CHAPTER I

INTRODUCTION

In Cambodia, soybean is the main crop after rice and it contributed equivalent to 0.6% of GDP in 2005. Soybean cultivated areas in Cambodia are largely in Kampong Cham, Battambang, and Preah Vihear Provinces (MAFF, 2008-2009) (Fig.1), although farmers in other provinces also produce soybean for their own consumption. Production of soybean in these three provinces makes up to 90 percent of the total production. Ninety percent of total soybean production are exported to Vietnam and Thailand and only 10% are use for domestic consumption. According to the annual report for Agriculture, Forestry and Fisheries in 2008-2009 (MAFF, 2008-2009), soybean harvested areas in Kampong Cham, Battambang and Preah Vihear provinces, were 21,003 ha, 25,870 ha and 10,323 ha and the production were approximately 37,806 tons, 42,038 tons and 12,387 tons with an average seed yield of 1.457 t/ha. Soybean cultivated areas in Kampong Cham province are different from those in Battambang and Preah Vihear provinces because more than 50% of the total area for this crop are under rubber tree plantations. Though it is common for farmers in this province to grow soybean in the rubber tree plantations but no information about soybean under such cultivated condition is available, thus it is one of the attractive research topics for investigation particularly those related with root nodule bacteria because it is rather unique ecosystem. Factors causing a low soybean yielding in Cambodia may be 1) using of traditional soybean varieties, 2) an absent of inoculation of effective root nodule bacteria which can improve yields and qualities.

Furthermore, most soybean cultivated areas in Cambodia are under rainfed (MAFF, 2006-2010), drought and unusual rainfall distribution may be also another yield constraint. No report on the quality of the soil in the major soybean growing areas in Cambodia is available, thus soil acidity and the other problems related with plant nutrient availability in the soil may be also yield limiting factors.

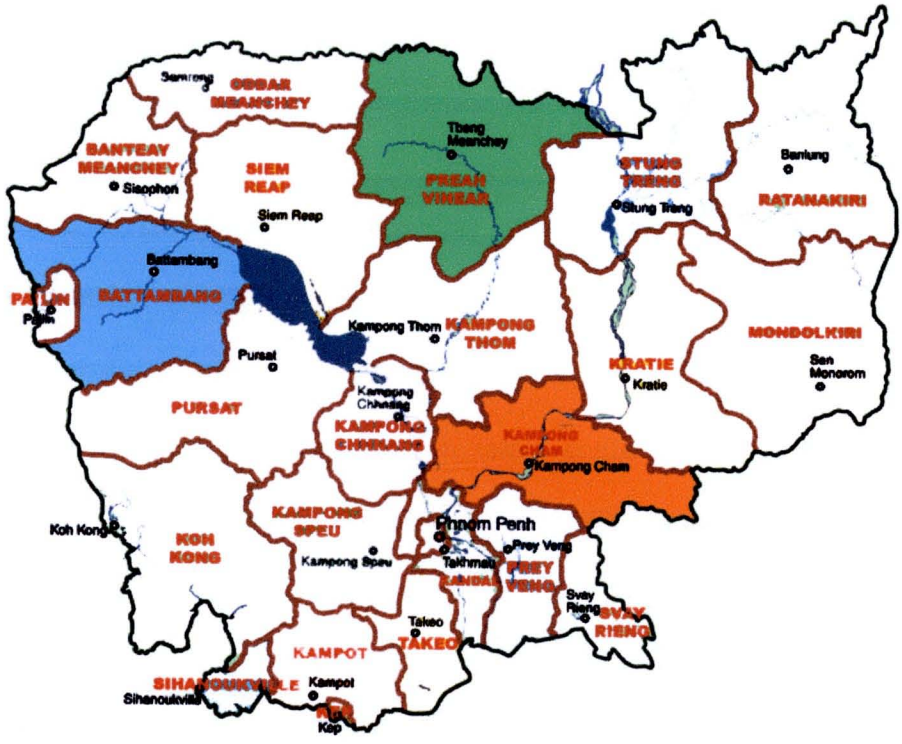

Fig.1: Soybean cultivated areas in Cambodia

Source: Ministry of Agriculture, Forestry and Fisheries in 2008-2009

Historically, majority of soybeans in Cambodia are not grown in the paddy field after rice but they are also grown in the main wet season (MWS) for lowland and upland areas in late wet season.

Soybean fits well in an upland crop rotation in combination with maize, sesame and peanuts. Since 2004, 2005 and 2006, rhizobial inoculation had been

included in on-farm demonstrations of improved technologies in Cambodia in collaboration with provincial Department of Agriculture staffs in the provinces and non-government organizations. Inoculation of Bradyrhizobium strains from Australia on soybean experimental fields at Kampong Cham (Chamkaar Leu, O'Rieng Ov and Tbaung Khmom district) and Battambang (district of Ratanak Mondul) showed very successful result of inoculation but difficult to implement because there was no locally produced inoculum and the inoculum required to be stored in a cool place (Dara *et al.*, 2006).

The use of endophytic actinomycetes with soybean has been reported by Thapanapongworakul (2003). In her study, the tested endophytic actinomycetes isolated from Japanese sweet pea could infect soybean. Inoculation of such isolate to soybean grown in N-free nutrient solution under controlled room improved dry weight and N uptake of the whole plant about 22 and 83% respectively compared to uninoculated control treatment. She also reported that combined inoculation of endophytic actinomycetes and Bradyrhizobium did not have negative effect on total dry weight and N uptake of shoot compared to single inoculation of Bradyrhizobium. Furthermore, the tested endophytic actinomycetes showed intense antagonism to almost all plant pathogenic fungi. The experimental data reported by Thapanapongworakul is attractive for future testing with soybean under pot experiment. None of the research on the use of root nodule bacteria from Cambodia soils either singly or incombination with endophytic actinomycetes with Cambodian soybean is reported. The experiment on this aspect of research particularly the root nodule bacteria from Cambodian soils seems to be very useful and worthwhile to do. The information obtained from this research can be used as the guideline for

consideration of the effectiveness of N_2 fixation of native root nodules bacterial isolates from Cambodian soils for improvement of Cambodian soybean variety. Their potential to use together with endophytic actinomycetes for improvement of N_2 fixation and diseases resistant are also useful and can be implemented in the future as biofertilizer and biocontrol agent for Cambodian farmers. The use of organic fertilizer or biofertilizer and biological control are the key factors for producing organic crops satisfactorily. Thus, nodule bacteria inoculation and the use of endophytic actinomycetes seem to be attractive means for good growth and satisfactory yield. It is very interesting to study the endophytic actinomycetes suitable for a biological agent for soybean and its effects on root nodule bacteria.

Objectives of research

The research had the objectives as follow:

1/ to collect general information on soybean cultivation in the rubber tree plantations by Cambodian farmers,

2/ to collect and screen effective native root nodule bacteria for soybean from this Ecosystem,

3/ to study the compatibility of selected endophytic actinomycetes and root nodule bacteria collected from different origins with Cambodian soybean variety.

4/ to study the effects of root nodule bacterial inoculation on growth, yield, nodulation, and N_2 fixation of selected Cambodian soybean variety.