CHAPTER 8

GENERAL DISCUSSION

The indigenous AMF in shifting cultivation system of Haui Teecha village were associated not only with follow enriching tree like *Macaranga denticulata* (Yimyam *et al.,* 2003) but also with local legumes. In low P acid soil growth of legumes was benefiting from the association with AMF. Moreover modern cowpea lines introduced to this area were also benefiting from the association with indigenous AMF. Interestingly these modern lines are normally susceptible to acid soil but they could grow well with out P deficiency in low P acid soil in Haui Teecha. The hypothesis that "the indigenous AMF in Haui Teecha can help to alleviate acid soil stress in legumes" was accepted by results of pot experiments with steam sterilized soil.

In these experiments P deficiency was clearly the limiting factor of legume growth. Soil acidity depressed legume growth by accentuating P deficiency. The AMF alleviate acid soil stress by improving P uptake in legume. Therefore the benefit of AMF highly depended on soil P. Too high P application rate in experiment 4.2.2 and 6.2.1 eliminated benefit of AMF in cowpea. Host plant normally gets benefit from AMF only in stress condition and the benefit is diminished when the stress is alleviated (Marschner, 1995: Peng *et al.,* 1993). But too low soil P like in experiment 4.2.1 caused the negative effect of AMF on cowpea growth. The negative effect of AMF in extremely low soil P should be the result of P competition between host plant and AMF (Janos, 2007; Marschner, 1995).

The effectiveness of AMF highly depended on inoculating method. Pasting spores on filter paper that laying under seed is a practical method of AMF inoculation

in some report (Youpensuk *et al.*, 2006). This method is sometimes not suitable and it caused low root colonization and small response to AMF in experiment 6.2.3. Removing the filter paper in chapter 7 lifted root colonization and brought back high responsive to AMF of cowpea. This indicated that filter paper asked like a barrier blocking spores to distribute in to soil profile. This make AMF spores had less chance to infect plant root (Figure 6.2).

An *Acaulospora morrowiae* isolated from Haui Teecha soil is an effective species of AMF for cowpea. Pure culture of this species can stimulate legume growth as well as mixed species of the soil inoculum. The hypothesis that "soil inoculum should be more effective than spore inoculum because it contains many kinds of infection (spore, infected root fragment and hyphe)" was rejected. Soil and *Acaulospora sp* spore inoculum finally had same potential to colonized plant root and promote plant growth. But the AMF in soil inoculum from Haui Teecha colonized host roots faster and its effect showed earlier. This should be caused by another microorganism because when mix species spores were extracted from the soil inoculum and surface sterilized they fail to promote plant growth. It is not clear why the surface sterilized mixed specie spores extracted from Teecha soil failed to promote plant growth. It was not the result of the antiseptic killing the spore. The antiseptic (0.5% NaClO) was tested before in experiment 7.2.2. It has no effect on spore efficacy. And in the experiment 7.2.3 the extracted spores were still as effective in colonizing plant roots as soil inoculum even though it lost ability to promote plant growth. While spores of *Acaulospora morrowiae* that were surface sterilized as the same way were still effective to colonize and promote plant growth.

The one hypothesis that may be put forward is that soil inoculum from Macaranga root zone not only contain AMF but also contain another microorganism that promote effectiveness of AMF to promote host plant growth". Some kinds of soil bacteria can stimulate AMF root colonization and encourage benefit of AMF on plant growth. They are called mycorrhizal helper bacteria (MHR) (Bonfante and Anca, 2009). Some of them stimulate AMF root colonization by suppression of plant defense (Lehr et al., 2007). Frey-Klett et al. (2007) proposed a theory that MHB enhance mycorrhizal symbiosis by producing growth factors. These growth factors stimulate germination of AMF spore and mycelium growth.

This study proposed a new way to deal with soil acidity problem in legume by using AMF. There are some reports that indigenous AMF from the shifting cultivation system promote growth of some crop species including upland rice, sorghum, job's tears (Wongmo, 2008), rubber (Kanyasone, 2009) and coffee (Yimyam, 2006). But all of reports use soil inoculum collected from *Macaranga* root zone that contain mix species of AMF spore. The population of AMF associating with *M. denticulata* at Huai Teecha is diverse by year and season (Youpensuk et al., 2004). The effective AMF species was not identified. The quality of the soil inoculum might vary by time that it is corrected. There is an important question that "can we used another plant host for producing AMF inoculum instead of Macaranga". Macaranga is a local tree in the uplands; it difficult to grow in lowland environment and it take much time to growth (Yimyam, 2006b). In this study *Mimosa invisa* was the perfect host for multiplying AMF spore both for mixed species in non-sterilized soil in chapter 5 and single species isolate in sterile condition in chapter 6 and 7. Mimosa root was quickly and heavily colonized by AMF in chapter 7. The spores multiplied by mimosa were

effective to promote legume growth. The production of AMF inoculum is much easier by using mimosa as host plant. Therefore the use of mimosa as a host for producing AMF inoculum should be further investigated.

Local legumes growing in low P acid soil of shifting cultivation system of northern Thailand were highly associated with endogenous AMF. The AMF from the system was effective to alleviated acid soil stress in improve cowpea line when P was the limiting factor. The *Acaulospora morrowiae* isolated from Haui Teecha village was an effective species on cowpea.