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PANGASINAN STATE UNIVERSITY ORGANIC FERTILIZER PRODUCTION (PSU-OFPP) PROJECT EXTENSION STRATEGIES AND INITIATIVES, PANGASINAN, PHILIPPINES

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ABSTRACT

Pangasinan State University, as one of the academic institutions in the country has critical roles to play in countryside development. This is consistent with the university mission which states that "The Pangasinan State University through instruction, research, extension and production, commits to develop highly principled, morally upright, innovative and competent individuals capable of meeting the needs of industry, public sector and civil society. One of the banner projects is the Organic Fertilizer Production Project (OFPP) which aimed primarily to develop technologies and promote the utilization of organic fertilizer through different techno-transfer strategies and initiatives to attain sustainability in agriculture. The paper showcases the extension strategies and initiatives of Organic Fertilizer Production Technology (OFPT) of the Pangasinan State University which has been generated for the last 12 years. The technology refers to the organic fertilizer which is promoted in collaboration with LGUs and other stakeholders for utilization and adoption among farmers and other interested individuals. It discusses the package of technology on organic fertilizer production, the different components to effect desired development outcomes for the rural communities and people. There were five major approaches used in the development and promotion of the technology. These involved (1) capability building/training of farmer-clienteles; (2) establishment of organic fertilizer production plants and assistance to LGUs Material Recovery Facility (MRFs); (3) techno-demo component of the project were undertaken to showcase the effect of PSU organic fertilizer technology, likewise, PSU organic fertilizer was used in the university's crop production activities; (4) techno-demo strategies, trainings and actual demonstrations were conducted and distribution of IEC materials in collaboration with cooperating agencies made possible through memoranda of agreements; (5) monitoring and evaluation on trained farmer cooperatives were undertaken to ensure optimum production and utilization of the technology; and integration of Solar Photovoltaic Technology for irrigation of agricultural crops. The results of the dissemination, promotion and utilization of the PSU organic fertilizer production technology in Pangasinan conducted from CY 2000-to present show (1) equipped farmers and other clienteles with the skills and knowledge on low-cost and adaptable organic fertilizer production technology; (2) established organic fertilizer production plants and assisted LGUs in the production of organic fertilizer using their acquired state-of-the-art equipment; (3) promoted the utilization and adoption of the OFPT thru technology techno-demo and development, production and distribution of IEC materials; (4) increased number of farmers adopting the technology; (5) linkages with other agencies were strengthened; and 6) solar photovoltaic technology was showcased as source of irrigation of farmer-adopters. It is therefore recommended to: (1) closely monitor and evaluate the performance of trained farmers; (2) intensify the conduct techno-demo at farmers' farms; and, 3) licensing of the product.

INTRODUCTION

Through the years, the enabling policies towards the promotion and development of organic farming/agriculture has become more coherent and integrated in a framework, hence, the areas to be organically farmed and market of organic products are expected to grow at a rapid pace. Technology has supported intensive agriculture for increased production. However, expansion and intensification of agriculture have brought about some negative impacts on human health and the environment.

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The harmful effects on the environment and on human beings of heavy and improper use of chemical fertilizer are becoming more evident. Further, the fossil fuels used in the production of nitrogen fertilizer are becoming scarcer, at the same time; the demand for food is going up as population increases. Hence, it became imperative to seek for alternative methods of farming that can address the problem of food safety and environmental degradation. According to FAO (2003) one of the methods that is respectful of the environment from the production stages through handling and processing is organic agriculture (OA). Organic agriculture has been defined by the National Organic Standards Board of the USA (1996) as "an ecological production management system that promotes and enhances biodiversity, biological cycles and soil biological activity. It is based on minimal use of off-farm inputs and on management practices that restore, maintain and enhance ecological

