ADOPTION OF *BHOOCHETANA* (YAMANG LUPA PROGRAM) PRINCIPLES AND APPROACHES IN BOOSTING AGRICULTURAL PRODUCTIVITY IN REGION 9, PHILIPPINES

Roger O. Bagaforo, John Paul F. Guadalupe, Rictibert C. Pamunag

Research Division – Department of Agriculture RFO IX,
Sanito, Ipil, Zamboanga Sibugay

ABSTRACT

Rainfed farmlands is considered one of the marginalized areas in agriculture today. Different biotic and abiotic stresses along with poor access to technologies and innovations are challenging the productivity and profitability of both the farmers and the community. With this, a collaborative study between different RDIs in the Region (DA–RFO IX and SUCs) along with the selected LGUs was conducted in upland communities from 2013 to 2018 that aims to improve rural livelihoods by increasing agricultural productivity and farmer's income.

Stratified soil sampling across Region IX was conducted that resulted to the distribution of GIS-based soil fertility maps and Soil Health Cards. Integration of best-bet interventions were introduced and strengthened. Results of the techno-demo of major crops had shown a remarkable increased in crop yield of 60.10% to 65.73% and increased farm income of 92%. During the five years of implementation, farmer's knowledge on fertilization and seed delivery system and community involvement through Farmer's Association were enhanced. The collaborative initiatives of different RDIs (DA and SUCs) in cooperation with the LGU down to the BLGU had significant impact on the delivery of technologies to farmers. The involvement of the farming community had resulted to increased income and profitability.

Keywords: Bhoochetana, Agricultural Productivity, Soil Rejuvenation, Convergence, Farmer's Empowerment

INTRODUCTION

Population growth, demands of urbanism and industry, and the increasing adoption of high value cash crop farming in the surrounding lowlands are leading to strong competition for upland terrain. In Zamboanga Peninsula, the uplands have traditionally suffered from drought and infertile soils, weeds and plant diseases. Soils that have been badly eroded and degraded as a result of the slash-and-burn agriculture for many years followed by logging activities. This, in turn, destroys the watershed, producing problems in the lands in the lowland.

In 2009, the International Crop Research Institute for the Semi-arid Tropics (ICRISAT) launched an innovative step of using the power of science to increase the agricultural productivity for the farmers while sustaining soil fertility in Karnataka, India. The initiative was called *Bhoochetana*, which means "revival of the soil". *Bhoochetana* mission program is a farmer participatory approach that links knowledge-generating institutions with knowledge-disseminating agencies to benefit smallholder farmers in the state (ICRISAT, 2013).

In the Philippines, efforts were done through the Department of Agriculture in developing the rainfed areas which cover around 75% of the cultivated land. In 2011,

the DA-BAR launched the Philippine Rainfed Agriculture Research, Development and Extension Program (PHIRARDEP) with the goal of developing, coordinating, monitoring and evaluating the implementation of a vigorous rainfed agriculture research, development and extension program to enhance food, nutrition and energy security, improve livelihoods and empower communities in the country's rainfed areas (ICRISAT, 2011) .

Together with the PHIRARDEP in realizing the *Bhoochetana's* success in India and its potential in the Philippines, DA-BAR in partnership with DA-National Rice Program, DA-HVCDP and ICRISAT, piloted and upscaled the mission program, together with partner R&D institutions, to serve as a platform project which could be out-scaled to the different regions in the country.

The program sought to answer the following objectives; to assess the soil health status in pilot areas of Region IX using stratified soil sampling and prepare GIS-based soil fertility status maps for developing specific nutrient management recommendations, to develop, evaluate and popularize best-bet soil, water, nutrient, pests and crop productivity, cropping intensity and farmers' income, to develop and strengthen existing seed delivery system to sustain good quality seeds of improved high-yielding cultivars to improve productivity of smallholder farmers, to develop and pilot test farmer-friendly ICT-enabled innovative extension and delivery system to reach smallholder farmers, and to build capacity of the different stakeholders for increasing agricultural productivity through sustainable intensification in Zamboanga Peninsula.

