EPIDEMIOLOGY IN PURE STANDS AND VARIETAL MIXTURES

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INTRODUCTION

In many regions of Africa bean production systems are characterized by the extensive use of varietal mixtures by small farmers. In order to provide these systems with appropriate disease control technologies, it is essential to understand better the nature of disease development in varietal mixtures compared to pure variety stands, and to evaluate the effectiveness of various strategies

Consequently, this review will attempt to cover general literature on

1) Disease development in mixtures and pure culture :

2) The effect on disease of adding resistant components to susceptible mixtures

3) The potential of non genetic methods to control disease in mixtures

DISEASE DEVELOPMENT IN VARIETAL MIXTURES AND IN PURE STANDS

Are mixtures worthwhile ?

A survey of the literature shows that mixtures yield at least as well as the mean of their components, often more so, and on some occasions outyield even the highest component (Wolfe 1985 Wolf and Barrett 1980, Trenbath 1974) It is indeed rare to find a mixture yielding lower than the mean of its components Mixtures increase the stability of yield and the security of farmers. In this contex the contribution of mixtures in reducing disease

development is an important factor to consider in areas where diseases limit the yield of beans

Do varietal mixtures reduce the incidence of disease, and if so by what mechanisme ?

In his recent review, Wolfe (1985) notes that, "host mixtures may restrict the spread of diseases considerably relative to the mean of their components, providing that the coum is produced within the field, then mixtures have a unique effect on reducing pathogen spread, and hence provide a degree of protection to the susceptible component Four mechanisms are usually stated (Burton 1978, Burton and Chilvers 1982):

a) Decrease in spatial density of dusceptible plants.

The presence of a resistant component within a mixture effectively decreases the density of the susceptible component. The reduction of the amount of susceptible tissue available reduces the maximum extent of pathogen spread. In addition, the chances of spore survival are reduced The ideal spacing arrangement would be one in which susceptible plants do not occur as neighbours The extent to which susceptible plants do not occur as neighbours The extent to which spatial density affects spread of disease depends on whether the pathogen dispersal has a steep or a shallow gradient (i e. spore concentration does or does not drop off rapidly with distance away from the inoculum source (McCarthney and Fitt 1985) Intercropping different species of crops would simulate a similar effect as that provided by resistant varieties in mixtures

b) Barrier provided by resistant plants.

Resistant varieties interfere with the passage of spores from one susceptible plant to an other.

c) Replacement

The replacement of susceptible plants by resistant components effectively increases the surface area occupied by resistant plants As a result, the chances of a spore landing on susceptible tissue are reduced (Burton 1978)

d) Induced resistance.

Resistance in normally susceptible plants is induced by non-

studies in which good control was obtained with low percentage of resistance in mixtures was in experiments using the wheat/Septoria nodorum and the Barley ?Rhynchosporium secalis disease systems (Jeger et al 1981) In this unspecialized host-parasite relationship 25/ resistance in a mixture resulted in large decreases in disease vis a vis that which was e pected. If these results can be obtained for diseases of beans in Africa then there is good reason to believe that the addition of resistant varieties to farmers'mixtures can have a large impact in the short term If however, higher proportions of resistance are required to obtain substantial reductions of disease them impact with resistant varieties will be a slower and less measurable.

What other strategies could have impact in the control of disease in mixtures ?

Variety non specific methods are likely to be of greater importance in systems where mixtures dominate than in those which use single varieties Little literature was found on this topic Nevertheless, it would be worth exploring further the relative merit of adapted use of improved cultural, biological and chemical techniques.

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