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EFFECT OF MIXED CROPPING OF MAIZE AND BEAN ON BEAN DISEASES

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INTRODUCTION

The commonest cropping system for bean production in Malawi, especially for the small-holder farmer who produces the bulk of the crop, is mixed cropping. The purpose of this study was to study the relationship between two cropping systems and disease situation in beans.

MATERIALS AND METHODS

Two experiments were carried out in two different sites (Bunda and Bembeke with altitudes of 1118 and 1608 metres above seas level, respectively) in 1980/81 growing season. A dwarf bean cultivar, Nasaka and a climbing bean cultivar, Kanzama and a Malawi hybrid (MH12) maize cultivar were used.

Dwarf beans were planted on ridges 91 cm apart with two rows per ridge. The distance between plants within each row was 10 cm. Climbing beans were also planted on ridges 91 cm apart but in single rows at a spacing of 15 cm between plants. The climbing beans were provided with 2m stakes (staked 30 cm apart) for support. Maize in pure or in mixed stand was also planted on ridges of 91 cm apart in a single row, 30 cm between plants. In the mixed plot of maize and dwarf beans or maize and climbing beans, both crops were planted at the same time on the same ridge.

A compound fertilizer (2o:8.7:0; N:P:K) was applied to all treatments at planting time at the rate of 300 kg/ha. When the maize crop was about 45 to 60 cm, a calcium ammonium nitrate (26%N) fertilizer was applied to maize at the rate of 200 kg/ha.

Disease recording in beans started three weeks after planting and continued at weekly interval until physiological maturity. A scale of 1 to 5 was adopted in recording the amount of each disease present. A grade of 1 was equal to .10 infection; 2, equal to 1 to 25%, 3, equal to 26 - 50%, 4, equal to 51 - 75% and 5, equal to 76 - 100% infection or death of the plant. These scores were later converted to disease index percentage (DI) by using the following formula.

$$DI = \frac{\text{Sum of the ratings}}{\text{Number of Plants Scored}} \times \frac{100}{5} \%$$

RESULTS

Six bean diseases were observed in both sites during the growing season (Table 1). These diseases were, bacterial blights, especially halo blight (*Pseudomonas phaseolicola* (Bulkh) DOWS), angular leafspot (*Isariopsis griseola* Sacc.) rust (*Uromyces phaseoli* var *typica* (Reben) Wint.), anthracuose (*collectotrichum lindemuthianum* (Sacc. and Magn.) Scrib), ascochyta blight (*Ascochyta phaseolorum* Saccardo) and web blight (*Thanatephorns cucumeris* (Frank) Donk. (imp. *Rhizoctonia microsclerotia*).

At Bunda College, the damage by bacterial blights, rust, anthracnose and ascochyta blight in both bean types was observed to be significantly higher in bean monoculture than in maize and bean association (Table 1). At Bembeke, a similar trend was also observed, though there was no significant difference in the amount of diseases in climbing beans under the two cropping systems (Table 1). Angular, leafspot incidence, was higher in maize and bean association than in bean monoculture at both sites. Dwarf beans had higher web blight attack in monoculture that in association with maize, but in climbing beans, it was observed that the web blight incidence at one site Bembeke was higher in maize and beans association than bean monoculture.

Table 1 Yield (Kg/ha) and disease intensity (%) of dwarf and climbing beans under two cropping systems grown at Bunda College of Agriculture (BU) and at Bembeke (Be) near Dedza.

Treatment	Yield Kg/ha		Disease Intensity %													
			BB*		AL		R		AN		AB		WB		MEAN	
	BU	Be	BU	Be	BU	Be	BU	Be	BU	Be	BU	Be	BU	Be	BU	Be
Dwarf beans (Monoculture)	468[b]	252[d]	37.7	33	8.9	49.4	3.3	4.9	0.9	42.4	4.1	6.3	1.3	34	9.4[a]	28.3[a]
Climbing beans (monoculture)	916[a]	637[a]	16.8	14.1	7.2	27	7.5	4.7	3.7	8.4	1.5	5.7	0	4.3	6.1[b]	10.7[c]
Dwarf beans (Association)	286[c]	325[c]	19.2	25.4	13.2	50	1.7	2.9	0.1	28.8	3.6	4.9	0.7	31.3	6.4[b]	23.9[b]
Climbing beans (Association)	93[d]	539[b]	10.9	7	11.5	30	6	0.9	0.1	8.2	0.2	3.1	0	9.4	4.8[c]	8.7[c]
Mean	441	438	21.2	19.9	10.2	39.1	4.6	3.4	1.2	22	2.4v5		0.5	12.1		

*BB = Bacterial blight; AL = Angular leaf spot; R = Rust; AN = AN = Anthractrose; AB = Ascochyta blight and WB = Web blight.

Figures followed by different letter in each column at each site are significantly different at P = 0.05.

DISCUSSION

Halo blight and other bean bacterial diseases, anthracnose and ascochyta spread within the field mainly by splash dispersal and winds during periods of rainfall. This explains why such diseases should be favoured in a monoculture and not in a mixed cropping system because the maize crop acted as a physical barrier to the spread of these diseases. Similar observation has been reported on halo blight incidence by Annonymous (1976) in Kenya.

In our study we observed that rust incidence was higher in beans when grown in monoculture than in association with maize. This is contrary to results obtained from Kenya (Annonymous 1976). In Kenya, they reported that rust incidence was lower when beans were grown in monoculture than in association with maize. It is probable that this might have been so because of the higher relative humidity that was observed within the maize-bean canopies which favoured uredospore production. From the source of production, urodospores would require some wind current to spread. Therefore, with the maize crop acting as a wind break, one could visualize that the spread of rust spores in beans in association with maize could be limited. In fields where beans were planted in association with maize, the maize crop acted as a "trap crop" in the sense that most spores landed on the maize leaves (nonhost) and might have eventually died. This "trap crop" action of an associated crop with beans has been reported in the control of bean insect populations (Annonymous, 1979).

Our observation on the spread of angular leafspot under these two cropping systems was in agreement with that of Moreno (1977). Why this disease behaves unlike other diseases like anthracnose and ascochyta blight (with similar spreading methods) will be the subject of the future investigation.

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Reactions of Phaseolus vulgaris cultivars to seed isolates of Pseudomonas phaseolicola

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Halo blight has been increasing in importance in dry beans in Nebraska during the past four years (1978-1981). Six isolates of Pseudomonas phaseolicola from 1980 Great Northern bean seeds were tested for their virulence on six bean cultivars. Leaves were inoculated by the watersoaking method; a circle 15mm diameter per leaf was inoculated and the diameter readings of lesions in these spots were measured two weeks later. HB-16 was used as the standard halo blight isolate. Two 1980 isolates were more virulent than HB-16, one was about equally virulent and three were less virulent. Red Mexican U.I. 3 was more susceptible to five isolates than HB-16, but six were less virulent on PI 150414. Selection 27 and Wisconsin 72 were more susceptible to only one or two isolates. There was an apparent cultivar and isolate interaction in this leaf inoculation experiment; a similar relationship was found in pod inoculations with the halo blight isolates.