Tackling everyday risks through climate adaptive organic farming[1]

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Keywords

Climate adaptation, Food security, Organic farming, Climate adaptive farming, Drought adaptive farming, Smart agriculture

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Summary

Gunungkidul district in Yogyakarta province is dominated by karst limestone areas where the land is less fertile and suffers long dry periods. With the shifting patterns of rain and dry periods as a result of global climate change, the people of Gunungkidul have to deal with extreme conditions, such as crop failure, ponds and artificial lakes drying up at an alarming rate due to high evaporation, which has led to people having to buy water for household purposes, and for farming and tending the livestock.

Participatory disaster and risks assessment and action planning were carried out to identify how communities perceive risks and identify priorities of actions. Farmers agreed to implement climate adaptive farming which combines organic farming, biological pest control and drought-resistant seedlings from local varieties. To address the wider problem on water and livestock feed scarcity, the farmers also conserve the artificial lakes and do livestock feed fermentation. The processes to adaptation required collective actions, paradigm shift and it also constitutes trial and error processes. Acceptance to innovation is one of the major challenges. Working with "contact" farmers and "advance" farmers is the key to the community organizing strategy for innovation and adaptation.[2]

Subject of the case study

Farmers' resilience in tackling climate variability in farming.

Important themes and issues

- Local/non-local knowledge sharing – receptiveness/reticence.
- Collaboration and influence.
- Learning from each specific and unique situation.
- Changing environments and climate.
- Using tradition and innovation.
- Cohesive or passive local populations.
- Addressing environmental degradation.
- Organic and adaptive farming.

[2] This case study is based on YEU's adaptation program funded by ICCTF.

Context

The landscape of Gunungkidul district in Yogyakarta province is dominated by karst areas with distinctive environmental characteristics and where the seasonal calendar is dominated by long dry periods, which are influential in shaping the lives of those who inhabit the area. With the shifting patterns of rain and dry periods as a result of global climate change, the people of Gunungkidul have to deal with extreme conditions, such as ponds and artificial lakes drying up at an alarming rate due to high evaporation, which has led people to buy water for household purposes, and for farming and tending the livestock. Crop failures in the area mainly occur due to the failure to predict the turn of seasons along with the inability to cope with pests and plant diseases. Government has crop insurance programs, but these are not fully operational; the requirements for accessing such insurance cannot be met by small farmers and rain harvest farmers. Additionally, the government seeds subsidy program is limited and does not reach all small farmers. Water shortages also exacerbate the consequences. There are some underground water sources, but there is no affordable and sustainable technology to pump the water for the community on a long-term basis. During the long dry season, livestock farmers suffer shortages of livestock feed which, in turn, forces them to buy fodder or give dried leaves to the livestock. Farmers are trapped in a vicious circle; whenever there is a shortage of water, they sell livestock, and whenever there is a good harvest, they buy new livestock.

Threats and consequences faced

Threat 1

Crop failures suffered by small farmers. Consequences are the reduction or loss of income of small farmers to sustain their livelihoods. When the land does not yield any crop, they switch to odd jobs and leave the land unattended.

Threat 2

Water shortages due to dried up ponds and artificial lakes occurring with increasing frequency. Consequences are that crops wither and die. Livestock suffers from dehydration. The community does not have sufficient water for household purposes. They face extra expenditure to buy water, creating an extra burden.

Threat 3

Pests and disease attacks from strains which are more resistant to pesticide, fungicide, etc. Consequences are that crops die in vast areas when attacks are not controlled effectively.

Threat 4

Scarcity of livestock feed. Consequences are that livestock is not properly fed, resulting in a low nutrition intake. This drives down the price of livestock when sold. Farmers sell their livestock when there is a water shortage, which has a negative impact on their only household savings.

Barriers to action

Governance

Government-appointed field facilitators are limited in numbers, and their areas of work cover many villages and bear multi-tasking duties.

Information and technology

The small farmers in the assisted areas are mostly poor and old generation farmers who are not familiar with newer farming technologies, such as weather forecast, agriculture/farming apps, and dissemination of research in agriculture.

