

Production and Utilization of Bio-Organic Fertilizer for Enhanced Rice Productivity in Selected Villages of Biliran, Philippines

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Abstract

A Community-based Participatory Action Research (CPAR) project was initiated to enhance the productivity of rice farmers in two selected villages of Biliran, Philippines. Bio-organic fertilizer production using the rice straw as the main biomass material was undertaken in the project sites. Produced bio-organic fertilizer was utilized in the rice farm as the nutrient source in combination with commercial inorganic fertilizer. Additional income was realized by the farmer-cooperators who ventured into bio-organic fertilizer production. Likewise, increased palay production and net income was observed during the CPAR project. The activities had resulted to monetary gains of the farmer-cooperators. CPAR was able also to capacitate and empower the project beneficiaries and implementers.

Keywords: participatory development, organic fertilizer production, farm productivity

Introduction

The Philippine government has given priority attention to food production program to alleviate poverty and attain food security. Various initiatives have been done by different government agencies to support food sufficiency and poverty alleviation programs. Interventions using appropriate technologies that would enhance food production have been introduced. Among these interventions is the promotion of the use of bio-organic fertilizer.

The use of bio-organic fertilizer has been gaining wide attention and popularity nowadays because of the increasing demand for organically grown produce (Rosen and Allan, 2007) and the depletion of soil fertility caused by continuous use of chemical fertilizers (Das et al., 1991). Several studies reveal the benefits of using bio-organic fertilizer. For instance, Wu et al., (2009) found out that bio-organic fertilizer containing combinations of antagonistic microorganisms controlled the wilt disease of watermelon. Similar result was observed by Qiu et al., (2012) in cucumber plants. Huang et al.,

(2011) revealed that bio-organic fertilizer could stabilize damping-off disease in cucumber seedlings. Luo et al., (2008) found out that bio-organic fertilizer not only promote the growth of cassava but also enhance the physical, chemical and biological characteristics of the soil. It is bio-degradable and hence does not cause environmental pollution as they become valuable raw materials for enhancing soil fertility (Nagavallema, et al., 2004).

In Biliran as with other rice farming communities, efforts are underway to encourage farmers to produce bio-organic fertilizers. Currently, the province is enjoying sufficiency in rice. The annual average palay production in about 14,678 hectares irrigated rice field for the past 10 years (2004-2013) is about 66,155 metric tons (Philippine Statistics Authority [PSA], 2014). However, given the increasing population, various sectors are alarmed as to sustainability of rice production. The need therefore, to increase rice productivity in the province has been suggested.

Community-based Participatory Action Research (CPAR) is one of the approaches to

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introduce a mature farming technology and verify its technical and economic feasibility for specific micro agro-climatic environments within the province/municipality (Bureau of Agricultural Research [BAR], 2012). CPAR encouraged active involvement and participation of the community in the project activities and technology verification studies. In this project, on-farm production and utilization of bio-organic fertilizer were introduced in the two rice-producing villages of Biliran using the CPAR approach. The two villages were non-users of organic fertilizer, a general practice of rice farmers in Biliran.

This paper describes the experiences and project outcomes in leading the rice farmers in the production and utilization of bio-organic fertilizer using the CPAR strategies.

Methodology

Research Setting

The project was undertaken in the two adjacent barangays Hugpa and Canila, Biliran, Biliran Province, Philippines (11°30'8.6"N 128°28' 38.9 E). With a total lowland irrigated rice area of about 220 hectares, rice farming is the major livelihood and source of income of the people in the two barangays. Hugpa and Canila were selected as CPAR project sites considering accessibility of the two barangays to different modes of transportation and their suitability as to the CPAR criteria.

Project Participants

The participants were chosen based on their willingness to participate and support the CPAR project. Twenty-four farmers having one or more hectares of tilled rice land were identified as farmer-cooperators of the project. The total area initially devoted by farmer-cooperators to the project is 14.09 hectares of rice farms.

Of this farmer participants, 15 owned their tilled rice land while the rest are just tenants.

Generally, majority of the participants have a monthly income range of Php 1,000.00 – Php 10,000.00 which reflect the general characteristics of the farming families in barangays Hugpa and Canila. Moreover, majority of them have attended secondary level of education.

Development of Farmers' Skills on Organic Fertilizer Production

Prior to the start of organic fertilizer production, series of on-farm trainings and seminars were undertaken to develop the skills and capability of the farmer-cooperators. The participants were also exposed to other organic fertilizer production sites in the region through field trips to let them observe the different processes and equipment used and personally acquire firsthand information from the organic fertilizer producers.

