Utilization of Local-Farming Resources to Strengthen the Adaptability of Dry Land Farmers in Lombok to Climate Change

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ABSTRACT

Farming on dry land, especially in northern Lombok Island, is limited mainly by the lack of available water for farming. Accordingly, climate change that may create drought or/and uncertain pattern of rainfall can severely impact farming in the area. To deal with the case, efforts to optimize the utilization of local farming resources have been run in the county (*Dusun*) of Jugil, the District of North Lombok (KLU). The main objective of the project was to strengthen the adaptability of local farmers to the change. Actions in the projects were the implementation of simple micro irrigation by utilizing deep-ground water wheel and rainfall harvesting, utilization of local varieties of several eatable crops, implementing multiple and inter-cropping systems, and organic fertilizer and botanical pesticides. The technical aspects were combined with development of knowledge and awareness of farmers about climate change, strengthening the self-supporting attitudes of farmers and cooperative works (*gotong-royong*) in farming practices. In general, the program run well and was fully adopted by local farmers. The most significant outcomes were (1) increasing farming intensity (from once to at least twice a year) as well as productivity, (2) farmers were less dependence on the high cost-hybrid seeds, synthetic fertilizers and pesticides, and (3) established a profitable and environmentally sound farming system. It may be concluded that the model of empowering farmer group having been implemented in this climate change adaptation program can be appropriately applied in the other areas in NTB.

Key Words: climate change, adaptation, local resources, dry land

INTRODUCTION

Climate change is a global issue which may create some serious problems for farming, specifically in the areas at the northern part of Lombok Island - Indonesia. The impacts of climate change may result the occurrence of abnormal rainfall or unfavorable weather condition in the area, i.e., irregular rainfall, too much or too little rainfall causing drought. Accordingly, appropriate farming technologies which will be adoptable for farmers in the area and adaptive to the climate changes are needed.

Farmers in the northern part of Lombok Island (KLU) are mostly small farmers, managing about 0.4 ha of farm land per house in average (P3LKT-Unram, 2009). The lack of water supply is the main limiting factor of the farming. This area is positioned in the climatic zone E with only 2 rainy months per year and the annual rain fall is 750 – 1,000 mm. In some areas, the additional water sources are deep-ground water (80 – 100 m depth) wheels. The utilization of the later water resource, however, requires high costs for constructing irrigation framework and water pumping. In term of cropping media, farming land in the area consists of sandy and porous-infertile soils, developed from pumice stone. These types of soil have very low water holding capacity as well as low contents of plant-essential nutrients. Based on the described condition, farming in the areas is so sensitive and risky to the climate changes.

The commonly grown food crops in the area were corn or/and upland rice (*padi gogo*) being inter-cropped with cassava. In most parts of the area, those crops are only possible to be planted in rainy season. Cropping in the dry season may be carried out only in certain areas that are facilitated with deep-ground water irrigation system.

To anticipate the possible-negative impacts of the climate changes to their livelihood condition, farmers in the areas should be prepared to be adaptive to the change. They must have appropriate alternatives of farming. For this reason, and by concerning the main agro-

ecological characteristics of the area, several activities have been launched in this project for 13 months.

This action research is a part of The Climate Change Adaptation Project (CCAP) being launched in Lombok Island by University of Mataram in cooperation with CSIRO Australia. The specific objectives are (1) to improve local farmers' knowledge and skill in cropping management that will be adaptable for facing the possible negative impacts of climate change, (2) to optimize the utilization of local natural-resources for farming toward the establishment of profitable and environmentally sound farming systems, and (3) to improve knowledge, skill, and awareness of local people about climate change as well as its possible impacts to their livelihoods. Several significant results of the action research during the first 10 months are described in this paper.

MATERIALS AND METHODS

General Agro-geophysical Condition

This action research has been carried out in Jugil county (*Dusun*), The Village of *Sambik Bangkol* - District of North Lombok (see Figure 1). The participants are all members (18 families) of a farmer group '*Beriuk Gati*'. Based on its water resources for farming, there are three types of dry in this site, which are (1) the dry land facilitated with deep-ground water irrigation system by using sprinkle big gun, (2) the dry land of point (1) but by using gravitation irrigation method, and (3) the fully rainfed dry land (without any irrigation facility). Those three agro-ecological systems are presumed to be representative for dry land systems in the northern Lombok.