Changing mindset

Chemical fertilizers and pesticides are more favourable and user-friendly because it is ready-to-use compared to organic fertilizer and bio-pesticides which need to be self-made and also require trial and error, time, knowledge and labor.

Local actors

Government

The district government has the responsibility for policy making regarding farming protection policy. Government-appointed field facilitators have the responsibility to inform farmers on climate variability, farming calendar and do field monitoring for pest control.

Rain harvest farmers

Four farmers groups have been trained to produce their own seeds and share these amongst members and practice inter-groups seed distribution networking. Four farmers group have been trained on organic farming methods, on controlling the pests and disease and they become facilitators/trainers to other farmers' groups. Four farmers groups have been trained on producing alternative livestock feed from locally available materials through fermentation or silage.

What was the challenge faced?

The Gunungkidul district of Yogyakarta Province is well-known for its vast karst/limestone areas which are characterized with barren land and karst hills facing the Indian Ocean and with peaks reaching 100–300 meters above the sea level. The district is also highly vulnerable to water and food shortages. The community has experienced long seasonal droughts; most of the inhabitants are farmers who already have local knowledge on how to cultivate the farm land with limited water resources to sustain lives. Some others have to buy water during harsh dry season to avoid crop failure. Approximately 133,682 hectares (90 percent) of total agricultural land in Gunungkidul district are rain-fed dry land with high dependence on precipitation (Muazam, 2015). Irrigated land is very limited. Rain-fed rice fields are categorized as sub-optimal with low fertility soil and limited water availability (Prihasto, 2013). According to Agricultural Research and Development Agency in 2013, rice production for the whole district was relatively low at the range of 3–3.5 tons per hectare and was very unlikely to be improved. However, agriculture remains as the major livelihood in Gunungkidul district with 69 percent of the population working in the agricultural sector. Gross domestic product in the district in 2015 amounted to 13.8342bn rupiah with the largest contribution given by the agricultural sector, amounting for 25.56 percent (BPS, 2017). The shifting of rainfall and dry seasons, as the direct impact of global climate change, has caused exposure of extreme conditions for the population in the Gunungkidul district. For example, increase in the evaporation rate resulted in more communal ponds drying up at an alarming speed, forcing people to buy water for household and agricultural purposes. Another threat is the high occurrence of crop failures mainly due to failure to predict seasonal change, to pest attack and timing for use of chemical fertilizers, chemical pesticides and other chemical substances to help grow the plants.

It is customary that during the dry season, when the community finds it difficult to access the adequate water supply or when facing crop failure, they switch

occupations and become handymen. The Food and Agriculture Agency stated that they did not have data on crop failures since crop failure is defined by the government as a reduction to 11 percent of the harvest. In fact, every year there are many small farmers suffering from crop failure or losses due to climate change in individual farm land. This is also one of the findings in the GNDR Frontline Survey [1], where crop failure has been identified as major threat for the community, especially in rural areas.

The action taken in response

In 2016, YEU received a grant from the Indonesia Climate Change Trust Fund (ICCTF) to carry out adaptation programs in four villages in the Gunungkidul district of Yogyakarta. The adaptation program was designed to strengthen food resilience in karst (limestone) areas in a way which is practical and applicable for field use. Participatory disaster and risks assessment was carried out to identify how communities perceive risks.

From the risk assessments, the following have been identified:

- Based on GunungKidul Government's official data, the level of drought and rainfall in GunungKidul are considered normal. Farmers have local wisdom of traditional seasonal calendar, but it has been acknowledged that the seasonal calendar is now invalid due to climate change.
- Based on the historical analysis, each year farmers are suffering from crop losses or crop failure due to disasters including landslide, volcanic ashes, long-tailed macaque attack and climate change leading to drought, long dry seasons, unpredictable rainfall, long rainy season, etc. They also experience secondary impacts from climate change including pest attacks and environmental degradation.
- Direct losses due to disaster and climate change felt by farmers include: decrease yields, crop failure, and lack of green grass for livestock feed and artificial lake water drying up. Aside from economic loss, farmers also suffer from additional expense for buying water and green grass during long dry season. It is common that they will sell their livestock to buy water and green grass. This practice is so-called "livestock eats livestock."
- Additionally, the price of seedlings is also high and the in general farmers have no capacity to make their own seedlings.