METHODS

Workshop and Planning for Strategies

Before the conduct of the program, a planning workshop was done for possible strategies that would be used in the program. Apart from this, the workshop was done to introduce the initiatives and approaches of Yamang Lupa Program to the stakeholders and likewise come up for promising intervention and feasible innovation to the upland farmers.

The program was a convergence of agencies/actors/stakeholders that have a significant role to play in agricultural productivity. The purpose was also to adopt the learning loop in planning of strategic research based on participatory research and development.

Courtesy Call to the Stakeholders

Simultaneous courtesy calls were conducted to the PLGU, MLGU and POs where the program was conducted. This activity was done in accordance to the protocol by which in every program/project/activity that will be implemented in the locality, a dialogue should be undertaken to have a smooth and well-coordinated partnership with the stakeholders.

Participatory Rural Appraisal and Baseline Survey

Participatory Rural Appraisal or PRA was conducted to generate the community profile, identify the community resources and flow of income, identify and process agricultural development issues and concerns and strengthen community capability on participatory approach. Likewise, a survey was conducted in the pilot sites to evaluate the existing data drawn from previous PRA led by the Department of Agriculture under the Community-Based Participatory Action Research Project.

Soil Sampling and Analysis

A comprehensive soil sampling and analysis was done as part of the general objectives of the program. A total of 485 soil samples were strategically collected

within the 12,799 hectares in region 9. Technical staff from the Regional Soils Laboratory and Bureau of Soil and Water Management (BSWM) together with the farmer leaders and project implementers assisted the soil sampling as well as conducted briefing to the farmers on the importance of soil analysis on crop production and soil health. The collected soil samples were brought to BSWM laboratory for soil nutrient analysis. The result of the analysis was reflected in the Soil Health Card (SHC) and served as the basis for fertilizer recommendation for the techno-demo.

Identification of Cooperators and Demonstration Farms

After a series of dialogue with the Municipal Local Government Unit (MLGU) and Barangay Local Government Unit (BLGU), 100 cooperators with their corresponding proposed demo-farm site and commodity were selected among the 1,231 farmers being registered to the program. These cooperators were selected following the set of guidelines approved by the Technical Working Group; a). Owner of at least 1-hectare farm, b). A permanent resident in the community, and c). Active members of the existing farmers' association in the community.

Introduction of Best-Bet-Option

Together with the farmer leaders, LGU counterparts and expert partners, sets of intervention were identified and introduced in different demo farms. The interventions were the combination of tested technologies from the Department of Agriculture (DA) and other partner Research and Development Institutions (RDIs), and these were; the use of quality planting materials, use of organically-produced pesticides for vegetables, use of *Trichogramma japonicum* for rice and *Trichogramma evanescens* for corn, and right, correct application of fertilizers following the recommendations from SHC, contouring in the hilly areas and water conservation through the establishment of small farm reservoir (SRF). All these interventions were compared to the existing farmer's practices.

Monitoring and Data Collection

Monitoring team from the implementers was created for monitoring and data collection purposes. The technical staff from DA-RFO IX Research Division and technical staff from partner SUCs and RDIs were responsible for the collection, analysis of data and review of output. Furthermore, the Municipal Facilitator from the DA-MLGU, Farmer Facilitators (FF) and Lead Farmers (LF) from the pilot Barangay were utilized to expedite the activities and likewise capacitate them in conducting R&D activities.

Information Drive and Awareness

Information drive and awareness were conducted through dialogue, trainings, field day, and Farmer Field School (FFS). These enabled farmers in upland areas to become well-feed, innovative and equip for reaching another level of farming.

Creation of Farmers' Association

To ensure the sustainability of the program and boost the participation of the community, the program had able to organized the farmers into an organization. The YLP-Farmers Association was organized and officially registered to the Department of Labor and Employment. Through this initiative, the association received several supports and services from the Department of Agriculture.