Farming lands in this site are mostly flat – undulating (2 – 8 % of sloping), consisting of coarse-sandy textured soils (Ustipsamments – Ustitropepts association) developed from pumice stones. The soils are lack of plant nutrients and very low of water holding capacity

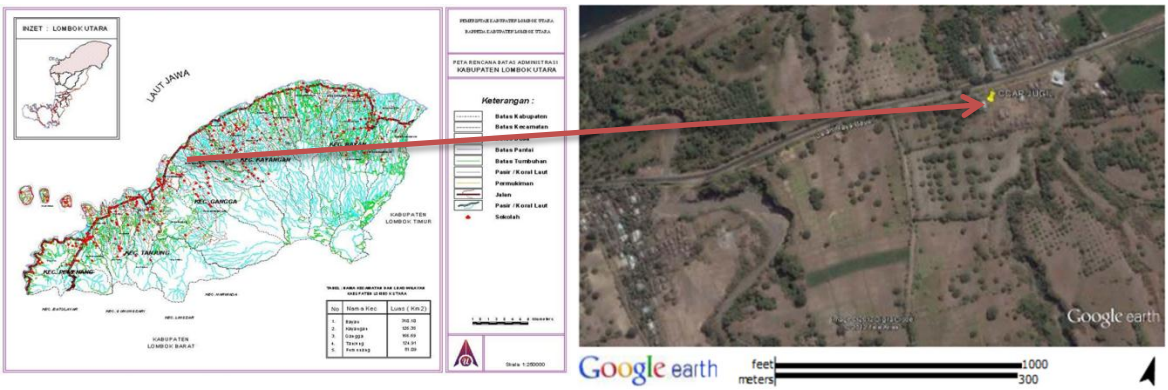

Figure 1. Project site in Jugil county, Sambik Bangkol village - North Lombok

(< 20 %) and porous. Without sufficient supply of water from the ground water wheel, farmer may grow food crops only once a year, e.g., in the rainy season (December/January – March/ April).

There is a deep-ground water wheel in this site, facilitated with gravitation irrigation system, and a 'sprinkler big gun system' covering only about 4 ha. Theoretically, the deep-ground water could be utilized to supply 20 – 30 ha of farming land. However, due to the improper irrigation system (the gravitation system) causing high water loss, farmers never utilized the facility for farming. Since water means everything in farming, optimizing the utilization of water has been the priority in this action research.

Action Research Activities

The main activity in this research was conducting a field school or field training by implementing a participatory approach. The activities being implemented in the field school were (1) optimizing the utilization of water resources for farming, by modifying crop-watering methods, (2) demonstrating several alternatives of cropping systems, (3) providing several seeds of food crop (local variety), (4) introducing the locally made organic-liquid pesticidal fertilizer, and (5) initiating the establishment of a self-supporting cooperation (*Koperasi Kelompok Tani Mandiri*).

In the field school, farmers were encouraged to participate in the farming management activities including planning, executing, controlling, and evaluation. Most school activities were carried out directly on farm. The materials which were not locally available, such as construction materials (cement and PVC pipes), fertilizers, and seeds were provided by the CCAP team, while labors were the farmers working in a cooperative system (termed as *gotong royong*).

RESULTS AND DISCUSSION

Modification of Crop-Watering System

As described in above section, two main water resources being utilized for farming in the area are rainfall and a deep-ground water wheel. To optimize the utilization of those water resources, the existing crop-watering systems are modified, in which the sprinkle big gun or/and open line-gravitation systems are modified into the direct watering into farming plots through PVC pipes (see Figure 2).

Figure 2. Watering system by using sprinkle big gun (left) is modified into the direct watering o farming plots through a PVC pipe (right).

This modification significantly increases the efficiency of water use for farming from a deep-ground water wheel. For growing corn, an example, by using watering system of

sprinkle big gun requires the operational cost of IDR 1,200 - 1,500 thousands, while for that of using the modified watering method requires only IDR 750 – 1,000 thousands in a growing session. Importantly, the improvement of water use efficiency has made possible and economically feasible for local farmers to grow food crops 2 – 3 times a year, and that has further positive effects and impacts to the other farming activities toward improvement of farmers' income. In addition, farmers has much flexibilities to apply various cropping patterns or/and planting systems, which makes the farming system in this area is more adaptable to climate changes.

Applying Organic Fertilizer and Pesticides

Actually, most farmers in the area already know, at least ever heard, about the beneficial effects of adding organic matter to soil quality and crop yield; and the organic technology had been applied for decades by our older generation. But, the modern farmers mostly do not apply it due to various illogical reasons. In this field school, farmers are tough to apply organic fertilizer (the composed cattle waste), liquid-silicate rock fertilizer (Priyono and Muthahanas, 2011) being combined with botanical fertilizer (the extract of *neem* leaf). A little amount of inorganic fertilizers, mainly urea and SP, are still applied to meet the high requirements for N and P nutrients for growing food crops.

