



## **Environmental Education through Eri-culture for Reducing Amounts of Chemical Pesticide Applied in Greater Phnom Penh of Cambodia**

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**Abstract** Cambodia is located in Southeastern Asia with more than 70% of population is living in rural areas and engaged in agriculture and related sectors. Agriculture is the most important sector for the country, and the government focuses on increasing productivity and trying to meet the international market demand. However, farmers are usually less educated and there are difficulties and obstacles for local farmers to increase knowledge for better ways of agriculture and creating better quality of life. Most of farmers apply agricultural chemicals with low knowledge to increase crop yields that causes various illnesses of local farmers and environmental problems. Statistical data showed that literacy rate of Cambodia from 2005 to 2010 was only 74% for over age of 15 years old. The rate in rural area was much worse than the city. Education for All (EFA) aims to provide quality basic education for “every citizen in every society.” Although education is one of the fundamental factors for the country to be developed, daily life security such as basic and stable income is more significant for local people. However, ensuring stable income needs basic education such as literacy and basic numerical ability. This paper deals with environmental education through eri-culture, raising eri silkworms, for reducing amounts of chemical pesticide taking into account the perspective of Education for All (EFA) and Education for Sustainable Development (ESD). Following the first survey in March 2011 for evaluating the potential of local farmers to reduce chemical pesticide through eri-culture, the results showed that expected percentage of chemical pesticide to be reduced for eri silk-raising farmers was remarkably higher than the other farmers. However, research interests have been focused on how much amounts of chemical pesticide local farmers succeeded to reduce compared to the conventional use. So, this study dealt with the evaluation of the amounts of chemical pesticide reduced through eri-culture in Kampong Cham province, Cambodia. The results showed that 35% of eri silk-raising farmers reduced the amounts of chemical pesticide to 80 to 100%, 45 % of eri silk-raising farmers reduced to 60 to 80% while only 5% of eri silk-raising farmers reduced to 20-40% and other 50% reduced to 0-20%. Consequently, eri silk-raising farmers succeeded to reduce the amounts of chemical pesticide use through eri-culture, and eri-culture has educational function to increase the environmental awareness to local farmers, especially, in terms of reducing chemical pesticide use.

**Keywords** eri-culture, sustainable rural development, ESD, environmental awareness

## INTRODUCTION

Cambodia is located in Southeastern Asia, bordering the Gulf of Thailand, between Thailand, Vietnam and Laos. Population is 14,952,665 (July 2012 est.), and population growth rate is in 2012 up to 1.687%. More than 70% of population is living in rural areas and engaged in agriculture and related sectors (CIA Factbook). Agriculture is the most important sector for the country, and the government focuses on increasing productivity and trying to meet the international market demand. However, farmers are usually less educated and there are difficulties and obstacles for local farmers to increase knowledge and technique for better ways of agriculture that hinder creating better quality of life for local farmers.

Most of farmers apply agricultural chemicals to increase crop yields, however at the same time they face to the risks to be affected by agricultural chemicals that leads them to various illnesses, such as cancer or skin disease. Most of agricultural chemicals are imported from neighboring countries and are sold with label in foreign languages. Prohibited agricultural chemicals such as Methyl parathion and Methamidophos are still on sale in the local market and farmers purchase those chemicals without knowing it is categorized as prohibited ones or not knowing the appropriate usage, just simply because they are illiterate or have low level of literacy, so they listen and believe what sellers say.

Statistical data show that literacy rate of Cambodia from 2005 to 2010 is only 74% for over age of 15 years old. Literacy rate of male is 83%, while that of female is 66% (UNESCO Institute for Statistic database, 2012). Literacy rate of female is lower than that of male, and also the rate in rural area is much worse than the city, Phnom Penh and it is also lower than the average literacy rate of other developing countries.

Education for All (EFA) is an international initiative and started in 1990 under the coalition cooperation of UNESCO, the World Bank, national government, development agencies and etc., to provide quality basic education for all children, youth and adults, “every citizen in every society.” EFA sets up six goals to be met by 2015. So, Governments, development agencies, civil societies and the private sectors are working together to reach the EFA goals that include to ensure the learning needs of all young people and adults should be provided through equitable access to appropriate learning and life-skills programs (Dakar Framework for Action, UNESCO, 2000). EFA expects literacy rate goes up to 78% in total, 85% for male, 72% for female by 2015.