Reaching out to Smallholder Farmers

The top priorities in the creation of Farmer's Facilitators (FF) and Lead Farmers (LF) were to guide and monitor techno-demo farms and reach out other smallholder farmers in the community. Approaches, strategies and principles of the program were channeled through these farmer leaders to break language and professional barriers.

RESULTS AND DISCUSSION

Yamang Lupa Program had three major components, namely; Soil Sampling, Analysis and Mapping, Productivity Enhancement and Capacity Building. The data obtained from the different techno-demo farms were analyzed to verify the efficiency of the introduced intervention and document the adoption capacity of the cooperators and other farmers within the community.

Soil Sampling, Analysis and Mapping

Soil is considered as one of the important factors affecting crop growth and development, and soil analysis provides information regarding nutrient availability in soils which forms the basis for the fertilizer recommendations for maximizing crop yields (Fageria, N.K and Baligar, V.C., 2005). The innovation of this program includes the identification of soil nutrient deficiency status and location-specific nutrient recommendations based on the nutrient status of the soil. The analysis was used as the basis of the distribution of fertilizers subsidized by 50% as stipulated in the Memorandum of Agreement between the Farmer's Association and the Local Government Unit (LGU).

During the course of the project, it covered 12,799 hectares representing the upland and rainfed lowland areas of RTLim, Siay, Buug and Imelda Zamboanga Sibugay, Bunguaio, Zamboanga City and Dapitan City. Out of the 12, 799 hectares, 485 soil samples were strategically collected for soil physical and chemical analysis.

The data obtained from the soil analysis was consolidated and summarized into a "Soil Health Card" or SHC (Figure 1). It is an innovative one-page back-to-back card reflecting the easy-to-understand presentation of the soil analysis and recommendations. Reflected on the SHC are; General information of the farmer with its corresponding number (included are the name of the farmer, Barangay, Municipality, Province, soil sampling depth and month and year of sampling).

Yamang Lupa Program

Soil Health Card

Farmer No : FS201

General Information

1. Name of the farmer : Clarita Siton
2. Barangay : Casacon
3. Municipality : RT Lim
4. Province : Zamboanga Sibugay
5. Soil sampling depth : 0-15 cm
6. Month and year of sampling : March 2014

Soil Chemical Analyses Report

Soil Health Information	Critical limit	Observed	Remarks*
1. Soil p^H (1:2 H_2O)	-	5.6	Acidic
2. Electrical conductivity (dS m^{-1})	<0.8	0.15	Normal
Major Nutrients			
3. Organic Matter (%)	2.0	1.75	Deficient
4. Available Phosphorous (mg kg^{-1})	10	1.0	Deficient
5. Available Potassium (mg kg^{-1})	75	222	Sufficient
Secondary Nutrients			
6. Available Sulfur (mg kg^{-1})	10	6.5	Deficient
Micro Nutrients			
7. Available Zinc (mg kg^{-1})	0.75	1.71	Sufficient
8. Available Boron (mg kg^{-1})	0.58	1.78	Sufficient
9. Available Iron (mg kg^{-1})	2.00	121.02	Sufficient
10. Available Copper (mg kg^{-1})	0.50	4.25	Sufficient
11. Available Manganese (mg kg^{-1})	1.00	85.08	Sufficient

"Use improved varieties of crop recommended for particular Barangay to ensure better utilization of nutrients and to maximize profits"

Nutrient recommendations (kg ha^{-1})

Crop	N	P_2O_5	K_2O	S	Zn	B
Rainfed Rice (WS)	80	60	60	30	10	0.5
Rainfed Rice (DS)	80	60	60	30	10	0.5
Upland Rice (WS)	90	60	30	30	10	0.5
Corn	120	60	30	30	10	0.5
Peanut	25	30	30	75	10	0.5
Taro	20	50	75	30	10	0.5
Bitter Gourd	50	60	30	30	10	0.5
Eggplant and Okra	80	60	60	30	10	0.5
Squash	80	60	40	30	10	0.5
Watermelon	60	90	45	30	10	0.5

Use of vermi-compost and soil incorporation of *Sesbania grandi flora* plants and *Gliricidia sepium* leaves to save cost on commercial fertilizers.

