

Improvement in Self-assessed Knowledge and Changes in Farming System Practices of Climate Field School Graduates in Bicol, Philippines

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ABSTRACT. Rainfed lowland and upland farmers have less access to new technologies especially those that would reduce their vulnerability to climate change. In the Philippines, the Philippine Rice Research Institute developed a package of technology called “*Palayamanan*” that is suited to rainfed sites. This paper presents the results of the study that disseminated the *Palayamanan* technology through the climate field school (CFS) in rainfed areas in Bicol. Thirty-eight farmers from two *barangays* of Pamplona, Camarines Sur, and 78 farmers from three *barangays* of Milagros, Masbate were the respondents. A five-point scale was used to self-assess farmers’ knowledge on topics discussed in the CFS, which were divided into four major parts: climate science, rice production, vegetable and animal production, and pest and water management. Weighted means of the farmers’ self-assessed knowledge scores before and after the CFS were generated. The Mann-Whitney U method was used to test the significance of the differences in the pre-and post-test scores. The differences between pre- and post-test scores were highly significant (at 5% level), especially on the clustered topics of climate, land preparation and seedling establishment, soil nutrient management, pest management, and harvesting. Some farmer-

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cooperators shifted from traditional crop varieties to high-value crop, thus, changing their farming systems from subsistence to commercial. Farmer-graduates in Pamplona and Milagros have improved self-assessed knowledge and farm practices of some farmer-cooperators also changed, resulting in more advanced farm technologies being adopted in the area. The participants also engaged in new recreational activities such as backyard farming, which became a supplemental source of income. There is need to conduct similar study that investigates other factors or variables that could affect farmers' participation in the CFS. The CFS as a mode of extension delivery in rainfed areas is still in its infancy stage. More funds can be poured into the strengthening of the curriculum as well as capacitating the agricultural technicians to be competent resource persons.

Keywords: *Self-assessed knowledge, climate field school, Palayamanan, farming system, Bicol, Philippines*

INTRODUCTION

Studies in agriculture give evidence that knowledge plays an important role in productivity and innovation (Pontius, Dilts, & Bartlett 2002; Manoj, 2013). While students learn in conventional classroom setting, farmers acquire knowledge through practical application and skills. They are actualized from application and field experimentation (Scott, 1998 as cited in Stuiver, Leeuwis, & van der Ploeg, 2003). For farmers, acquiring knowledge is a continuous process of 'learning by doing' (Giddens, 1984 as cited in Stuiver, et al., 2003).

Agricultural knowledge has a great impact on farming activities, but these are not evenly distributed. In Mtega, Ngoepe, and Dube's study (2016), farming areas are classified as either information rich or information poor. For instance, the upland areas in the Philippines can be considered information poor because of technology and information accessibility problems. Literature on upland information transfer is also lacking. On the other hand, lowland areas are considered information rich because the participants have attended farmer forums and summit workshops.

While knowledge and practices could be acquired, Lwoga (2010) as cited in Mtega et al. (2016) described two kinds of knowledge

that farmers use: indigenous and exogenous. Indigenous knowledge and practices are traditional and local knowledge in agriculture that farmers apply. These are common activities practiced and passed down across generations. The other type of knowledge is exogenous, which could be acquired from farmer interactions and from different media channels. Farmer interactions could be from interpersonal communication with co-farmers or with people from the external environment. It could also be through other forms, channels, or sources of information such as television, radio, and formal schooling and training.

One of the ways to increase knowledge of farmers about climate change and the corresponding adaptation strategies is to conduct a climate field school (CFS). The CFS is a non-formal type of education wherein farmers attend schooling (once a week) in makeshift classrooms in their community for half a day.

The farmer field school (FFS) training programs were seen as effective strategies in raising farmers' knowledge (Rola, Jamias, & Quizon, 2002). The CFS is an offset training from the FFS with additional topics on climate change. CFS aims to lessen the vulnerability of agriculture to climate change by enhancing transfer of knowledge and information among farmers and farmer-groups. Through knowledge acquired from CFS, farmers become more able to adapt farming practices that minimize the impact of climate-related hazards on farming and improve yield and productivity. Winarto, Stigter, Anantasari, and Hidayah (2008) stated that the CFS curriculum teaches farmers to build up resilience in farming systems. Stigner et al. (2013) as cited in Leippert (2014) acknowledged that CFS could also change the behavior of participants in a non-directed, independent way.

Evaluating the knowledge gain of farmer graduates is important in assessing which topics are relevant to their farming practices and in determining farming systems suitable to their communities. Moreover, topics in the CFS curriculum and modules that need improvement can be identified. Application of climate information could also be improved through CFS (Boer, Tamkani, & Subbiah, 2003). While numerous studies on knowledge gain and changes in farming practices have been conducted, there is scant literature on the knowledge acquisition of farmers in upland and rain-fed areas in the Philippines, the locale of this study. Thus, this paper focuses on the self-assessed knowledge improvement of the CFS farmer graduates in Pamplona, Camarines Sur and in Milagros, Masbate, Philippines. The objectives of this paper are to measure the improvement in self-assessed knowledge in both sites;

compare this variable between Pamplona, a lowland rainfed community, and Milagros, an upland community; and document the changes in farming system practices of farmer-cooperators of the CFS in both sites.