However, promoting EFA or ESD to local farmers in Cambodia, some kind of incentive related to poverty reduction and sustainable development are the keys to spread the concepts of EFA and ESD. Although education is one of the fundamental factors for the country to be developed, daily life security such as basic and stable income is more significant for local people. On the other hand, ensuring stable income needs basic education such as literacy and basic numerical ability. In short, promoting EFA and ESD are inseparably related to poverty reduction and income generation, and it is important that above aspects should be promoted together that will raise the level of “Sustainable Development”.

Eri-culture, raising eri silkworms, has introduced to local famers in Kampong Cham province in October 2010 and has been promoted since as a part of regional challenges of Regional Centres of Expertise (RCE) to promote as environment education (Kawabe, 2010). After 6 months passed since eri-culture introduced to local farmers in Kampong Cham province, questionnaire survey was conducted to evaluate the effects of eri-culture on promoting environmental awareness. The results showed local farmers who raise eri silkworms wanted to reduce 92.5% of chemical pesticide compared to the conventional use, while local farmers who just participated in the workshop or who have never participated in the workshops showed only 72.3% or 66.9% of chemical pesticide to be reduced (Kawabe et al., 2012). The expected percentage of chemical pesticide to be reduced for local farmers who raise eri silkworms was significantly higher than that for local farmers who just participated in the workshop or who have never participated in the workshops. So, it was considered that eri-culture has educational function for local farmers especially, regarding the reduction of chemical pesticide application.

## OBJECTIVE

Accordingly, this paper deals with environmental education through eri-culture for reducing amounts of chemical pesticide, taking into account the perspective of Education for All (EFA) and Education for Sustainable Development (ESD). First survey was conducted 6 months passed after eri-culture has introduced to the local farmers in Kampong Cham province for the first time in October 2010 to evaluate the potential of local farmers to reduce chemical pesticide through eri-culture. However, research interests have been focused on how much amounts of chemical pesticide local farmers succeeded to reduce compared to before starting eri-culture. So, this study aims to evaluate quantitatively the amounts of chemical pesticide reduced through eri-culture in Kampong Cham province, Cambodia.

## METHODOLOGY

### Eri-culture

Eri-culture, raising eri silkworm (*Samia cynthia ricini*) is conducted not only for rural development but also for women's capacity building and income generation in some developing countries, such as Thailand, Vietnam, Philippines, south China, and Ethiopia where the areas can grow the host plants of eri silkworms, castor (*Ricinus communis*) and cassava (*Manihot esculenta*). Eri silkworm is categorized as wild silkworm although it is completely domesticated as same as silkworm of the mulberry tree (*Bombyx mori*). While *Bombyx mori* hatches once or twice per year according to the types, eri silkworm hatches approximately 6 times a year. In October 2010, eri-culture has introduced to local farmers in Kampong Cham province, Cambodia. Since then, workshops and demonstrations on promoting eri-culture have been conducted in the villages.



Photo. 1 Eri silkworms



Photo. 2 Cocoons of eri silkworms



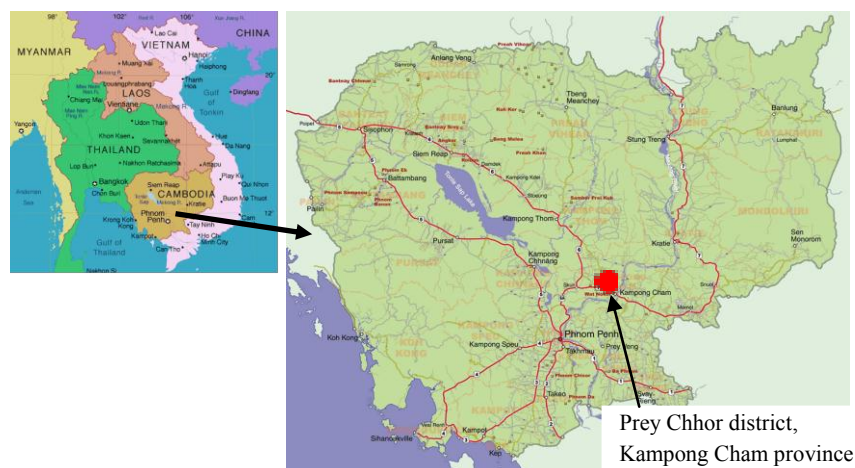
Photo. 3 Extension activity for promoting eri-culture in Kampong Cham, Cambodia