*If soil status is deficient, apply full dose, otherwise, apply only half of the recommended dose of nutrients.

Soil test based fertilizer recommendations (kg ha^{-1})

Option 1:

Crop	Urea	14-14-14	MOP	Gypsum	Zn SO_4	Borax
Rainfed Rice (WS)	43	429	0	182	25	2.5
Rainfed Rice (DS)	43	429	0	182	25	2.5
Upland Rice (WS)	65	429	0	182	25	2.5
Corn	130	429	0	182	25	2.5
Peanut	0	214	0	482	25	2.5
Taro	0	357	0	182	25	2.5
Bitter Gourd	0	429	0	182	25	2.5
Eggplant and Okra	43	429	0	182	25	2.5
Squash	43	429	0	182	25	2.5
Watermelon	0	643	0	182	25	2.5

Option 2:

Crop	Amm. Sulfate	16-20-0	MOP	Gypsum	Zn SO_4	Borax
Rainfed Rice (WS)	152	300	50	0	25	2.5
Rainfed Rice (DS)	152	300	50	0	25	2.5
Upland Rice (WS)	200	300	25	0	25	2.5
Corn	343	300	25	0	25	2.5
Peanut	5	150	25	474	25	2.5
Taro	0	250	63	182	25	2.5
Bitter Gourd	10	300	25	166	25	2.5
Eggplant and Okra	152	300	50	0	25	2.5
Squash	152	300	33	0	25	2.5
Watermelon	0	450	38	182	25	2.5

Apply nitrogen preferably in 2 or 3 splits. Farmyard manure at 5 t ha^{-1} *is desirable. Strictly follow the recommended timing of fertilizer application.*

For further details, please contact:

Ms. Marry Joy P. Flores
Region IX Coordinator on YLP - Soil Sampling, Analysis & Mapping
Researcher
DA-Zamboanga Peninsula Integrated Agricultural Research Center
Ipil, Zamboanga Sibugay
Phone: (062) 333-2829; Mobile: 09101794575
E-mail: Mjporras_77@yahoo.com

Dr Gina P. Nilo
National Coordinator on YLP - Soil Sampling, Analysis & Mapping
Chief, Laboratory Services Division
DA-Bureau of Soils and Water Management
Diliman, Quezon City
Phone: +632 9230456; Mobile: 09178350644
E-mail: ginapnilo@ymail.com

Figure. 1. A sample of comprehensive one-page back-to-back YLP Soil Health Card as a guide and basis in the fertilization of different crops.

Soil chemical analysis report includes the soil health information, critical limit observed and remarks. Below the soil health information are major nutrients, secondary nutrients and micronutrients needed for plant growth and development.

Meanwhile, the back portion of the SHC reflects the nutrient recommendation for specific crops, soil test-based fertilizer recommendations with two options and contact information in case there are queries and clarifications from the farmers or any stakeholders who would like to know matters relative to the SHC. Specifically, there are two options for the farmers to choose for the soil test-based fertilizer recommendations. This enabled the farmers to select what type of fertilizers they'll be using based on the availability and prevailing price in the market. Furthermore, the list of crops reflected in SHC were the major crops grown by the farmers in the community and this was supported by the data gathered during the PRA. SHC purpose is to use indicators that assess each soil's ability to support crop production within its capabilities and site limitations. The card, which will carry crop-wise recommendation of fertilizers required for farm lands, will help farmers identify health of soil and judiciously use soil nutrients (Malavath, R. and Kumar, B. K., 2017).