Knowledge Improvement through Climate Field School

Climate field school. The climate field school (CFS) is one of the innovative channels for information sharing and transfer among experts and farmers. Understanding climate and its effect to agriculture is the main objective of the CFS. Adaptation measures related to farming activities were taught through lectures and technology demonstration (techno demo) farms. The curriculum adapted for CFS was designed for 18 sessions including activities such as field demonstrations, field day or learning trip, and graduation. Topics discussed were divided into four major parts, namely: climate science, rice production, vegetable and animal production, and pest and water management.

The CFS used the participatory approach in designing the curriculum by engaging the local officials during the curriculum development process. A general process flow of CFS in Figure 1 shows the relationship of the three stages of implementation in the study locales. In each of the study sites, a unique set of activities was implemented depending on local needs and aspirations.

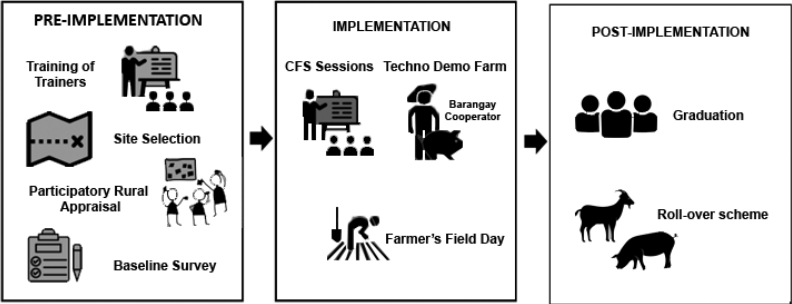
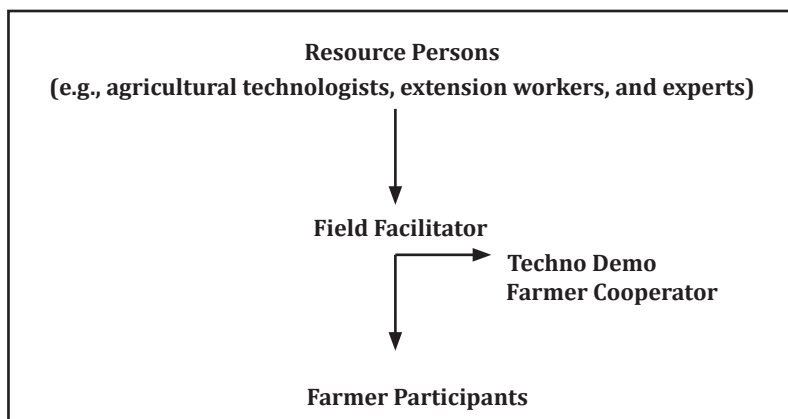


Figure 1. Process flow of the climate field school implemented in Camarines Sur and Masbate, Philippines



**Figure 2. Process of knowledge acquisition in the climate field school
(modified from Leippert, 2014)**

Agricultural extension services such as the FFS were seen as effective ways of conveying knowledge to farmers (Godtland, Sadoulet, Janvry, Murgai, & Ortiz, 2004). Extension services such as the CFS do not only transfer climate knowledge to farmers but also communicate information as an approach to bring about behavioral change toward climate change (Boer et al., 2003). Thus, the CFS curriculum derived from a participatory stance has location-specific activities.

Farmer participants in the CFS acquire knowledge by attending the lectures and engaging in practical demonstrations through the techno demo farms (Figure 2). Agricultural technicians, extension workers, and experts acted as resource persons and facilitators who deliver lectures and apply the lessons learned through actual demonstrations. Boer et al. (2003) stated that extension officers acted as mediators in translating and relaying climate knowledge and information into farmer language that participants can understand. Further, handouts were given and supplemental activities such as learning trips were included in the curriculum.

A farmer-cooperator, selected in each study area, acted as the farm manager of the techno demo plot and managed agricultural inputs provided by the project. This person also served as the leader of the farmer-participants during the CFS. The farmer-cooperator's duties also included reporting problems encountered in the techno demo farms and CFS sessions to the municipal technologists.

Effects of knowledge gain on farmers. Improvement of knowledge from agricultural extension efforts has affected farmer participants in numerous ways. There were self-improvement, enhanced farmer relations and interactions, and greater productivity. Agricultural extension services such as the FFS were seen as effective ways of conveying knowledge to farmers (Godtland et al., 2004). The field school has provided farmers the opportunity to interact with fellow farmers and extension workers. Moreover, it strengthened the farmers' decision-making skills and improved their analytical skills (Mancini, 2005 as cited in Manoj, 2013; Feder, Murgai, & Quizon, 2003).