harmony". Fertilizer has become a major input in crop production around the world. Farmers, since the inception of the food production programs of the government have been more and more dependent on the use of chemical fertilizer. As its use has grown, the traditional use of organic materials such as farm yard manure and green manure crops have been increasingly neglected. Therefore, a need for more practical way of combating the problem is very much necessary, thus interest in sustainable farming – through the use of renewable resources available is growing. Such a system maintains soil fertility as far as possible by the biological means – the use of organic fertilizer from crop and animal wastes – and combining this with moderate amounts of chemical fertilizer. Researches had shown such combinations to be more effective than any single source in improving soil quality and nutrient use efficiency and thus, yield. Moreover, this system is also more environmentally sound than one that relies solely on chemical fertilizers. Moreover, organic-based agriculture, on the other hand, using the beneficial microorganisms (BMs) for bio-fermentation is steadily gaining recognition not only in the Philippines but in other countries as well.

The increasing popularity of using organic fertilizer can be attributed to the following reasons: a) rapid increase in the price of synthetic petroleum-based chemical fertilizers, b) growing awareness among consumers on the benefits of organically produced product, c) adverse effects of chemical input in soil fertility, and d) decreasing trends in the production per hectare which is attributed by researchers on soil acidity and depletion of inherent soil fertility which is further explained and attributed to the high levels of chemical fertilization. Pangasinan State University, as one of the academic institutions in the country has critical roles to play in countryside development. This is consistent with the university mission which states that "*The Pangasinan State University will provide better service in the technical and professional training in the arts, sciences, humanities, and in the conduct of scientific research and technological studies and community service* (P.D. No. 1497)". One of the banner projects is the Organic Fertilizer Production Project (OFPP) which aimed primarily to develop technologies and promote the utilization of organic fertilizer through different techno-transfer strategies and initiatives to attain sustainability in agriculture. Generally, this project aims to promote the utilization and adoption of the PSU-Organic Fertilizer Production Technology (OFPT) among farmers and other stakeholders in all crop production activities with the end goal of obtaining sustainable agricultural production.

METHODOLOGY

The following methodologies were employed to attain the desired outputs of this development project: The project is a private-public partnership approach. Another best practice sustainability strategy in implementing community-based studies in the rural areas is participatory approach. Concerned stakeholders will have a deeper sense of ownership over the project. Other best practice approaches will be integrated into the Project as they fit. Participating stakeholders include but not limited to government (local and national), private sector, civil society, financing entity, and the beneficiary community. Immersion and rapid rural appraisal model of gathering relevant, reliable and appropriate data was considered in the project, as much as possible. Relevant, effective, and affordable interventions will be developed through valid consultations without losing focus on the organic farming issues and concerns. The techno ware, info ware, human ware, and organ ware components of the technology will be addressed in the project so that sustainability issue is addressed as early as the conception of the project. Capacity building activities for identified local stakeholders will be done through full-hands-on-onsite-skills training approach. Train and visit (T&V) model will also be used in the sustainability aspect of the project.

RESULTS AND DISCUSSION

The PSU Organic Fertilizer Production Project is one of the development projects of the university that is now in full swing which aims to promote the adoption and utilization of organic fertilizer to activate soil microorganisms, consequently, increasing the availability of nutrients that plants feed on and at the same time improves soil properties. Initially, the purpose of the project are: 1) to establish a potential source of organic fertilizer for farmers, cooperatives, entrepreneurs, as well as, the University and other interested groups; and, 2) to establish a collaboration between farmers' organization, LGUs, NGOs, and University in terms of the transfer of organic fertilizer technology. The project started its operation on May 2, 2000 at PSU Sta. Maria using the vacant room of the Pangasinan Post-Harvest Handling and Processing Center (PPHPC) as the laboratory in producing *Trichoderma* CFA.