Out of the 485 SHC distributed to farmers, a cumulative SHC for the respective Barangay were printed in a 6x4 inches tarpaulin. These over-all SHC were placed in frames and positioned in the Barangay Hall where every farmer in the community would be able to refer to for nutrient recommendation. Also, a GIS color coded soil nutrient status maps were also formulated for the benefits of farmers in the community and other RDIs (Figure 2).

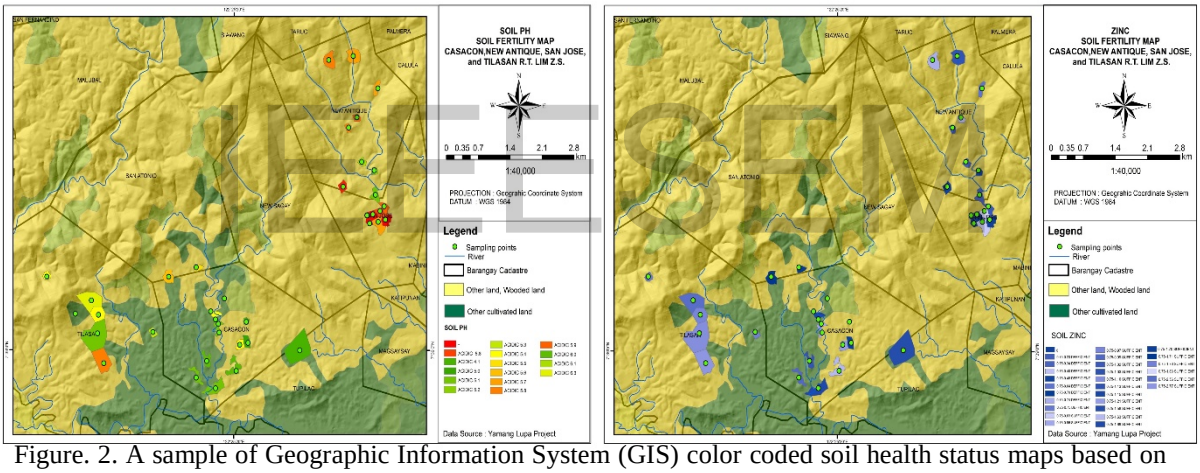

Figure. 2. A sample of Geographic Information System (GIS) color coded soil health status maps based on the soil nutrient analysis.

The distribution of SHC to the community had great impact on the decision-making of the farmers. Not only were the cooperators benefited from the SHC but also the neighboring and adjacent farmlands with similar soil characteristics and topography. For farm management soil quality and soil health, SHC is recommended to assist farmers to evaluate the effects of their management decisions on soil productivity. The purpose of SHC is not only useful for comparing soil types with one-another, rather to assess each soil's ability to function within its capabilities and outer limitations (Brejda and Moorman, 2001).

Productivity Enhancement

The program had established 100 techno-demo farms across pilot sites. The crops that were utilized in the demo farms were the major crops grown in the community. The data obtained during the conduct of Participatory Rural Appraisal (PRA) were also used as basis in the selection of demo farms as well as the kind of technology being demonstrated.

The best-bet-options such as the used of quality planting materials, use of micro- and macro-nutrient based on the Soil Health Card, application of

Trichogramma japonicum and evanescens and locally-available insecticides and establishment of contours along sloping area for the control of soil erosion were showcased in the program. Also, the program had established a Small Farm Reservoir (SFR) to deposit the excess water during rainy season. The collected water was used by the crops during the critical growth stages in dry season. To mitigate and adapt the climate change in the hilly areas, rainwater harvesting will solve the water supply problem in the upland. Establishment of water impounding project in the upper reaches of watershed could be defense against floods at the same time for irrigation, soil erosion control, tapping unused water, pasture improvement for livestock, and future studies of the same field could be possible (PCARRD, 1986).