The important lessons for farmers from those teachings that applying only 25 % of the commonly recommended doses of the inorganic fertilizers (urea and SP) combined with the organic fertilizer (0.5 – 1 t/ha), significantly increased corn and peanut yields up to 80 %. Additional increases of yield were gained by applying the liquid-rock fertilizer + botanical pesticides. Those lessons have changed farmers' knowledge and believe in the area that adding organic matter may increase crop yield, farming benefit, and improve the quality of

soil. Importantly, farmers become much less dependent on using the expensive inorganic fertilizers toward the establishment of self-supporting farmers for fertilizer.

Growing Local Varieties

The dependency of farmers on hybrid seeds, especially on corn seed, is very high. In the planting season, the demand for seeds of food crop is so high. On the other hand, the availability of the seeds in the market is often so limited that causes the jumping of seed price. Moreover, the yield of hybrid crops can't be re-planted for the next cropping seasons. In such situation, farmers have little choice to grow various commodities.

In this field school, the team of CCAP provided a composite corn variety and selected local-mungbean seeds. This corn variety was developed by Sudika (2011) from Unram. It is drought tolerant, has relatively short growing period (70 days), and its yield potency is about 5 t/ha. Moreover, the biomass of corn is 'stay green at its mature stage', so that the farming waste (corn biomass) may be utilized to feed their cattle. In contrast to hybrids, the local varieties may be re-planted for the next copping seasons which results to the self-supporting farmers for seeds. In short, the use of food crop seeds that are produced from the cross cultured local varieties is the most appropriate for dry land farming in the area. Those crop varieties are much more resistant the negative effects of climate change, mainly the occurrence of drought, relative to that for the hybrid varieties.

Cropping System

At this time, the results of an introduction of applying mixed-farming system have not been evaluated as this farming practice has long-term effects. Theoretically, however, growing various types of crop in a farming plot may reduce the risk of the total fail of dry land farming due to unexpected changes of weather condition. In addition, the mixed

cropping system may optimize the utilization of land resources toward the improvement of farmers' income and livelihoods.

The Establishment of Famer Group Cooperation

A common weakness of most dry land farmers in Lombok is that they are lack in farming capital. It is presumed that the most appropriate solution to solve the problem is by establishing a self-supporting cooperation (*koperasi mandiri*) as a financial supporting agent for each members of the farmer group. At this time, the cooperation has been initiated, but it not established yet.

An important aspect among various others of the cooperation that should be managed properly or should be exist is the economic or commercial activities. The action plan to create the economic activities for the cooperation, which are associated to the farming activities described above, it will produce and sell organic pesticidal fertilizers and seeds of local varieties. In producing the fertilizer, the farmer group will cooperate with (be guided by) P3LKT Unram by utilizing the locally available raw materials, whereas the seeds will be corn seed (at least) selected from farmers' yield.

During the field school as described above, farmers got fertilizers, seeds, and operational farming costs for watering. It was agreed by the farmers and CCAP team that those costs must be returned to the farmer group at harvesting time, and then this money is used as a stating capital of the farmer group cooperation. It is hope that the cooperation will run well as proposed. The cooperation is by and for the farmers.

Keys of Immediate Effects and Potential Impacts

This action research has been run for relatively short time, e.g., about 9 months. However, some significant effects and impacts of the activity to local people have been

recognizable. Firstly, the improvement of water use efficiency for farming due to the modification of crop-watering system may be the key gain of this action research. It has produced a multiple effects to the farming activity in the area, which includes the increase of cropping intensity as well as productivity and profitability of farming. Further, those effects will potentially impact to better economic and livelihoods condition in general of the farmers' household. Secondly, the practices of organic farming is started by optimizing the utilization of local resources, including fertilizer, pesticide, and re-plantable seeds. The third aspect, the strengthening 'cooperative working system' (termed as *gotong royong*) is the most appropriate of working system for village communities. The system will not only reduce farming cost, but also improve the spirit of unity of the community and learning to and from other for many living aspects. Those all will stimulate the improvement of the adaptability of farmers to any problem, including the possible negative impacts of climate change.

CONCLUSIONS

The model of empowering the dry land farmers being applied in this CCAP is appropriate enough to be applied for the dry land farming condition in north part of Lombok Island, the dry land farming area that has very high risk to the climate change. The key problem should be solve in such farming area is the sufficiency of water supply. Modification of crop-watering system from sprinkle big gun to a less cost and simple watering system, introducing organic fertilizer and pesticides, and growing local variety of food crops, have produced significant positive effects which potentially will impact on the improvement of farming income and adoptability of the farming to climate change. This model may be applied in other similar areas/communities by considering the local specific agro-ecological condition.

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