CHAPTER V

DISCUSSION

In this research, selection of effective Bradyrhizobial isolates from one of the Myanmar soil was done by short term trails with plastic cups containing sterile sand as recommended by Somasegaran and Hoben (1994). The cultivated soybean plants were irrigated with N-free solution. At 30 day after sowing, formation of nodule and total plant dry weight including root and nodules of the inoculated plants were compared for comparison of Bradyrhizobial isolates or strains as suggested by (Erdman and Means, 1952; Halliday, 1984). From the effectiveness testing under the controlled room, the effective Bradyrhizobial isolates or strain for biomass improvement of soybean varied with soybean variety. The standard Bradyrhizobial strains such as USDA 110 and THA 7 which have been used for inoculant production were significantly effective for both Myanmar and SJ 5 soybean varieties, MB, Bradyrhizobial isolate from Myanmar showed a trend to be better than MA for increasing of the whole plant biomass but in Cambodia soybean, opposite trend was observed.

Senaratne *et al.* (1987) reported that plant dry weight, nitrogen yield, percent nitrogen derived from air and amount of nitrogen fixation were significantly influenced by specific combinaiton of host genotype and Bradyrhizobial strain. The results of effectiveness testing from this research supported report of Senaratne *et al.* (1987).

The result on the use of *Streptomyces sp.* , testing the selected endophytic actinomycetes (EA) for improvement of the whole plant biomass of soybean which was also varied with soybean warieties indicated that the effectiveness of the tested

endophytic actinomycetes was dependent on host genotype. Significant improvement of the whole plant biomass of Myanmar soybean (88%) and a trend to increase biomass of SJ 5 (12%) and Cambodia soybean (68%) over that of the uninoculated control plant by EA inoculation with steril sand and N-free nutrient solution suggested that EA could infect the tested soybean varieties. Nevertheless, confirmation of the existing of EA in the tissue of inoculated soybean plants by reisolation of this tested EA is still needed. From the study of Thapanapongworakul (2003) the use of the same EA as used in this trail showed a trend to improve of the total dry wieght of the whole plant of Thailand soybean at 1 month after inoculation about 22% over that of the control under plastic growth pouches condition with N-free nutrient solution. The experiemental result of the effectiveness testing in the controlled room agreed with her report.

From the results of pot trials, all soybean plants from uninoculated Bradyrhizobial treatments in each variety formed root nodule even the soil used was steriled by autoclaving suggesting contamination of Bradyrhizobia from open field enviroment. Anyhow, the plants from the control treatment smaller root nodule biomass, RUI value and even shoot dry weight than the inoculated treatments. Thus, it was expected that the contaminated *Bradyrhizobia* were not effective.

In Myanmar sobyean, single inoculation of MB, USDA 110 and THA 7 were effective to improve significantly nodule dry weight, shoot biomass and seed yield. There were about 237-513 mg of N from seasonal N2 fixation which were about 84%-100% of total plant N. MB, Bradyrhizobial isolate were not different significantly from USDA 110 and THA 7 for the effectiveness on N fixation, growth and seed yield improvement of Myanmar soybean. However when each of the tested

Bradyrhizobium was inoculated together with EA, the experimental results from Myanmar soybean indicated the differences of the compatibilities with EA among the tested *Bradyrhizobia*.

The difference between MA and MB could be observed from the effect of single inoculation and dual inoculation with EA on nodulation, RUI or %P-fix, shoot dry weight and even seed yield. In Myanmar soybean, MA, *Bradyrhizobium* was not effective for all studied parameters if this isolate was used singly. With dual inocualtion of EA + MA, noudle dry weight, percentage of N derived from air improved significantly and yield seed weight including the amount of seasonal fixed N had a trend to be improved also.

Synergistic effect of dual EA and USDA 110 and THA 7 were also found and the such effect was even more clearly shown than that of EA + MA. Contrasingly, MB could not compatible well with EA and dual inoculation of EA + MB produced depressive effects on almost all studied parameters.