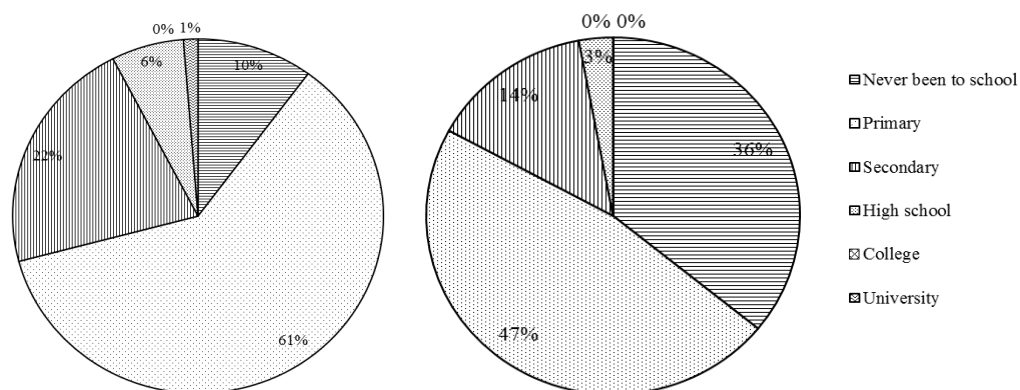
The first survey was conducted in March 2011 to evaluate the effects of eri-culture on promoting environmental awareness of local farmers in Kampong Cham province. The results showed that eri silk-raising farmers wanted to reduce 92.5% of chemical pesticide compared to the conventional use. While local farmers who just participated or who have never participated in the workshops showed only 72.3% or 66.9% of chemical pesticide to be reduced. Environmental awareness of eri silk-raising farmers on chemical pesticide to be reduced was significantly higher than that of other farmers who just participated in the workshop or who have never participated in the workshops (Kawabe et al., 2012). Sequel questionnaire survey was conducted in October 2011, 12 months passed after eri-culture has introduced to local farmers, as attention has been paid how much in fact the eri silk-raising farmers did reduced the amounts of chemical pesticide applied compared to conventional use.

### Research sites

The research sites are namely Wat Chas village and Rong Kor village in Baray commune, Prey Chhor district in Kampong Cham province where located approximately 100 km northeast from the capital of Cambodia, Phnom Penh (Fig. 1). Due to the suitable location for distributing agricultural products to Phnom Penh, most of farmers apply agricultural chemicals for farming practice to increase the productivity.



**Fig. 1 Location of Wat Chas and Rong Kor villages in Baray commune, Prey Chhor district in Kampong Cham province**



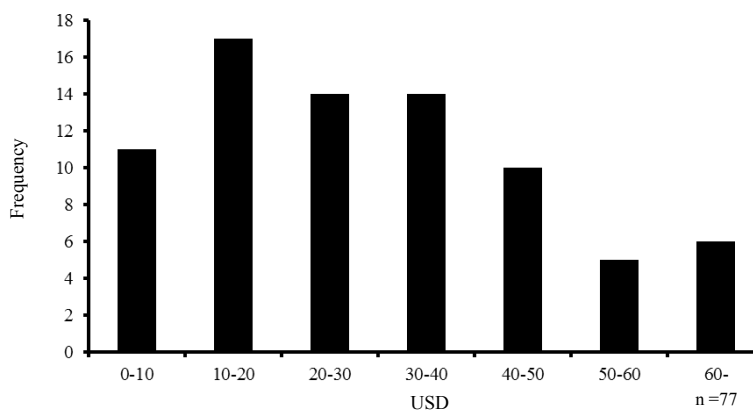
**Fig. 2 Education level of farmers at Wat Chas (Left) and Rong Kor (Right) villages, Kampong Cham province**

Source: ERECON Questionnaire Survey in 2009 and 2010

According to the surveys conducted in 2009 and 2010 by the Institute of Environment Rehabilitation and Conservation (ERECON), level of education of farmers at Wat Chas and Rong Kor villages were observed. The results shows 10% of farmers have never been to school, and 61% completed only primary school and 22% completed secondary school, while only 6% completed high school in Wat Chas village (Fig. 2). In Rong Kor village, less percentage of farmers completed secondary or high school as shown in Fig. 2.