The former PSU President, Dr. Rodolfo V. Asanion, recognizing the viability of the project in terms of its contribution to the trilogy functions of the university, gave his all out support. Thus, in the late 2001 the project finally settled to a permanent site at the orchard area of the college with the construction of the laboratory stockroom, storage area and mixing plant capable of processing 1,000 bags per cropping on March 6, 2002 with a total cost of P623, 047.00. Initially, the project produced *Trichoderma* (*Trichoderma harzianum*) Compost Fungus Activator (CFA) as a cellulose decomposer for organic fertilizer production but later uses the indigenous beneficial microorganisms (IBMs) as decomposer of the project. The finished product of PSU Organic Fertilizer have been regularly subjected for analysis every after production cycle to ensure the quality of the product. The N-P-K contents ranges from 1.07 - 3.30; 1.0 to 2.24; 4.41 - 5.07, respectively. The product has an MC equal to 25 percent and pH of 7.02. The product is devoid of foul odor and has a processing temperature of more or less 65^0C, which guarantees the elimination of weeds, including pathogens.

The indigenous beneficial microorganisms inoculants being used as decomposer by the project holds great promise including its effectiveness in improving production performance, odor control, waste management, sanitation, and organic fertilizer production. In a study conducted by Della (2007) showed that it contained live beneficial microorganisms with predominant population of nitrifying bacteria. Moreover, as far as the structure and characteristics is concerned, it is rod-shaped, non-motile classified as endospore-forming, gram-positive rod under genus Clostridium and round-shaped, non-motile classified as nitrifying bacteria of family Nitrobacteraceae of genus II Nitrococcus. Aside from being low cost, it is being produced locally using indigenous materials.

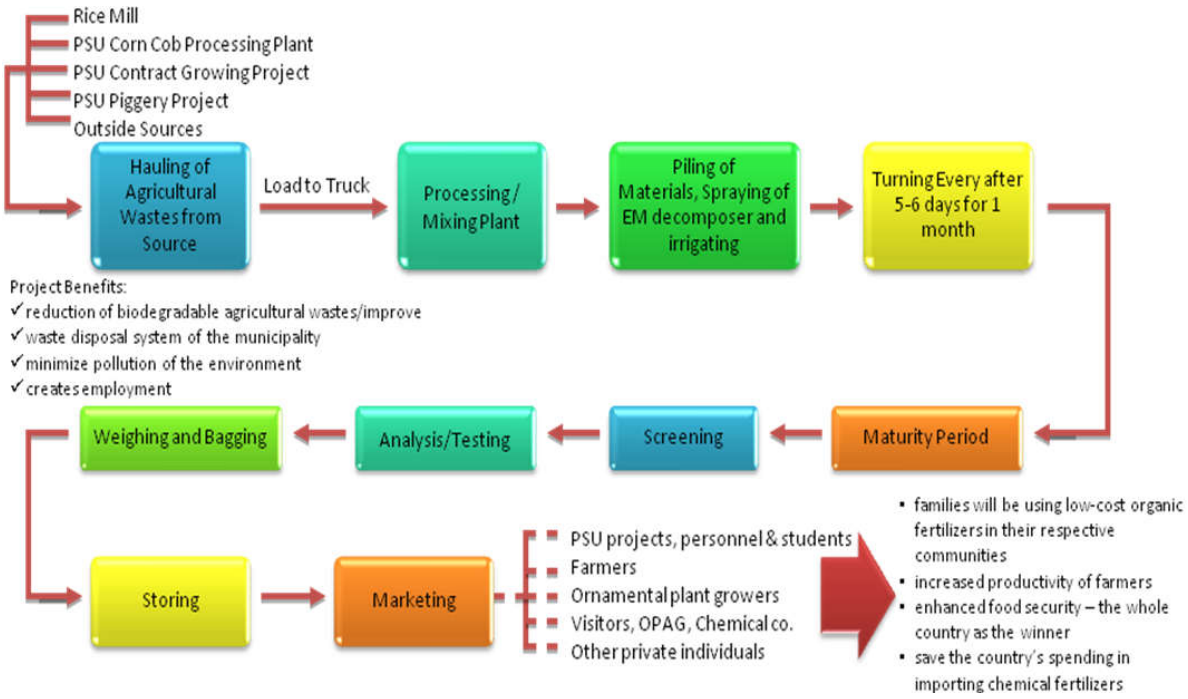

Figure 2. Project Flow

Table 1. Trainings, seminars, briefings, and demonstrations conducted on the OFP Technology in Pangasinan CY 2000-2010