As reflected in (Figure 3), taro and bitter gourd obtained the highest average yield with 17,583 kg/ha and 17,430 kg/ha, respectively. Compared to Farmer's Practice, taro under YLP had the highest percent yield increase of 104% followed by lady finger and peanut with 91% and 78%, respectively. Farmers seldom applied fertilizers to these crops, thus, the application of macro-and micro-nutrients based on the result of the soil analysis resulted to better yield. The practice of correct fertilization was contributed to the remarkable increase in crop yield. According to the study of Lokesh Kumar Jat et.al of 2015, INM increases crop yield by 8-150% as compared to the conventional practice. This also increase water and nutrients use efficiency and the economic returns to farmers, while improving grain quality and soil health and sustainability.

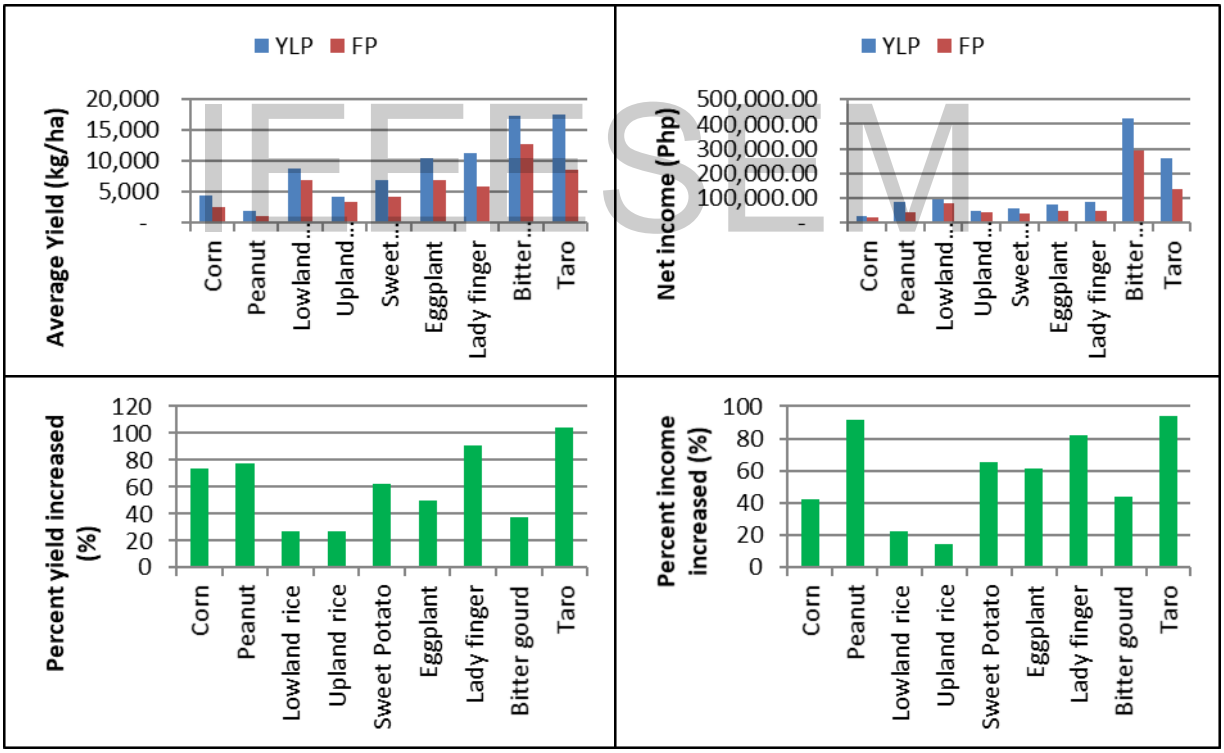

Figure. 3. Average yield, net income, percent yield increase and percent income increase of 9 major corps under techno-demo farms between YLP and Farmer's Practice.