Thus, farmers identified the following adaptation plan:

(1) Climate adaptive farming which combines organic farming, biological pest control and drought-resistant seedlings from local varieties.

For this action, YEU conducted capacity building which covers the following:

- introduction to and identification of pests and plant diseases and the symptoms;
- the identification of plant pest organisms (PPO) and the natural enemies of the PPO;
- making biological pesticide to control the pests and plant diseases which affect the rice;
- and making organic fertilizer a schedule for fertilization and pest control actions.

(2) Conservation of an artificial lake as source of water during long dry season.

For this action, the community conducted communal work to build embankments and plant 425 trees around the lake.

(3) Fermentation of livestock feed to reduce the cost of buying green grass during the dry season. For this action, YEU facilitated training and practice on how to make fermented livestock feed from straws, grass and leaves that are available during dry season. Most importantly, the fermented livestock feed is enrich with nutrients.

What happened during the action

The program was carried out in collaboration with the Food and Agriculture Agency and with the active engagement of farmers groups. In increasing the capacities of farmer groups in organic farming, providing training itself would not be sufficient. It took trial and error processes, therefore the facilitation consists of training (knowledge transfer), practice (application of new knowledge) and continuation of practice of the newly gained skills (production of organic fertilizer, biological pesticide and fermented livestock feed). Climate adaptive agriculture program undeniably raised concerns amongst local farmers on crop failure or decline in crop harvest since they were accustomed to chemical fertilizers. However, after the introduction of organic practices with close monitoring from the agriculture extension officers, the farmers' groups were strongly committed to apply the practices to reduce the dependence on chemical substances which contributed to the damage of the soil fertility, and reduce any expenditure on buying expensive chemical fertilizers.

In determining the demonstration plot for this, the farmers agreed on specific land owned by the member of the groups. Once the group decided on the plot, then the landowner should discuss the land use internally with the family. The decision should come from awareness that with the absence of volunteerism and sacrifice, no farmer will start learning the new farming method. In addition, the landowner should secure another land for his own farming activity to ensure family income. During the practice, an evaluation was conducted to monitor the process and results. This practice was repeated until farmers mastered the process and the result is satisfactory. For the continuation of practice, some farmers chose to do it individually and some chose to do it by traditional systems of reciprocal exchange (gotong royong). After the training–practice–reproduction was done, the farmers were ready to apply the climate adaptive farming through the demonstration plot. Aside from climate adaptive farming, to adapt to the water scarcity during dry season, each household has a water reservoir to harvest the rain water. One community in Temon sub-village also conserved an artificial lake called TelagaMakam. The strategies for conservation were formulated through community resource mobilization. Each household in the community provided one cubic meter of materials for building 140 cubic meters of embankment and planting 425 perennial trees, which have been able to slow down the evaporation rate.

What has been effective?

Shifting from traditional practice into climate adaptive organic farming.

The trainings and direct assistance to climate adaptive farming have benefitted the farmers as they are able increase the farming production through the following actions:

(1) Using seed variety which is suitable with the geographical and climate conditions in the Gunungkidul district which is dominated with karst and long dry season. The selected variety also has other qualities such as suitable in rain-fed rice fields, more resistant to pests and disease and has short duration from seeds to mature plants (±103 days).

(2) Composting cow manure, which often becomes the breeding place for endemic pests 'uret' (Lepidiota Stigma), into organic fertilizers. It significantly reduces the uret population as well as reduces the costs for purchasing chemical

fertilizers. Before the program intervention, farmers directly sprinkled manure into the field without processing the manure into organic fertilizers. This practice created risks to the field being infested with pest (*lepidiota stigma*) endemic in the area, as uncultivated livestock manure invites pests. After the training, the farmers know that the cause of the pest is the livestock manure that is not properly processed into organic fertilizer. In addition, during the project period, the farmers also got the experience to treat pest affected fields by flooding/inundating the farm land with water for some time. So now farmers can do prevention and eliminate the pest effectively. Previously, to handle the pest they did it by trying to catch the pest (*lepidiota stigma*) in its larvae stage in the ground, and the result was ineffective.