A. LGU SWM-OFP				
1. LGU-Asingan				
11. OFPT	2008	Brgy. Prado, Umingan, Pang.	Brgy. Officials & members	40
12. OFPT	2008	Graduate Students PSU GS	Dynamics of Rural Development students	30
13. OFPT	2010	PSU OFPP Sta. Maria, Pangasinan	LGU-DA Technicians & farmers	50
B. LGU/POs/GOs, Livelihood Projects				
13. Natividad, Pangasinan	2009	Office of the MAO, ATs, farmers	Mayor, LGU-DA, Waste Management Officials	75
C. Joint Regional IRR Consultation on Organic Agriculture Act of 2010 (RA 10068)				
1. PSU Lingayen, Pangasinan	2010	PSU Convention Center	OA Officers and Members for Ilocos, Cagayan Valley, Central Luzon and Cordillera Regions	120
2. DA-BSWM	2010	BSWM-Conference Room	OA Officers and Members for Luzon, Visaya & Mindanao OA Advocates	450

Table 2. Techno-Demo Yield vs. Farmer's Practice Yield

	Area (m^2)	Yield (Number of Bags)		No. of kilos (Dry)
		Wet	Dry	
Techno-Demo	1000	8.35	7	347
Farmer's Practice	1000	7.84	5.54	293.36
Difference		0.51	1.46	53.64

Table 3. Gathered data from sample plants in OA and farmer's practice fields

Parameters	Organic Agriculture	Farmer's Practice
No. of plants	100	100
Weight of stover	23.25 kilos	26.50 kilos
Weight of corn in-cob	19.50 kilos	26.50 kilos
Weight of grains (fresh)	14.20 kilos	19.50 kilos
Weight of cob (fresh)	4.80 kilos	6.25 kilos
Weight of grains (dry)	11.0 kilos	15.45 kilos
No. of ears affected by corn borer	6	8
Percent of infestation	1-5%	1-7%

The project has a great potential in helping agriculture attain sustainability, not only in terms of crop yields, but also in terms of protecting Mother Earth and conserving soil fertility.

The PSU-OFPP utilizes its own agricultural wastes produced in the different agricultural projects of the University as well as outside sources in the production of organic fertilizer. Figure 2 shows the flow of activities in the project.

Table 4. Yield in terms of the number of bags/kilos in OA and farmer's practice

Technology	Yield (No. of bags/kilos)	Price per kilo	Amount
Organic Agriculture	5 - 256.00	11.50	2,944.00
Farmer's Practice	13 - 811.45	11.50	9,331.60

Table 5. Production and income of the PSU-OFPP (2001-2008)

ITEMS	2001	2002	2003	2004	2005	2007	2008
7,500	39,000	58,080	33,000	15,000	37,500	36,000	
(50)	(260)	(400)	(220)	(100)	(250)	(240)	
4,550	16,900	33,500	14,080	9,666	18,855	20,210	
1,700	4,800	7,100	2,600	2,200	4,680	5,080	
(17)	(25)	(44)	(24)	(20)	(25)	(29)	
2. Material Inputs:	2,850	12,100	26,400	11,480	7,466	14,175	15,050
a. Raw Materials	-	48,000	12,000	4,800	4,500	5,400	8,800
b. Fuel and Gasoline	1,850	3,200	5,000	2,850	1,000	4,575	2,700
c. Supplies	500	2,600	7,400	3,080	1,200	3,000	2,800
d. Food	500	1,500	2,000	750	766	1,200	750
B. Overhead Expenses	1,000	1,000	1,000	1,000	1,000	100	100
TOTAL EXPENSES (P)	5,550	17,900	34,500	15,080	10,666	19,855	21,210
III. Net Income (P)	1,950	21,100	23,580	17,920	4,334	17,645	14,790
IV. Return Above Variable Costs (P)	2,950	22,100	24,580	18,920	5,334	18,645	15,790
V. Return on Total Expenses (%)	35.14	117.90	68.35	118.83	40.63	18,645	15,790
VI. Average Production Cost (P/bag)	111	68.85	86.25	68.54	106.66	79.42	88.40
VII. Breakeven Production (bag)	37	119.33	230	100.53	71.11	132.37	141.40