Improvement of personal abilities and self-regard was also investigated as an effect of participating in agricultural extension activities. In Indonesia, a study reported positive effect on human capital. The farmers have developed positive self-regard, creativity, independence, and mutual collaboration (Braun, Jiggins, Röling, van den Berg, & Snijders, 2006). Duveskog, Friis-Hansen, and Taylor (2011) have also conducted a study on the impact of FFS on farmer's well-being. They said that the increased well-being of farmers has translated into innovation in their farming technologies. Farmers were empowered.

Changes in farming system practices. The study in Mindanao, Philippines showed that CFS small-scale farmer participants have exhibited an improvement in planning and farm management practices such as choice of crops, land preparation, and timing of planting and harvest. Other changes were adoption of organic farming, intensification of the rice system, and establishment of a community seed bank (Chandra, Dargusch, Mcnamara, Caspe, & Dalabajan, 2017).

Yamazaki and Resosudarmo (2008) also reported that FFS graduates have improved not only their farming practices but also their yield performance. Farmers who graduated from the field schools have significant improvement in knowledge and performance. New knowledge was obtained and changes in practice were observed such as a decrease in the use of pesticides. However, the headway was not upheld through the years, and the high performance has declined. The impact of FFS on farmers was seen to be short-lived.

The Palamayanan model. The *Palayamanan* model of diversified integrated rice-based farming system developed and established by the Philippine Rice Research Institute (PhilRice) is composed of synergistically compatible farming ventures (Corales et al.,

2005). PhilRice coined the word to encourage farmers to increase not only their rice yield, but more so their income. The term *palayamanan* is made up of two simple words: “*palay*” – the Filipino term for rice at any stage prior to husking; and “*yaman*” – a term which means wealth. The combined words mean that there is wealth not only in rice, but that rice can be combined with other high-value crops, livestock, and fish to generate more wealth. Rice is the major component of the system as it is the staple food of the Filipinos. Adding high valued vegetable crops, fishponds, poultry, and livestock on their farms increase income of the farming households and also assure continuous food supply for the family.

METHODOLOGY

The project conducted two season-long cycles of CFS in each province, which lasted for 3-4 months. For this paper, only the second-year implementation of the CFS (2016-2017) was used in analyzing self-assessed knowledge scores. The facilitation of CFS in the project sites was supervised by the local government units (LGUs) and partner state universities. Agricultural technologists from the LGUs and experts from the academe served as resource persons. The CFS was designed for 18 weeks with a curriculum patterned after the PhilRice’s *Palayamanan* system with the integration of topics on crop and animal production as discussed earlier. A techno demo farm, managed by farmer-cooperators, were established in the study *barangays*. Changes in the farming system practices of these farmer-cooperators observed during the two-year project implementation are further reported in the paper.

Primary data were obtained from a set of questionnaires administered to 38 rice farmers who were CFS graduates from two rainfed *barangays* of Batang and Tampadong in Pamplona and 78 farmers from the upland *barangays* of Matagbac, Sawmill, and San Carlos in Milagros. The pre- and post-test questionnaires were used to gather information on the farmers’ self-assessment of knowledge in the different topics discussed in CFS, and their evaluation of the CFS and the project itself. Additional information about knowledge gain and changes in farming practices of farmer-graduates were obtained from a baseline survey conducted before the CFS and from interviews with farmer-cooperators and agricultural technologists after the CFS. There were four farmer-cooperators in Pamplona, Camarines Sur and five in Milagros, Masbate interviewed.

The questionnaire used a scale in which self-assessed knowledge was measured using a 5-point rating, where 5 = excellent (*napakahusay*), 4 = very satisfactory (*mahusay*), 3 = satisfactory (*katamtaman*), 2 = poor (*mahina*), and 1 = very poor (*mahinang mahina*). Farmers' responses were encoded using the R software. The encoded responses related to knowledge self-assessment were clustered into eight main topics: 1) climate, 2) land preparation and seedling establishment, 3) soil nutrient management, 4) pest management, 5) water management and special topics, 6) organic agriculture, 7) animal production, and 8) harvesting and postharvest.

Data were analyzed by assigning weights to each rating in order to calculate the mean pre- and post-test scores.

Rating	Weight
5 (excellent)	0.4
4 (very good)	0.3
3 (good)	0.2
2 (poor)	0.1
1 (very poor)	0

The Mann-Whitney U test is a non-parametric test used for determining the mean of two different groups. This method was used in obtaining the mean scores of the knowledge level. To test the significance level of the difference between the pre- and post-test scores, t-test α values of 0.1 (10%) and 0.05 (5%) were set.

Description of the Study Sites

Lowland rainfed areas of Camarines Sur. In Camarines Sur, the poverty incidence registered at 27.1 percent, slightly lower than the regional level, but nonetheless, indicates a relatively high proportion of households that were unable to meet basic needs. Further, the proportion of households in Pamplona, Camarines Sur living below the poverty line was higher at 32.9 percent (Philippine Statistics Authority, 2014). This high figure translates to the fact that a considerable number of people, mostly in the rural areas, were finding it hard to meet their needs for daily subsistence.