Production of Organic Fertilizer

Farmer-cooperators established and constructed the organic fertilizer production shed in each barangay sites to facilitate easy production and safe keeping of the products produced. Counterpart from the farmer cooperators were labor and some construction materials. The rest of the expenses and materials were shouldered by the implementing agency.

The CPAR project introduced organic fertilizer production using Bio-Plus Activator (BPA). The composition and corresponding amount (% by weight) of raw materials used in the production of organic fertilizer were as follow: 55% plant biomass, 35% animal manure or chicken dung, 10% carbonized rice hull, and 5% BPA. Production procedure is presented in Table 1. Full decomposition of raw materials was determined using the guidelines provided by Cuevas (1997) as follows: 1) the temperature in all parts of the pile drops to 33-35°C, or approximately air temperature, 2) the different materials in the substrate are no longer recognizable, 3) the

Table 1: *Organic fertilizer production procedure.*

Steps	Procedure
1	Dividing the organic materials into a manageable number of sets
2	Piling of the organic materials one after the other
3	Moistening the dry organic material up to a maximum of 80% moisture level before broadcasting the activator
4	Steps 2 and 3 are repeated until all the organic materials are completely piled
5	Mixing of the pile and followed immediately by completely covering it with a canvas or equivalent material
6	Turning again of the pile after 2-3 days and every 2-3 days thereafter until all organic materials are fully decomposed
7	Curing/sweetening of the decomposed materials for 8-10 days. The process was done by completely removing the pile cover and continuously turning the decomposed materials everyday to further lower the temperature and reduce the moisture content
8	Sieving of the compost using a 1/8" wire mesh. This is followed immediately by bagging

compost is dark brown to black, and looks like soil, and 4) the ripe compost does not emit a foul odor. When the pile was already fully decomposed, sweetening and curing followed until the moisture content reduced to not more than 20%.

Rice straw generated from the field after harvest was utilized as the main biomass material in the production of organic fertilizer. Utilizing rice straw is a strategy initiated by the project to minimize or eliminate the burning practice in the field after harvest which is being done by most of the farmers in the project area.

Results and Discussion

Bio-organic Fertilizer Production

Table 2 shows the organic fertilizer production and income in the 2 production sites during the two- year period (May 2010 – April 2012). The volume of production primarily depends on the availability of raw materials in the locality. Since rice straw was utilized as the main biomass material, peak production occurs during after harvest time. The data reveals that the farmer-cooperators were able

to generate income from organic fertilizer production. The financial benefit of the activity has encouraged the farmer-cooperators to produce more organic fertilizer during the succeeding year. It was observed that the practice of burning the rice straw in the field after harvest was minimized because the farmers utilized them for organic fertilizer production.

Application of Bio-Organic Fertilizer

Each CPAR farmer-cooperator devoted more or less 1/2 hectare of their ricefield for the project and applied the locally produced organic fertilizer. A total of 14.09 hectares (8.31 ha. in Hugpa and 5.78 ha. in Canila) was initially devoted by the farmers for the application of organic fertilizer. The bio-organic fertilizer produced by the project was used as fertilizer in the project area which were sold at Php 8.00/kg to the users and farmer-cooperators.

Tables 3 and 4 show the comparative results of the palay production as well as the income before and during CPAR for four cropping seasons at the two production sites

Table 2: *Bio-organic fertilizer production in the two production sites.*

Production Period	Parameters	Production Sites		Total
		Canila	Hugpa	
Year 1 (May 2010 to April 2011)				
	Qty. Produced (kg)	4,985.00	6,705.00	11,690.00
	Gross Income (Php)	39,880.00	40,680.00	80,560.00
	Total Expenses (Php)	22,480.00	29,932.00	52,412.00
	Net Income (Php)	17,400.00	11,108.00	28,508.00
Year 2 (May 2011 to April 2012)				
	Qty. Produced (kg)	6,430.00	9,150.00	15,580.00
	Gross Income (Php)	51,440.00	73,200.00	124,640.00
	Total Expenses (Php)	32,642.00	42,708.00	75,350.00
	Net Income (Php)	18,798.00	30,492.00	49,290.00
Annual Average				
	Qty. Produced (kg)	5,707.50	7,927.50	13,635.00
	Gross Income (Php)	45,660.00	56,940.00	102,600.00
	Total Expenses (Php)	27,561.00	36,320.00	63,881.00
	Net Income (Php)	18,099.00	20,800.00	38,899.00

which were applied with organic fertilizers. An increase in the average yield of palay accompanied with the decrease in the average expenses which resulted in higher net income can be noted during the CPAR project. Proper nutrient management adopted by the farmer-cooperators could have attributed to the increase in palay yield during CPAR. Moreover, the utilization of locally produced organic fertilizer which limited the use of commercially available inorganic fertilizer had reduced the expenses of the farmers.