(3) Increasing the crop population by applying seed row spacing by measuring the distance of the crops, manipulating the nutrient placement, ensuring enough sunlight and reducing the weed competition. Consequently, there are fewer weeds competing with the crops for moisture and nutrients. Based on the study conducted by International Rice Research Institute, the findings suggested that "proper spacing can increase the yield by 25–40 percent over improper spacing."

From the demonstration plot, it can be concluded that adaptive organic climate agriculture if properly implemented can reduce the risk of crop failure, and increase agricultural yields by approximately 60 percent from traditional farming practices commonly practiced by farmers where they usually use low quality seedlings, cultivated the soil with unprocessed manure for compost and do not use the row-spacing technique for planting the seeds. With the demonstration plot, the farmers used seed variety which is suitable with the geographical and climate conditions in the Gunungkidul district which is dominated with karst and long dry season, composting cow manure into organic fertilizer and applying seed row spacing by measuring the distance of the crops, manipulating the nutrient placement, ensuring enough sunlight and reducing the weed competition. Consequently, there are fewer weeds competing with the crops for moisture and nutrients (Figure 1).

Strengthening local risk governance and program ownership

To improve and intensify the agricultural information dissemination to farmers, since 1976 the Agricultural Department introduced agricultural extension with training methods and field visits (LAKU method) to help solve various problems faced by farmers. To enable reaching millions of farmers by a limited number of agricultural field facilitators, agricultural extension by the LAKU method is carried out in stages through farmer groups. There are three grades of farmers in Indonesia: "contact" farmers, "advance" farmers, and "follower" farmers. Contact farmers are farmer opinion leaders who can bridge the communication between farmer facilitators and the farmer group members. Follower farmers are the slowest group to receive inputs, therefore it is essential to increase the number of contact farmers and advance farmers. YEU adopted this approach during the program implementation, where YEU works with government's field facilitators of the Agricultural Department in conducting training and monitoring visits to farmer groups. In decision-making for