In essence, the economy of Camarines Sur was mostly agriculture-based in which 29 of the 37 towns are agricultural. From



Figure 3. Map of Camarines Sur

2010 to 2013, coconut production was higher than rice production. This pattern was reversed from 2014 to 2016.

Coconut production declined beginning 2014, even if the area devoted to its production remained the same. On the other hand, increase in rice production was mainly due to the increase in area planted to rice. The area planted to rice rose from 316.8 thousand ha in 2010 to 351.1 thousand ha from 2010 to 2016.

The municipality of Pamplona in Camarines Sur (Figure 3) was chosen as one of the study sites due to the presence of rainfed farms in sloping areas and also due to high level of poverty incidence in the municipality. The *barangays* of Batang and Tampadong were lowland rainfed areas. Farming system in the two *barangays* was rice-vegetable-livestock. Rice was grown for two cropping seasons. Common vegetable crops were eggplant, okra, bitter gourd, squash, and string beans. Livestock raised were for farm use and source of income such as carabao, duck, swine, and goat.

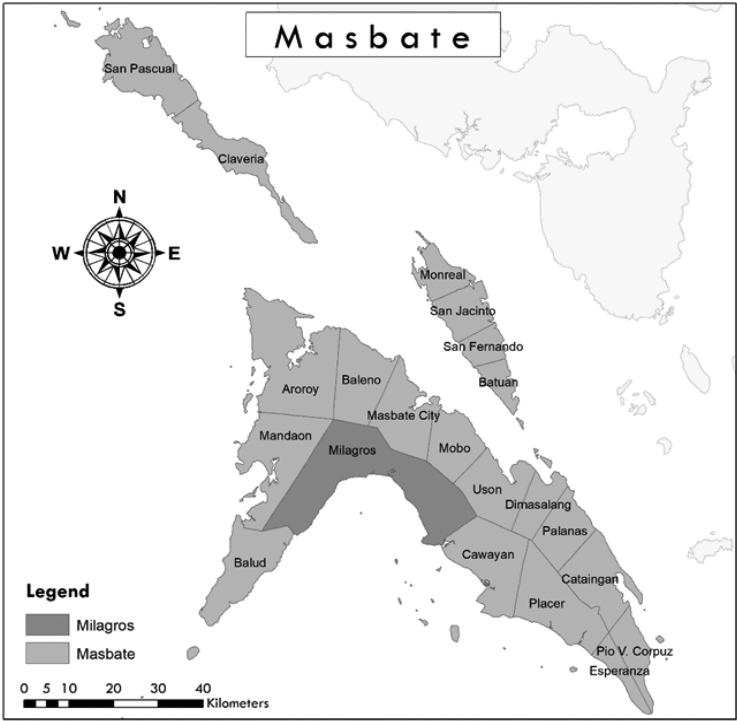


Figure 4. Map of Masbate

Upland areas of Masbate. The poverty incidence in Masbate registered at a relatively higher percentage of 40.6 percent. Looking further at the municipality of Milagros (Figure 4), the poverty incidence in 2012 was 49.6 percent - a figure that is almost half of the total population of the municipality. The high percentage of poverty incidence implies that a great percentage of the population in Milagros had income that is not enough to meet their daily needs.

Mono-cropping was the main farming system followed by respondents, and rice was the main crop. Yields were primarily allotted for consumption and were only sold if need arises or if there were excess to daily dietary needs. For the disposable income of the respondents, majority were sourced from livestock and poultry production. From 2006 to 2017, the rice production in the province was increasing. Production of rainfed rice in Masbate was relatively higher than that of irrigated rice. The average yield of a farmer, when converted to cash, however, was still below the poverty threshold.

Upland *barangays* of Matagbac, Sawmill, and San Carlos were chosen as location of the CFS. Some farmers in these *barangays* practiced rice-vegetable-livestock farming systems. Rice was the main commodity in the area and other crops such as cassava, corn, and sweet potato were also planted. Farmers also practiced vegetable production with crops such as squash, eggplant, mungbean, okra, and white squash. Farm animals and livestock raised were carabao, swine, and goat; while horses were used for transporting harvests to the lowlands.

RESULTS AND DISCUSSION

Socio-demographic Profile of CFS graduates

Above 50 percent of the respondents in both provinces were female. Mostly housewives, female farmers attended schooling more than male farmers who preferred working in their farms. Female farmers were also more patient in attending classes and listening to lectures. According to the farmer-cooperator in Sawmill, she purposely invited female farmers to participate in the CFS to engage them in a new recreational and productive activity rather than stay in their homes.

