 in a randomized complete block design with four replications at the University of Arizona Marana Agricultural Center, under near optimum irrigation. Plots of each crop alone were grown in the same test area, to evaluate each intercropping combination and to estimate the relative efficiency. The sorghum x soybean intercropping developed as the most appropriate for the environment.

A Land Equivalent Ratio (LER) value was calculated to determine the efficiency of particular intercropping combinations. These values were calculated as follows:

$$\text{LER} = \frac{\text{Intercropping yield of crop A}}{\text{Sole yield of Crop A}} + \frac{\text{Intercropping yield of crop B}}{\text{Sole yield of Crop B}}$$

RESULTS AND DISCUSSION

The yields of the three legumes produced in competition with the three cereals are presented in Table 1. The yields of the three cereals produced in competition with the three legumes are shown in Table 2. It is difficult and confusing to compare and discuss yields of six different crops in different combinations. Therefore, the yields of the sole crops were computed and the percentages of intercropping over the respective sole crops were calculated in order to have a standard basic unit.

Overall, with a few exceptions, intercropping showed to be more advantageous than monocropping under the conditions studied as shown in Table 3 (LER > 1.00). The greatest individual crop advantages were shown by field beans, followed by cowpeas. The best intercropping combination with the highest LER

was for pearl millet x field beans, followed by sorghum x field beans. Among all six crops, corn and pearl millet showed the highest decrease in yield when intercropped, which means a greater effect from competition.

Taking cash price (price paid at the farmer level) into consideration (Table 4), sorghum x cowpeas had the highest economic value, followed by sorghum x field beans and pearl millet x cowpeas. However, the differences in costs of production were not considered. These costs do differ under actual conditions for the following reasons: 1) cowpeas had three harvests because of a large range in maturity; 2) field beans had two harvests, also because of a large range in maturity; and 3) Soybeans and the three cereals were all harvested at one time.

The first two reasons would make the cost of production be higher for cowpeas and field beans due to intensive labor involved in handpicking the pods.

Based on the Analyses of Variance (Tables 1 and 2), the following can be said: 1) all three legumes had a higher yield when intercropped with pearl millet, showing that this cereal was not a good competitor against these legumes; 2) sorghum was the best cereal competitor for yield against the legume crops; 3) pearl millet was the cereal with the greater decrease in yield when intercropped, showing that it was the least competitive against the legumes; and 4) cowpeas were the least competitive legume against the cereals.

Table 1. Yield of the three legumes (cowpeas, field beans, and soybeans) intercropped with sorghum, corn and pearl millet

Legumes intercropped with	Yield of cowpeas* (kg/ha)	Yield of field beans* (kg/ha)	Yield of soybeans* (kg/ha)
Sorghum	568 A	333 A	882 A
Corn	590 A	189 A	1011 A
Pearl Millet	895 B	547 B	1218 B

*Means followed by the same letter do not differ statistically by the Newman-Keul's Test.

Table 2. Yield of the three cereals (sorghum, corn, and pearl millet) intercropped with cowpeas, field beans, and soybeans

Cereals intercropped with	Yield of sorghum* (kg/ha)	Yield of corn* (kg/ha)	Yield of pearl millet* (kg/ha)
Cowpeas	2959 B	912 A	902 B
Field beans	2665 B	847 A	792 AB
Soybeans	2063 A	1063 A	572 A

*Means followed by the same letter do not differ statistically by the Newman-Keul's Test.

Table 3. Percent of yield of the nine intercroppings over the respective sole crops

Intercropping	---% of yield over sole crop---		
	Cereal	Legume	LER
Sorghum x field beans	49.15	150.70	2.00
Sorghum x cowpeas	54.57	62.43	1.17
Sorghum x soybeans	38.05	54.16	0.92
Corn x field beans	32.96	85.20	1.18
Corn x cowpeas	41.20	64.74	1.06
Corn x soybeans	35.32	62.03	0.97
Pearl millet x field beans	38.35	247.05	2.85
Pearl millet x cowpeas	43.70	98.31	1.42
Pearl millet x soybeans	27.69	74.74	1.02

Table 4. Cash price (U.S. dollars/ha) for nine intercropping combinations

Intercropping	Cash price ($)
Sorghum x field beans	484.88
Sorghum x cowpeas	616.96
Sorghum x soybeans	448.81
Corn x field beans	186.95
Corn x cowpeas	374.61
Corn x soybeans	322.05
Pearl millet x field beans	321.76
Pearl millet x cowpeas	474.57
Pearl millet x soybeans	318.36