Note:
- Labor expense includes hauling, piling, irrigation turning / mixing which rate ranges from P100 to P250 per manday per production cycle.
- Material inputs include chicken manure (CM), pig manure (PM), processed corn cob (PCC), sawdust, rice hull coal, and PSU-IBMs decomposer.
- Fuel and gasoline for hauling of raw materials and irrigation.
- Supplies include sacks, plastic liners, and plastic twine.
- Food incurred during operation.
- Overhead expenses include land & warehouse rental, & interest on capital set at P1000/prod'n cycle.

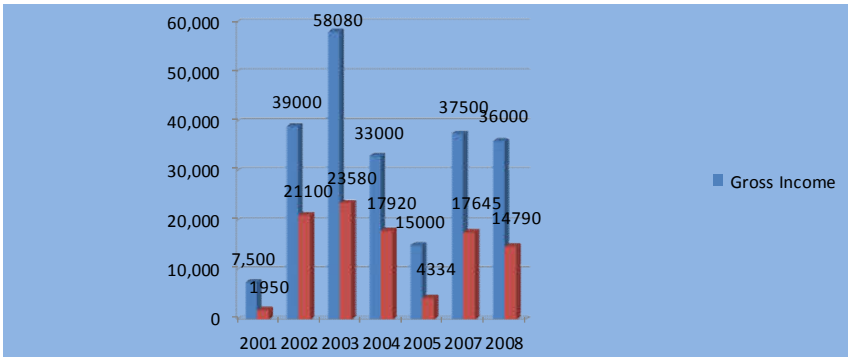

Figure 4. Gross Income and Net Income Generated by PSU-OFPP from organic fertilizer production (2001-2008)

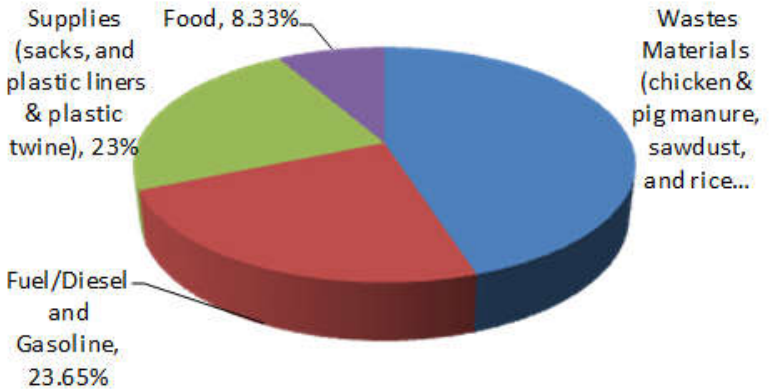

Figure 5. Additional Income Generated by the different agro-industrial wastes owners provided by the PSU-OFP Technology

The PSU-OFPP Technology

Below is the technology of producing PSU organic fertilizer, using its own locally produced indigenous beneficial micro-organism as decomposer available at very affordable price as well as people and environment-friendly.

Materials Needed

- Raw Materials: a) animal wastes (pig and chicken manure), 43%; b) crop waste (sawdust / processed corn cob), 22%; c) rice hull coal, 11%; c) PSU-IBMs decomposer, 4%; and, e) water, 20%.
- Materials / Equipment; a) weighing balance; b) shovel; c) pail; d) sprinkler / power sprayer; e) plastic twine; f) bag sewer / needle; g) sacks with plastic liner; h) hose & irrigation pump; i) ½" X ½" wire mesh or screener; and, j) dust masks.