Farmer-graduates from Camarines Sur were relatively younger than those from Masbate. There were 12 high school student-participants (Grades 9 and 10) in CFS in Pamplona. These students were from the adjacent high school in *Barangay* Tampadong. The interested students joined the CFS sessions together with their adviser. They belonged to the 15-24 age bracket, comprising 26 percent of the total participants. The average age of farmer-graduates in Pamplona was 42 years. Meanwhile, 32 percent of the farmer-graduates in Milagros were in the 33-42 age range. Average age was 43.

Fifty percent of the participants in Camarines Sur reached high school, whereas most of the participants in Masbate had elementary level of schooling (38%).

The most common reason for joining the CFS was to have additional knowledge and information on farming. The farmers believed that their participation in the CFS can improve their productivity and income.

**Table 1. Socio-demographic characteristics of farmer-graduates
in Pamplona, Camarines Sur and in Milagros, Masbate, 2016**

PARAMETER	PAMPLONA, CAMARINES SUR (n=38)		PARAMETER	MILAGROS, MASBATE (n=78)	
	No.	%		No.	%
Sex					
Male	13	34.2	Male	34	43.5
Female	25	65.8	Female	44	56.4
Age (years)					
15-24	10	26.3	23-32	16	20.6
25-34	3	7.9	33-42	25	32.0
35-44	5	13.1	43-52	15	19.2
45-54	6	15.8	53-62	20	25.6
55-64	10	26.3	63-72	2	2.6
65-74	4	10.6	Mean	43	
Mean	42				
Educational attainment					
Elementary level	16	42.1	Elementary level	30	38.4
High school level	19	50.0	High school level	27	34.6
College level	2	5.2	College level	19	24.3
Postgraduate (Master's) level	1	2.6	Vocational level	2	2.5

Agricultural Delivery System and Extension Services in Camarines Sur and Masbate

The municipal agriculture office (MAO), under the local government unit, is responsible for delivering agricultural programs and extension services in the area. The municipal agriculture officer and agricultural technicians are the leading implementers of the different banner programs of the Department Agriculture (DA). Table 2 shows a comparison of the access to agricultural information and delivery system of extension services in the study areas.

Milagros has a larger land area and a bigger farm size as compared with Pamplona. However, despite a bigger area for delivery system of extension services, Pamplona has more extension technicians

Table 2. Comparison of access to agricultural information and delivery system of extension services between Camarines Sur and Masbate, 2016

ITEM	PAMPLONA, CAMARINES SUR	MILAGROS, MASBATE
Land Area	80.60 km ²	565.3 km ²
Farm Area	4,682.72 ha	54,746 ha
No. of extension technicians	6	5
Ratio of farmer to technician	1:800 for rice banner program	1:1000
Distance from agricultural extension services (from Municipal Agriculture Office to <i>barangay</i> study sites)	Batang: 1.81 km Tampadong: 4.79 km Del Rosario: 2.43 km Tambo: 0.85 km Veneracion: 2.71 km	Bacolod: 2 km Cayabon: 2.7 km Tawad: 3 km Narangasan: 5 km Capaculan: 6.7 km Matagbac: 42 km Sawmill: 45 km San Carlos: 52 km
Existing agricultural program in the area	Department of Agriculture's banner programs: rice, corn, high value crops Other programs: Philippine Rice Information System, farm business school	Department of Agriculture's banner programs: rice, corn, vegetables, cassava
Availability of expert's advice	Experts from Central Bicol State University of Agriculture and DA-Regional Field Office V	Experts from Masbate Center for Livestock Development, Dr. Emilio B. Espinosa Sr. Memorial State College of Agriculture and Technology

than Milagros. One technician attends to 800 farmers in Pamplona, while the ratio of technician to farmer in Milagros is 1:1000. Pamplona has also more DA banner programs implemented than in Milagros.

Farmers in Pamplona have easier access to agricultural information and extension services because the chosen study sites were closer to the MAO. The closest *barangay* is only 0.85 km away while in Milagros, extension providers have to travel using motor vehicles (habal-habal) to the upland *barangays*. San Carlos, the farthest *barangay* among the study areas, is 52 km away from the MAO. Technicians do this just to reach the farmers to conduct trainings and to provide expert's advice. It was the belief that agricultural information and extension services like the CFS are effective methods in the knowledge improvement and change in practices of the farmers.

Results of CFS in Pamplona, Camarines Sur

Self-assessed knowledge improvement. A comparison of the self-assessed pre- and post-test scores of participants from Pamplona revealed that not a lot of rice farmers have prior knowledge about the CFS topics. This is despite long years of experience and the knowledge accumulated through farming practices over time. There were also farmer-graduates who have attended and participated in the FFS conducted earlier in the town. The average percentage for the pre-test was 36.3 percent, which was relatively low (Table 3).

A huge difference was observed in the farmers' scores after CFS participation. The farmers' post-test scores increased in almost all the clustered topics, especially land preparation and seedling establishment, and soil nutrient and pest management.