In SJ 5 sobyean almost similar result by single and dual inculation of Bradyrhizobium and EA as found in Myanmar soybean were observed. Thapanapongworakul (2003) reported that under controlled room experiment using plastic growth pouches and N-free nutrient solution inoculation of USDA 110 improve total dry weight of Thailand soybean at 1 month old about 26% over that of uninoculated control while dual inoculation of the same EA **are** used in this trial and USDA 110 improve plant dry weight about 30%. The N uptake of both single USDA 110 inoculation and dual inoculation with EA were similar and both significantly better than that of the uninoculated control treatment. This experimental result on the effect of USDA 110 and EA + USDA 110 agreed with Thapanapongworakul's report

and also supported that this tested endophytic actinomycetes could significantly improve the amount of seasonal fixed N for SJ 5 soybean. It is very interesting to investigate this synergistic effect of EA + USDA 110 under filed condition in the future. It was noticed that single inoculation showed a trend to improve seed yield of SJ 5 about 31% over that of the control. This beneficial effect of EA on seed yield of Thailand soybean seemed to be more clearly shown than in Myanmar and Cambodian soybean varieties.

In Cambodian soybean, the beneficial effect of single inoculation of MA was markedly shown from nodule dry weight at R3.5 stage, the amount and percentage of seasonal fixed N, shoot dry weight at R3.5 stage and seed yield. However in this soybean variety, MA could not compatible well with EA. Dual inoculation of EA + MA resulted in depressive effect on noudle dry weight, amount and percentage of seasonal fixed N, shoot biomass and seed yield. In Cambodian soybean, single inoculation of MA was the best treatment for improvement of N2 fixation, nodulation and seed yield.

In all pot trails, the application of N fertilizer at the rate of 6 kg N/ rai by equally split application twice was not significantly effective for shoot biomass at V6 and R3.5 stages and seed yield. It was expected that the N fertilizer (urea) might be leached out after application by irrigation water.

According to Somasegaran and Hoben (1994), the legume- root nodule symbiosis exhibits widely differing degrees of specificity. In some instances, the symbiosis is highly specific in that a particular species or strain of root nodule bacteria can form an effective symbiosis association with only one particular legume

species or variety. The experimental results from pot trails supported Somasegaran and Hoben (1994).

Bezdicek *et al.* (1978), Caldwell and Vest (1968), Rennie and Dubetz (1984), Weaver and Frederick (1974) reported that *Bradyrhizobium japonicum* strains differ in their abilities to form nodules and to support nitrogen fixation and sobyean yield. The results of the pot trails agreed with the reports of those authors and also that of Senaratne *et al.* (1987).

Though no report on the effect of endophytic actinomycetes and *Bradyrhizobia* on soybean under pot trials was available, but there was one report on interaction involving endophytic actinomycetes (*Streptomyces lydicus* WYEC 108) and nodulated pea plant (Tokala *et al*., 2002). From their study, *S.lydicus* WYEC 108 could colonize pea root resulting in increasing root nodulation frequency, possibly at the level of infection by *Rhizobium spp. S. lydicus* also colonized and then sporulated within the surface cell layers of the nodules. Colonization of *S. lydicus* improved the size of noudle and improved the vigor of bacteriod within the nodules by enhancing nodular assimilation of iron and possibly other soil nutrients. None of these mechanisms were tested in this research but these mechanisms could be occurred in the case that synergistic effect of dual inoculation of EA and each of test Bradyrhizobial isolate or strain were observed.

The effectiveness of dual inoculation of EA and *Bradyrhizobium* for soybean cultivation in this research is very attractive for future investigation because the experimental results indicate high potential of these useful microbes to reduce the use of agrochemical and for soybean yield improvement. The research results show also that selection of a good partner for effective symbiosis with soybean host is essential.