Procedure

- Select a well-drained compost site with shade 50 meters away from residential houses. The compost site may either be cemented or earthen flooring.
- Haul and prepare all the needed materials in the composting site following the above formulation. Percentage formulation may be changed depending on the availability of raw materials.
- Divide the materials into two and pile the materials one after the other i.e., RHC, crop wastes, animal wastes, decomposer and water. Repeat the procedure after completing the first layer and irrigate the pile using hose and irrigation pump.
- Mix the piled material wastes five to six days after piling and irrigate the pile. Repeat the procedure sixth or seventh times, after which the wastes shall have been well decomposed and ready for bagging. Compost is ready for use when: a) the pile has low temperature; b) the color of the materials ranges from brown to black, no longer recognizable and soily in appearance; and, c) the pile has no foul order or has an earthly smell.
- Screen the organic fertilizer / compost using ½ X ½ inch wire mesh in order to remove foreign matters like stones, plastics, woods, etc.
- Bag the screened compost / organic fertilizer using a sack with plastic liner. Each bag should weigh 50 kgs or depending upon your derived packaging content or standards set by Fertilizer & Pesticide Authority (FPA).
- Store the bags of organic fertilizer in a well ventilated shade. Avoid direct hit of sunshine or rain.

Organic Fertilizer Production Project Extension Strategies & Initiatives

Capability Building/Training on Organic Fertilizer Production Technology

Series of trainings seminars, lectures and demonstrations on the PSU-OFPT and on the importance of using organic fertilizer in different agricultural production activities were conducted by the PSU Organic Fertilizer Production Project in coordination with the Land Bank of the Philippines, cooperatives, peoples organizations' (POs), local government units (LGUs).

Table 1 shows the trainings, seminars, briefings and demonstrations conducted on the PSU-Organic Fertilizer Production Technology and its utilization in the different municipalities of Pangasinan and other provinces of Region I involving cooperative officials and members, OSYs, farmers, businessmen, agricultural technicians etc. from CY 2008-2010. The trainings, seminars, briefings and demonstrations were started as early as CY 2001-2002.

Technology Demonstration

Comparison between the techno-demo and farmer's practice showed that techno-demo obtained a yield (number of bags) of 8.35 bags wet and 7 bags dry while farmer's practice it was able to harvest 7.85 bags wet and 5.54 bags after drying, hence a difference of 0.51 for wet and 1.46 for dry. Likewise, in terms of the number of kilos (dry) harvested, techno-demo obtained 347 kilos and farmer's practice registered 293.36 kilos. In terms of the difference in the yield of techno-demo and farmer's practice for wet and dry, it has a difference of 0.51 and 1.46, respectively. Consequently, the difference in terms of the number of kilos (dry) was 53.64 kilos, hence, using 50% Organic Fertilizer and 50% Inorganic Fertilizer or Balanced Fertilization Strategy in hybrid rice (Bigante) in a 1,000 m^2 area in the study showed promising result. Results of this study further showed that techno-demo performed slightly better than farmer's practice in terms of the parameters of the study.

Table 3 shows the data obtained from OA techno-demo and farmer's practice in terms of the number of plants, weight of the stover, weight of corn in-cob, weight of grains (fresh), weight of cob (fresh), weight of grains (dry), number of ears affected by corn borer and percent infestation. In all the parameters gathered in this study, farmer's practice performed better. It can be noted that the weight in grains in wet and dry form showed that farmer's practice performed better, 14.20 kilos for OA and 19.50 kilos on farmer's practice for wet while 11.0 kilos for OA and 15.45 kilos for farmer's practice in dry condition. However, in terms of the number of ears affected by corn borer and percent of infestation, OA techno-demo registered only 6 as compared to 8 for farmer's practice while the degree of infestation is 1-5% for OA while 1-7% for farmer's practice, respectively. Table 4 shows the yield performance where farmer's practice is more superior to farmer's practice in terms of the number of bags/kilos obtained. OA registered a total harvest of 5 bags or equivalent to 256 kilos while 13 bags or 811.45 kilos for farmer's practice. Result of the study shows that the nutrient requirement of corn in terms of the macro-elements are higher as compared to other cereals like rice.