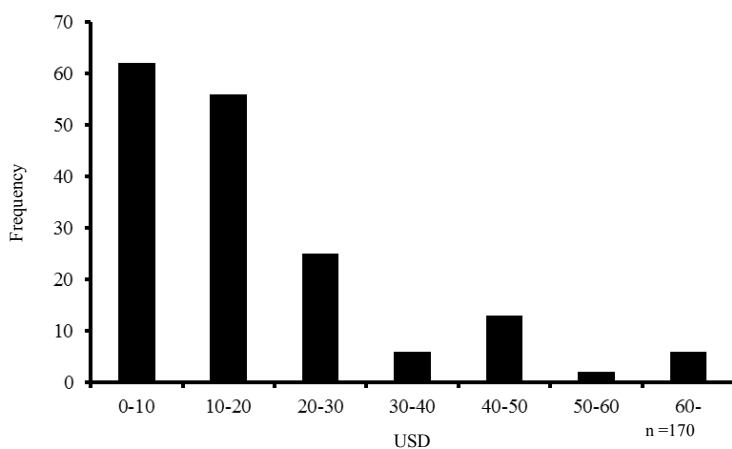
Education for adults is usually not paid enough attention, also not enough provided. Local farmers tend to think education is costly and they are too old to go back to school for study. However, they face difficulties due to being illiterate or less educated that cause poor access to the knowledge of agriculture and adoption of new techniques. Being illiterate, the information and technology are not easy for local farmers to access. Thus, any kind of non-formal education could take an important role for local farmers to reach appropriate and reliable information and knowledge that promote sustainable development.

In the research sites, all men and women aged 18 and over were eligible to receive land equally by the Cambodian government when Pol Pot regime was over. Thus, the average farmland is quite small and approximately 0.45 ha per household today. Rice in paddy field and some amounts of vegetables in upland fields are cultivated. Due to the limited size of farmland and one-crop system for most of farmers, agro-production is limited and poverty level is higher than other province of Cambodia (Kawabe, 2011).



**Fig. 3 Monthly income from agriculture at Wat Chas village, Kampong Cham province**

*Source: ERECON Questionnaire survey at Wat Chas village, 2009*



**Fig. 4 Monthly income from agriculture at Rong Kor village, Kampong Cham province**

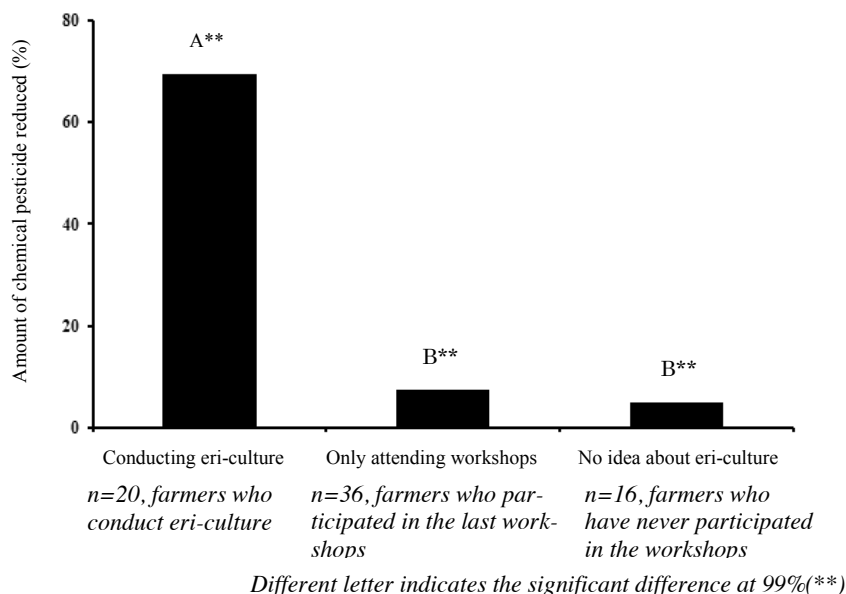
*Source: ERECON Questionnaire survey at Rong Kor village, 2010*

According to basic survey, monthly income from agriculture at Wat Chas village is shown in Fig. 3. Income from agriculture, main income for living remains relatively low, and the income range of 0 to 40 US dollar dominates 70% of the farmers in Wat Chas village, while the income range of 0 to 30 US dollar dominates 83% in Rong Kor village (Fig. 4). However, increasing and maintaining in yields, most of farmers purchase agricultural chemicals with small income and apply into farmlands that cause not only weighing down the household budget, but also causing health problems of farmers, degradation of soil and water.