Using the Mann-Whitney U method, with the level of significance set at 5 percent, differences between pre- and post-test scores were tested. Results showed highly significant changes in scores related to climate ($U=144.0$, $p=.000$), pest management ($U=62.00$, $p=.001$), land preparation and seedling establishment ($U=49.00$, $p=.001$), soil nutrient management ($U=25.00$, $p=.008$), and water management ($U=16.0$, $p=0.029$) and animal production ($U=16.0$, $p=0.029$). This indicates farmers' self-assessed knowledge gains from these topics after participating in the CFS. Table 3 also shows that other main topics did not exhibit statistically significant changes in the percentage of test scores.

**Table 3. Comparison of pre-test and post-test of CFS graduates,
Pamplona, Camarines Sur, 2016**

CLUSTERED TOPIC	PRE-TEST SCORE (%)	POST-TEST SCORE (%)	MANN WHITNEY U	P VALUE
Climate	31.3	64.9	144.0	.000*
Land preparation and seedling establishment	44.9	72.0	49.0	.001*
Soil nutrient management	36.2	68.8	25.0	.008*
Pest management	39.8	66.7	62.0	.001*
Water management and special topics	31.8	63.1	16.0	.029*
Organic agriculture	35.7	63.7	9.0	.100 ns
Animal production	37.0	65.0	16.0	.029*
Harvesting and post-harvest	33.8	59.4	23.0	.32 ns
Mean	36.3	65.45		

*Significant if p value is <0.05 while not significant (ns) if p value is > 0.05

Farmer graduates have significant knowledge improvement on subtopics under climate change (i.e., its causes and impact on agriculture, climate of the Philippines, basic meteorology, climate forecast, and analysis of weather effects) mainly because of its relevance to the climate hazards that farmers saw in their area. During the second year of implementation of CFS in Camarines Sur, two strong typhoons have damaged agricultural crops. The increase in self-assessed knowledge could also be attributed to the farmers' exposure to different training programs and climate fora. Hence, CFS became some sort of a review of previously acquired knowledge. Also, the results revealed that farmers possessed technical knowledge in other topics such as pest and soil nutrient management. Traditional farming practices dealing with these topics were acquired through years of experience as majority of the participants were already into farming for more than five years. Practical application and field experimentation in the techno demo farms also contributed to the self-assessed knowledge gain. During interviews,

farmers claimed that through the CFS, they have significant learnings on proper application, use, and handling of fertilizers.

Changes in farming system practices. Farmers are expected to adapt farming activities to changes in climate. Changes in farming practice such as choosing what crop and variety to plant, deciding what cultural measures to apply, and managing soil, water, and other resources were also observed (Winarto et al., 2008). Farming has been a practice in the study areas for a long time. Majority of the families in the community came from generations of farmers. Based on interviews conducted among *barangay* cooperators from the two provinces, farmers relied mainly on rice before the project. They described their farming activity as simple because they only knew about planting of rice and a few vegetables. With the project intervention, cooperators said farmers were encouraged to seek new opportunities to try new varieties of rice as well as deal with such commodities as high-value vegetables and livestock (Table 4).

Table 4. Changes in farming system practices of farmer-cooperators in Pamplona, Camarines Sur

YEAR	PARAMETER		No. (n=4)	%
	From existing practice	To change in practice		
1	Farming practice of planting rice, corn, and traditional vegetable varieties (e.g., okra, <i>ampalaya</i> or bitter gourd, squash, eggplant)	Farming practice of planting rice, corn, and high-value crops/vegetables (e.g., carrot, baguio beans, broccoli, cabbage)	2	50
2	Farming practice of planting rice, corn, and traditional vegetable varieties (e.g., okra, <i>ampalaya</i> , squash, eggplant)	Farming practice of planting rice, corn, and high-value crops/vegetables (e.g., carrot, baguio beans, broccoli, cabbage)	2	50
	Farming system of rice-vegetables	Shift to diversified cropping system of rice + vegetables + livestock	2	50
	Rice farming as sole activity for source of income	Additional source of income (e.g., livestock raising, vegetable production) and activity (e.g., backyard farming)	1	25

Others also claimed that they practiced what they learned from the CFS in their backyard gardens, and this has become a productive pastime. The cooperators enjoyed picking vegetables from their gardens instead of buying them from the market.

Results of CFS in Milagros, Masbate

Self-assessed knowledge improvement. Farmer graduates in Milagros did not know much about climate, land preparation, and seedling establishment before participating in CFS. Table 5 shows that the average pre-test score was 29.3 percent, which was lower than in Pamplona with 36 percent. The highest pre-test scores were seen in traditional farming activities and practices under the clustered topics of land preparation and seedling establishment (33.2%). The average post-test score was 71.2 percent.