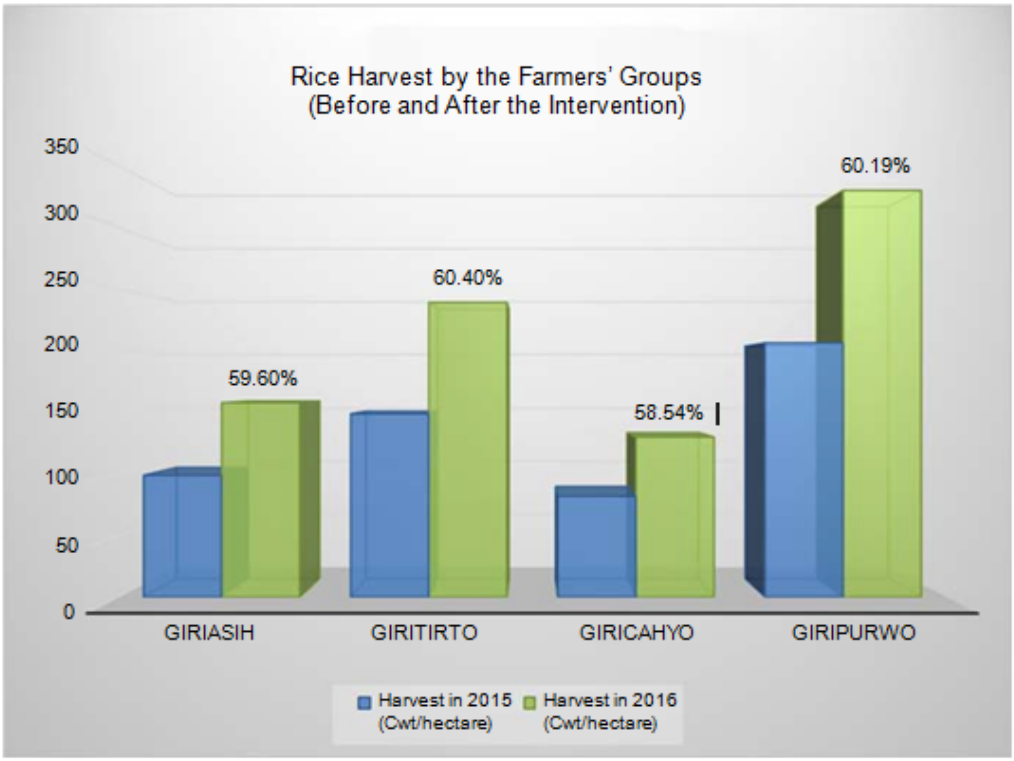

Figure 1: Increased of harvest after the intervention

organic farming, YEU also approaches the leader of the farmer groups and head of village government to bridge the communication with group members, so that groups are willing to build a shared commitment. YEU also identifies advanced farmers who are the agents of change in a group that lead by example by practicing the results of the training independently. As of the end of the project, of the 212 trained farmers, there were 35 advanced farmers (7 women and 28 men) who volunteered to practice the outcomes of the training. The practice of advanced farmers is expected to be followed by farmers' followers. One of them is by jointly making fertilizer on a rotation basis.

What challenges, problems and barriers were there?

Limitations to government support

One of the challenges faced by the government is limited manpower – especially the small number of field facilitators which are overburdened due to multiple tasking. Government could utilize/recruit "contact" farmers as field facilitators as a strategy for addressing limited manpower and to use different kind of platform to disseminate agricultural information.

Information and technology

The Ministry of Agriculture has launched an application called "KATAM" (integrated farming calendar) which gives information about the right time for farmers in a specific location to start farming. This application can be accessed through websites, Play Store as well as SMS centers. However, old generation and rural farmers are not comfortable with this application. Dissemination of information is needed to ensure farmers in rural areas can utilize this app. The use of information and technology for farmers should be strengthened with continuous assistance to utilization of the appropriate technology and access to sources of information in the applied agriculture to increase agricultural productivity.

Changing mindset – acceptance of innovation by farmers

In the beginning, farmers were hesitant to provide large areas of farm land for organic farming demonstration plots because they were worried that the harvest results would be very low compared to their traditional practices. Communities feel reluctant to try new ideas and innovations due to the difficulties they fear they might face, often focusing on the hardship or potential failure instead of positive results. Therefore, they need intensive assistance from transfer of knowledge, application, monitoring and evaluation. NGOs including YEU and the farmers facilitators from the

Agriculture Department play significant roles in this process, to ensure commitment and consistency. Due to this hesitation, the farmers chose to have two demonstration plots, one with pure organic treatment and the other still using chemical fertilizer but with lower amount than their traditional practice. Additionally, the farmers tend to wait and see the results of demonstration plots before they apply the organic farming knowledge they gained to their own farm land. The farm land is less fertile, located in the hillside and is also narrow (less than 1,000 m^2) which is not ideal for a demonstration plot. However, it represents the typical farm land in the target areas. After seeing the evidence and results of the pilot, farmers are more motivated to replicate the practice. The community learns from the demonstration plot, that organic farming can deliver a good harvest and is sustainable.

Reflecting on action

- Experimental learning, strong leadership and social cohesion play significant roles in the adaptation of new farming techniques processes.
- Peer-learning from those who already learnt the skills, leading to transfer of knowledge. The government could utilize and recruit contact farmers or advance farmers as field facilitators as a strategy for addressing limited manpower and to use a different kind of platform to disseminate agricultural information. Government field facilitators also play significant roles to bridge the gaps.
- Seed subsidy is a national program, but the seeds distributed by government must consider local risks and conditions. The seeds distributed should not only be a variety for fertile land farm, but also be a variety for rain harvest farming. Community seeds bank have helped to fill in the gap of seeds subsidy shortage, by increasing farmer capacity in saving local varieties and improving their livelihood.
- The community learns from the demonstration plot, that climate adaptive organic farming can produce good harvests and is sustainable. In this case study, there are four farmers groups; each group has two demonstration plots. In this way, the farmers can learn the good and bad practices in real time.
- The real challenges on the continuation of the production of organic fertilizers are identified with: limited organic materials available in the village to meet
- the demand of more farmers who want to make their own organic fertilizers, the inadequate or under capacity of the support technology in agriculture and the absence of incentive for the business actors in marketing organic agricultural

products. Thus, the government should create enabling environment for a more sustainable organic farming.

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