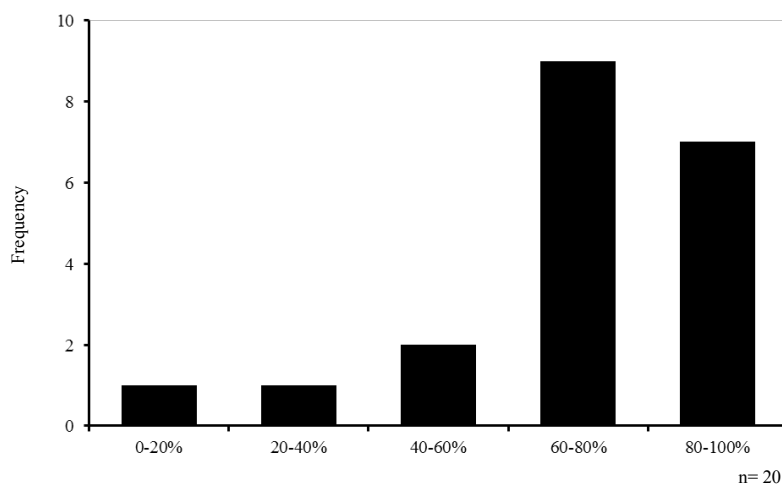
Solving the above mentioned problems, eri-culture has introduced to local farmers in Kampong Cham province as part of regional challenges of Regional Centres of Expertise (RCE) to promote ESD through the food, agriculture and environment education.

## RESULTS AND DISCUSSION

In the first survey in March 2011 to evaluate the effects of eri-culture on promoting environmental awareness of local farmers, the results showed that eri silk-raising farmers wanted to reduce 92.5% of chemical pesticide compared to the conventional way.



**Fig. 5 Difference in actual percentage of chemical pesticide reduced between eri silk-raising farmers and others**



**Fig. 6 Percentage of chemical pesticides reduced for eri silk-raising farmers**

While local farmers who just participated or who have never participated in the workshops showed only 72.3% or 66.9% of chemical pesticide to be reduced (Kawabe, 2010). Expected percentage of chemical pesticide to be reduced for eri silk-raising farmers was remarkably higher than the other farmers. So, an attention has been paid to reveal that how much in fact the eri silk-raising farmers reduced the amounts of chemical pesticide application compared to the conventional use. Questionnaire survey was conducted in October 2011, one year after eri-culture had introduced to the local farmer in October 2010.

The results showed that eri silk-raising farmers succeeded to reduce the amounts of chemical pesticide 69.5% compared to the conventional use, while farmers who only participated in the eri-culture workshops or who never participated in the eri-culture workshops reduced only 7.5% or 5% (Fig. 5). Observing the detail amounts of chemical pesticide reduced by the eri silk-raising farmers, 35% of eri silk-raising farmers reduced the amounts of chemical pesticide to 80 to 100%, 45 % of them reduced to 60 to 80%, while only 5 % of them reduced to 20-40% and other 5% of them reduced to 0-20% (Fig. 6).

Consequently, eri silk-raising farmers succeeded to reduce the amounts of chemical pesticide use through eri-culture, and eri-culture has educational function to increase the environmental awareness to local farmers, especially, in terms of reducing chemical pesticide use. Moreover, eri-culture has strong impact on local farmers who raise eri silkworms to move forward to sustainable rural development.

## **CONCLUSIONS**

Expected percentage of chemical pesticide to be reduced for eri silk-raising farmers was remarkably higher than the other farmers. So, an attention has been paid to reveal that how much in fact the eri silk-raising farmers reduced the amounts of chemical pesticide application. Questionnaire survey was conducted in October 2011, one year passed after eri-culture had introduced to the local farmer in October 2010. The results showed that eri silk-raising farmers succeeded to reduce the amounts of chemical pesticide 69.5%, while farmers who only participated in the workshop or who never participated in the workshops reduced only 7.5% or 5%. Observing the detail amounts of chemical pesticide reduced by the eri silk-raising farmers, 35% of them reduced the amounts of chemical pesticide to 80 to 100%, 45 % of eri silk-raising farmers reduced to 60 to 80% while only 5% of eri silk-raising farmers reduced to 20-40% and other 50% of them reduced to 0-20%. Consequently, eri silk-raising farmers succeeded to reduce the amounts of chemical pesticide use compared to conventional use through eri-culture, and eri-culture has educational function to increase the environmental awareness to local farmers, especially, in terms of reducing chemical pesticide use although most of farmers have less education in childhood. Moreover, eri-culture has strong impact on local farmers who raise eri silkworms to move forward to sustainable rural development, especially supplementary income is great motivation for local farmers to learn and obtain knowledge and skills more and more. Education is the key for development, but it is not necessarily a panacea for everything, and it should be discussed along with the ideas of income generation for adult education.

## **ACKNOWLEDGEMENTS**

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