The positive outcome of the project has caused increase on the number of farmers adopting the technology. The number of farmer-cooperators increased from 14 to 19 and 10 to 12 in Brgys. Hugpa and Canila, respectively. Moreover, there are 17 non-CPAR members adopting the technology (10 males and 7 females) coming from the two barangays and from the adjacent barangays. Consequently, there was also an increase in the total rice area of farmer cooperators from 0.5 hectare to 0.75-1.0

hectare applied with organic fertilizer. The total size of production area dedicated by the non-CPAR farmers is 8.5 hectares. To date, more than 50 hectares of rice farm in Canila, Hugpa and the neighboring barangays are being applied with organic fertilizer by the rice farmers. Moreover, the barangay has maintained the enforcement of a barangay ordinance prohibiting the burning of rice straw/hays and providing penalty thereof.

Social Benefits of the CPAR Project. Aside from the monetary gains derived from the production and utilization of organic fertilizer, the CPAR project was able to capacitate and empower the project stakeholders. As shown in Table 5, the project has strengthened the different stakeholders in terms of management and resource generation. The association has already established a close tie-up with the LGU, the academe and the government's line agencies such as the Department of Agriculture. Through the CPAR project, the farmer's association was able to avail different grants from LGU and the Department of

Table 3: *Rice production and income (Brgy. Canila).*

Parameters	Before CPAR		During CPAR			
	Wet Season	Dry Season	Wet	Dry	Wet	Dry
			Season	Season	Season	Season
			(Jun-Oct)	(Jan-May)	(Jun-Oct)	(Jan-Apr)
			2010	2011	2011	2012
Ave. Yield (tons/ha)	4.31	4.78	5.05	5.6	5.6	5.4
Gross Income (Php)	56,000.00	62,140.00	65,650.00	72,800.00	72,445.45	75,558.00
Expenses (Php)	38,070.00	40,500.00	35,890.00	30,807.00	36,512.00	36,780.00
Net Income (Php)	17,930.00	21,640.00	29,760.00	41,993.00	35,933.00	38,778.00
MBCR			1.59	2.24	1.92	2.06

Table 4: *Rice production and income (Brgy. Hugpa).*

Parameters	Before CPAR		During CPAR			
	Wet Season	Dry Season	First	Second	Third	Fourth
			Cropping	Cropping	Cropping	Cropping
Ave. Yield (tons/ha)	4.31	4.78	5.12	5.57	6.9	5.86
Gross Income (Php)	56,000.00	62,140.00	66,560.00	73,445.00	89,700.00	82,010.53
Expenses (Php)	38,070.00	40,500.00	37,710.00	29,526.44	39,665.86	36,350.86
Net Income (Php)	17,930.00	21,640.00	28,940.00	42,918.36	50,034.14	45,660.53
MBCR			1.54	2.3	2.67	2.44

Table 5: *Benefits derived from CPAR projects by the different stakeholders.*

Project Stakeholders	Benefits/ Project Outcomes
Institution	Enhanced the capability of the project members and CPAR team in terms of project management, technical skills, community organizing, team working among the farmers and the CPAR team implementers.
Farmer- Cooperators	Gained knowledge and developed their technical skills on organic fertilizer production and its utilization to rice productivity. It increased their farm production, decreases farm inputs, increased income, and less debts thus improves their quality of life. Developed team building among members, unity, cooperation and synchronization of farming activities so that the occurrence of pest and diseases would be decreased or minimized. Gained knowledge and awareness on the proper utilization of farm waste products and awareness on the healthful and ecological beneficial micro-organism on the benefits of organic farming. Thus, there was an enforcement of barangay resolution on the ordinance prohibiting the burning of rice straw/hays resulting in minimized to zero incidence of burning rice straws.

Agriculture to enhance their rice production activities. Just recently, the Canila Agrarian Reform Beneficiaries' Multipurpose Cooperative with the facilitation of the project implementers was able to avail a 6-tons capacity mechanical flatbed palay dryer from the Department of Agriculture. They are now in the process also of availing a palay thresher grant from the Department of Agriculture.

The concerted effort of the various stakeholders of the project has resulted in the attainment of the project's objectives. The project implementers have been responsible in mobilizing the community to actively participate the project activities, crafting and implementing the necessary policies and ordinance to promote production and utilization of organic fertilizer, and provision of necessary logistic support in the capability-building activities.

Conclusion

Organic fertilizer production is an agri-venture that would help farmers and their organization generate additional income. The application of organic fertilizer to rice farm coupled with appropriate nutrient management practices had resulted to higher yield and net income in palay production. Empowerment of the rice farmers was attained through the CPAR strategy.

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