Table 5. Comparison of pre-test and post-test of CFS graduates in Milagros, Masbate, 2016

CLUSTERED TOPIC	PRE-TEST SCORE (%)	POST-TEST SCORE (%)	MANN- WHITNEY U	P VALUE
Climate	46.7	68.1	121.0	.000*
Land preparation and seedling establishment	33.2	75.8	49.00	.001*
Soil nutrient management	26.4	71.9	25.00	.008*
Pest management	25.4	71.1	64.00	.000*
Water management and special topics	24.8	71.6	9.00	.100 ns
Organic agriculture	29.3	69.3	9.00	.100 ns
Animal production	25.4	69.3	16.00	.029*
Harvesting and postharvest	23.8	73.2	25.00	.008*
Mean	29.3	71.2		

*Significant if p value <0.05 while not significant (ns) if p value > 0.05

The knowledge scores showed improvement in the topics of land preparation and seedling establishment, harvesting and postharvest, soil nutrient management, and water management. The differences between pre-and post-test scores were tested at the 5 percent level of significance. Results showed that main topics on climate ($U=121.00$, $p=.000$) land preparation and seedling establishment, ($U=49.00$, $p=.001$), soil nutrient management, ($U=25.00$, $p=.008$), pest management ($U=64.00$, $p=.000$), animal production ($U=16.00$, $p=.029$), and harvesting and postharvest ($U=25.00$, $p=.008$) were significantly different.

The increase in self-assessed knowledge about climate was relevant in the area because climate hazards such as droughts and dry spells were experienced in the project sites. There were delays in the onset of rains and has affected the agricultural activities of the farmers. In the case of Milagros, topics on harvesting and postharvest showed statistically significant results. The subtopics under this cluster are proper harvesting of vegetables, postharvest handling of vegetables, roguing, harvest and postharvest technologies for rice, and yield assessment. Knowledge was obtained from the field demonstrations.

Masbate is known for cattle raising; hence, farmers here already have a high level of knowledge on animal production. Nevertheless, the differences in pre- and post-test scores still showed improved self-assessed knowledge in animal production. In terms of water management, farmers demonstrated poor knowledge on the topic because of the lack of irrigation in the area. Only a small portion of Matagbac has irrigation while the upland communities of Sawmill and San Carlos were purely rainfed. As to topics on organic agriculture, the test scores did not exhibit statistically significant differences because the farmers in Milagros prefer to use synthetic fertilizers.

In a study conducted by Mtega et al. (2016), the factors that inhibited access to agricultural knowledge among rice farmers in Tanzania included the following: limited number of demonstration plots, late delivery of information services, limited number of agricultural extension agents, and poor information and communication technologies. These same factors were also observed in Milagros, Masbate, which could have contributed to the low pre-test scores of the farmer-graduates.

Farmer-graduates in the upland areas of Milagros were very appreciative of and receptive toward the project. The positive attitude of the farmers also contributed to the high knowledge gain as reflected by their post-test scores.

Changes in farming system practices. Changes in farming techniques by farmer-cooperators were observed in Milagros. According to one agricultural technologist and *barangay* cooperator, the introduction of *Palayamanan* in the area has changed some traditional practices of the farmers. One of the cooperators described the project as being “high-tech,” or more advanced than the other technologies practiced in their communities.

Farmers said that they are now very conscious of the importance of following the proper procedures and techniques in farming. The examples given were the proper propagation of *ampalaya* (bitter gourd), proper application of fertilizers using the prescribed amount, and following plot measurements in crop planting (Table 6). Another change in practice lessened the number of days devoted to land preparation because farmers now follow a prescribed schedule. A cooperator also reported trying a new rice variety, and has planted that same variety for the duration of the project. Aside from these, farming activities leveled up because farmers are now able to plant high-value crops aside from the usual varieties of *pinakbet* (a native dish that is a mixture of vegetables such as beans, squash, okra, and *ampalaya*). They have become more knowledgeable about animal production and breeding, thus opening more opportunities for potential income earning activities.

According to one farmer-cooperator, farmers’ habits, hobbies, and activities also changed. Before, the farmers were into gambling. When the CFS sessions started, their gambling activities were reduced, according to a community member.

Comparative Analysis Between Masbate and Camarines Sur Farmer’s Self-assessed Knowledge Improvement

Comparing the knowledge improvement of farmer-graduates from both municipalities validates that lowland rain-fed areas are more information rich than those in upland municipalities. Information-rich areas have smaller value addition since they have more and easier access to agricultural information and extension system. On the other hand, upland areas are considered information poor because of challenges in delivery system of extension services and inadequate channels of information dissemination.

