IMPROVING LEGUME PRODUCTIVITY BY MAXIMIZING THE EFFICIENCY OF MYCORRHIZAL RHIZOBIAL INTERACTION

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INTRODUCTION

INTRODUCTION

The symbiotic relation between higher plants and soil microorganisms represents one of the most striking biological phenomena. The classical example of this type of the symbiotic relations is the well known one between Rhizobium and legumes which produces enough nitrogen to support the building of the whole protein requirements of the legumes.

Recently, the mycorrhizal fungi particularly the endomycorrhizae, have recieved considerable attention by the microbiologists, specially for leguminous plants because VA mycorrhizae affects nitrogen fixation indirectly by its action on P uptake, increased uptake of zinc and copper ions, levels of chlorophyll and some hormones in plants.

The use of symbionts is more economical and much better than the use of chemical fertilizers which has already raised serious objections and real concern about the pollution of the environment. Thus, greater attention has been directed to the use of microorganisms as biofertlizers, to provide nutrients for higher plants without any pollution to the environment.

Despite the very comprehensive scientific publications on the symbiotic relations of the triparite system, plant-rhizobia-mycorrhizae, is still a lot more to be done for better understanding of the different aspects of these systems. However, the information on the interaction between VA mycorrhizal fungi and *Rhizobium* has yet to be clarified.

Little work has been done on the VA mycorrhizal status of Egyptian soils and whether this endophyte can enhance plant growth (Edrees, 1982; Fawaz et al. 1983; Mahmoud et al. 1985 b; Fares, 1986).

The present work aims to study the occurence of VA mycorrhizal fungi and their interaction with *Rhizobium leguminosarum* in Egyptian soils. The growth response of some legumes to dual inoculation with VA mycorrhizal fungi and *Rhizobium* has been also investigated in greenhouse and field experiments.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

1. Occurrence of VA Mycorrhizae:

With few exceptions, VA mycorrhizae are found in all soil types. North temperate podzols, very wet soils, and highly disturbed soils, such as coal spoils, may support relatively few natural infections by mycorrhizae (Hayman, 1982 a). Other soil types present in grasslands, muck farms, rain forests, sand dunes and arid regions support variable levels of VA mycorrhizae.

In cultivated areas, VA mycorrhizae are affected by the various soil, plant and environmental factors as well as by the agricultural and horticultural practices. Most crop species can become mycorrhizal. In southern Spain, Hayman et al.(1976) found that maize , *Phaseolus* beans and grapevine were consistently heavily mycorrhizal, olives were variable, and tomatoes consistently fairly lightly infected even when present at the same sites as the first three. In mixed cropping infection in the host plant wheat was reduced by the non-host mustard (Iqbal and Qureshi, 1976).

According to Butler's review (1939), VAM root infections may be more abundant in orchard and plantation crops than in annual field crops. However, Hayman (1978) indicated that more VAM spores could be found in the latter.

This may be explained by selection pressures on a mixed VAM population that favour those endophytes able to survive as spores the follow periods between crops and at least a year with a non-host crop (Hayman et al., 1975). VAM populations are believed to be very low in intensively cultivated garden soil, probably because of their high fertility.

Differences in crop susceptibility to VAM presumabely account in part for changes in VAM populations with different rotations. A lightly infected crop will obviously leave behind less infected root material than a heavily infected one. However, the effects of different rotations of annual crops are not altogether consistent. Kruckelmenn (1975) observed more spores in wheat monoculture, and fewer in wheat after oats than in oat monoculture. There were fewest spores with potatoes. Probably the volume of soil occupied by the root systems of a crop as well as the percent root lenght infected influence the number of spores produced. These factors could also explain the higher spore numbers at intermediate than at high or low levels of phosphate fertilizer in a Rothamsted field (Hayman et al., 1975). Presumabely there was abundant total infected root material at the intermediate level because high phosphate decreased percent root infection and low phosphate decreased root growth. This illustrates possible ambiguities in some estimates of root infection and the relationship between root-based fungal biomass and spore production. Where total root growth is not greatly affected by treatment, percent infection and spore numbers can be closely related, e.g. in their negative responses to nitrogen fertilizer (Hayman, 1970). Thus the considerable variation in field populations of VAM fungi to be found within a single site can be partly explained by the inhibitory effects of large applications of nitrogen and phosphate fertilizers, (Hayman, 1970; Strzemska ,1975). However, fertilizers may have a positive effect on VAM if initial soil fertility is very low(Kruckelmenn , 1975).

At a single site in Florida, Schenck and Kinloch, (1980) found marked differences in population of VAM fungi between different crops grown in monoculture for seven years on a newly cleared woodland site. There were more spores with soybean than with the other crops and fewest in the woodland. Three species of Gigaspora were most numerous around soybean roots, whereas two Glomus spp. were most prevailent with Bahia grass and Acaulospora spp. with cotton and peanut. Sorghum had the largest number of VAM species. This is one of the most detailed reports on the selective effects of host species under field conditions.