Production and Income of the PSU-OFPP

Table 5 shows the production and income of the PSU-OFPP from 2001 to 2008. Note that majority of the produced were utilized in the crop production systems of the college.

Economic Impact of the Project

The PSU-OFPP have shown great potential in terms of income generation as shown by the number of bags produced and income derived from the organic fertilizer produced.

Environmental Impact of the Technology

On the part of the agro-industrial wastes owner (poultry and piggery farms, salt and puto manufacturers, and lumber /

woodcraft and furniture factories), they were able to generate additional income from sale of their wastes materials such as chicken manure, pig manure, rice hull coal, and sawdust, were essential raw materials used in the production of PSU organic fertilizer. Of the total material inputs used in the production of organic fertilizer, Figure 5 shows that wastes materials constitute 45.02% (P40,300.00), followed by fuel and gasoline (23.65% or P21,175.00), supplies (23% or P20,580.00), and food (8.33% or P7,466.00).

Through the PSU-Organic Fertilizer Production Technology, conversion of wastes materials into organic fertilizer was made possible. Utilization of these wastes greatly reduces problems on pollution that usually confronts agro-industrial wastes owners, specifically, the poultry and piggery farms. Likewise, this technology contributes and complements in the implementation of RA 9003 otherwise known as Solid Waste Management Act by way of proper management of municipal and city solid wastes. Furthermore, farmers who adopt the use of organic fertilizer in their different agricultural production activity, found an alternative solution to rising cost of fertilizer inputs. Initial result of this partial shift from chemical to organic fertilizer utilization significantly help improved their farm soil condition. If sustained, this technology will help farmers in the promotion of organic agriculture in the country as well as encourage production of organic products that are healthy and safe for human consumption.

Social Acceptability of the Project

Faster adoption of the benefit of the technology is manifested by the number of adopters buying the PSU-organic fertilizer composed of farmers, entrepreneurs, students, government agencies, school and other clienteles. Interest on the technology can be manifested by the continuous request for trainings cum demonstrations in the farmer organization's or interested parties' place. Conduct of techno-demos on organic agriculture using PSU-organic fertilizer and field days have been conducted by PSU from 2006 up to the present with initial funding from ILARRDEC and continuously funded by PSU R&D office. At present, techno-demo on organic agriculture is now being entered into by PSU with DepEd-EPAC, Sta. Maria, Pangasinan and a farmer co-operator identified by LGU-DA, Santo Tomas, Pangasinan.

Conclusion

The PSU Organic fertilizer Production Technology in Pangasinan conducted from CY 2000-2008 generated tangible and conclusive outputs in the following areas: SUCs like PSU is capable to develop its own decomposer using naturally-isolated beneficial microorganisms to be integrated in their organic fertilizer framework. The use of PSU-Organic Fertilizer in rice, corn and spinach vegetable production brought positive result in terms of reducing costs of chemical fertilizer inputs. Enhanced capabilities/skills of farmers on the use of organic fertilizer in their crop production activities as well as equip the adopters with knowledge on low-cost PSU-Organic Fertilizer Production Technology in producing their own organic fertilizers through demonstrations, seminars and trainings. Promoted and enhanced the adoption/utilization of PSU-OF in crop production as well as additional source of income for cooperatives as evidenced by increasing number of farmer adopters and invitation to conduct lectures, seminars and demonstrations. Economic profitability can be attained in adopting the PSU-OFPT as manifested by the cost and return analysis of Organic Fertilizer production project of PSU and its assisted cooperatives and student organization.

Recommendation

Increase financial support for local, provincial and national government should be source out to attain project sustainability among existing and future PSU-OFPP assisted projects. Intensify the conduct of techno-demo on different crops using PSU-Organic Fertilizer for faster adoption and promotion of organic agriculture in the country. Seek government support in terms of licensing and commercialization of the PSU PSU-IBMs-based Organic Fertilizer. Further analysis of the indigenous beneficial microorganisms being used as decomposer by competent agencies like BIOTECH.

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