Table 6. Changes in farming system practices of farmer cooperators in Milagros, Masbate

YEAR	PARAMETER		No. (n=5)	%
	From existing practice	To change in practice		
1	Farming practice of planting rice, corn, and traditional vegetable varieties (e.g., okra, <i>ampalaya</i> or bitter gourd, squash, eggplant)	Farming practice of planting rice, corn, and high-value crops/vegetables (e.g., carrot, baguio beans, broccoli, cabbage)	2	40
2	Farming practice of planting rice, corn, and traditional vegetable varieties (e.g., okra, <i>ampalaya</i> , squash, eggplant)	Farming practice of planting rice, corn, and high-value crops/vegetables (e.g., carrot, baguio beans, broccoli, cabbage)	3	60
	Farming system of rice-vegetables	Shift to diversified cropping system of rice + vegetables + livestock	3	60
	Land preparation practices only include cleaning and planting in the farm	Lessen number of days for land preparation and more systematic planting techniques	1	20
	Use of fertilizers as a crop management	Proper application of fertilizers following the prescribed amount	2	40
	Traditional propagation of bitter gourd	Propagation of bitter gourd using <i>ampalaya</i> net technology and proper trimming of leaves	2	40
	Farmers are into vices such as gambling	Acquired new activity such as backyard farming	1	20

For both provinces, the self-assessed knowledge improvement of farmer-graduates varied, depending on the component, but there were similarities in terms of significant changes in the pre- and post-test scores, specifically on the topics of climate, land preparation and seedling establishment, soil nutrient management, and pest management. Table 7 indicates that, through CFS, the level of self-assessed knowledge of farmer-graduates in Pamplona and Milagros was raised. This increase could be attributed to the lectures delivered by the resource persons and experts during the CFS. The use of handouts as supplement to the learning modules also raised the farmers' retention of knowledge. Farmers' practical demonstration and application of lessons learned, especially in land preparation and seedling establishment up to harvesting, through a techno demo farm also facilitated learning.

Mean differences between the pre-and post-test scores were obtained by subtracting farmer scores in Camarines Sur from those in Masbate. The differences in self-assessed knowledge scores of Milagros farmers were relatively higher than those of Pamplona farmers possibly because access to agricultural information was relatively easier in lowland Pamplona than in the upland municipality of Milagros where access to transportation and communication is a challenge. More farmers attended CFS in Milagros because they were very eager and more motivated to learn. Despite the poor facilities in the area, farmers in Milagros were appreciative of the agricultural extension services. They have been hungry for information and farming technologies, which, in turn, changed their attitudes toward adopting better farming practice.

CONCLUSIONS AND RECOMMENDATION

The analysis showed that farmer-graduates in Pamplona and Milagros have improved self-assessed knowledge as exhibited by the highly significant differences in their pre- and post-test scores. However, there were also topics discussed during the CFS that did not result in significant self-assessed knowledge gains. Some of these topics were quite new to them while others are not applicable to their farming activities and practices. In the future, other useful topics for the curriculum are marketing and farm planning and budgeting, the knowledge gains for which would contribute to the farmers becoming entrepreneurs.

Table 7. Comparison of pre- and post-test scores of CFS farmer graduates in Pamplona, Camarines Sur and Milagros, Masbate

CLUSTERED TOPIC	PRE-TEST				POST-TEST			
	Pamplona, Camarines Sur (%)	Milagros, Masbate (%)	Mean Difference	P value	Pamplona, Camarines Sur (%)	Pamplona, Masbate (%)	Mean Difference	P value
Climate	31.3	46.7	-3.3	.000*	64.9	68.1	-11.4	.000*
Land preparation and seedling establishment	44.9	33.2	-3.7	.000*	72.0	75.8	-12.7	.000*
Soil nutrient management	36.2	26.4	-2.8	.000*	68.8	71.9	-12.0	.000*
Pest management	39.8	25.4	-1.9	.016*	66.7	71.1	-12.0	.000*
Water management and special topics	31.8	24.8	-12.5	.045*	63.1	71.6	-12.2	.001*
Organic agriculture	35.7	29.3	-3.7	.031*	63.7	69.3	-12.0	.001*
Animal production	37.0	25.4	-3.3	.002*	65.0	69.3	-10.4	.022*
Harvesting and postharvest	33.8	23.8	-2.4	.007*	59.4	73.2	-13.8	.000*

*Significant if p value <0.05 while not significant (ns) if p value > 0.05

Farm practices of some farmer-cooperators also changed, resulting in more advanced farm technologies being adopted in the area. Examples included the more systematic and conscious approach in land preparation. The use of traditional crops has also changed as farmers tried growing other rice varieties and vegetable crops. The participants also engaged in new recreational activities such as backyard farming, which became a supplemental source of income.

Further research is needed. One recommendation is the conduct of a similar study that investigates other factors or variables that could affect farmers' participation in the CFS. For instance, the decision-making skills of farmers with respect to the adoption of a technology such as the *Palayamanan* could be investigated. Other possible research topics are identifying the factors that influence knowledge gains and change in practices of CFS farmer-graduates. The information transfer from CFS graduates to co-farmers or members of the family or community could also be studied.

The CFS as a mode of extension delivery in rainfed areas is still in its infancy stage. More funds can be poured into the strengthening of the curriculum as well as capacitating the agricultural technicians so they can become competent resource persons. Rainfed areas are not as accessible to the extension system compared to irrigated areas, but incentivizing the CFS facilitators and resource persons can bring more technology information to farmers in these marginalized areas.

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