In the case of bitter gourd, the used of quality planting materials contributed to the significant increase of yield. Based on the result of the PRA, farmers seldom used quality seeds. Farmers only asked seeds from neighbors without any information about the viability of the seeds and its reaction to pests and diseases. Furthermore, farmers claimed that buying seeds from Agri-supply only add the expenses. However, results of the demo-farms shown that planting bitter gourd using YLP initiatives obtained a remarkable income of 423,750.00 per hectare and had 44% percent income increased as compared to conventional practice. Accordingly,

the used of high quality seeds is one of the most important element in increasing agricultural production in any farming system and estimated that all other factors remaining the same, the use of quality seed of high yielding varieties increases crop yield by 15-20% and in certain condition this increase could be in 30 to 60% (Sabry, 2018).

As observed in the major crops, planting peanut, lady finger and sweet potato under YLP principles had a remarkable increased in percent income with 92%, 82% and 65%, respectively (Figure 3). These crops were considered cash crops by majority of the farmers but results of the techno-demo indicated that by following a holistic approach in farming like in YLP, farmers can still earn to support their family need to some extent. As reported by ICRISAT in 2011, with the intervention of the *Bhoochetana* or YLP, farmers are capacitated to attain greater heights in the upland development. Remarkable increase has also noted the *Bhoochetana* in India for groundnut that enhance crop yield in the range of 32 to 41%.

Capacity Building

Sustainability was considered as a major expected output of the program. In this manner, the program came up with an idea of organizing the farmers into an association. The Municipal Agriculture Office, Farmer Facilitators (FF), and Lead Farmers (LF) processed the application of the association to the Department of Labor and Employment for registration purposes. The association already elected their first set of officers, created by-laws and conducted the first YLP-Farmers' Association assembly. The association strengthened the existing seed delivery system which was introduced by the previous program of the Department of Agriculture. According to Msuta and Urassa (2015), Farmers' Organizations' (FOs) play a significant role as an institutional vehicle for promoting agricultural development through helping farmers solve common problems in relation to agricultural inputs, credit, technical knowledge and marketing of produce.

To operationalize the project, the services of farm facilitators (FFs) to take technologies to the farmer's doorstep were utilized. Above all, the convergence of all the existing schemes of DA channeled through the Yamang Lupa Program was the innovative strategy. The DA was responsible for the project, while the consortium supervised daily activities at different levels or locations.

In order to strengthen the seed delivery system and seed banking in the community, portion of the yield from the demo farms were distributed among interested farmers within the Barangay for seed purposes. The FF and LF were responsible in the technology dissemination from crop establishment to post-harvest handling. After harvest, the cycle starts over again and because of the demand of quality seeds, cooperators managed to venture into seed production. To emphasize, Community seed banks (CSBs) are locally governed and managed, collective-action institutions, whose core function is to maintain seeds for local use (Development Fund, 2011). The seed delivery system and seed banking the selected communities did a remarkable impact not only to the farmers within the community, but to neighboring communities. The system was also copied and replicated by other communities and other non-government agencies.

Meanwhile, tested technologies were popularized through Farmer's Field Schools and field days. The FFSs trained 102 farmers on rainfed lowland rice, corn and sweet pepper production. Apart from the organized extension services, FF and LF with direct supervision from assigned Municipal Facilitator (MF) conducted regular monitoring of the techno-demo farms. By this activity, FF and LF did not only monitor the existing demo but likewise initiated exchange of ideas as far as farming is concern. This strategy was found effective since the farmers and cooperators primarily entrusted their confidence to the person whom they already knew for quite

some time. Thus, mobilizing the FF and LF did not only maximize the manpower thrust of the program but also expedite the transfer of technology to the farmers.

The mobilization of farmer leaders and capacitation of the farmers in the community had significant result to agricultural productivity. This means that what matters for agricultural development and achieving the above situation is the capability of people to be effective and productive economic agents (Chikaire et al., 2015).

CONCLUSION AND RECOMMENDATION

It is evident from the higher yields observed in demo farms under YLP intervention as compared to current crop yields that rainfed agriculture has substantial untapped potential in food security. The complementation of different RDIs, Extension Services Institutions like SUCs and Local Government Units in extending agricultural services and technologies were considered as one of the effective strategies in boosting agricultural productivity. This minimized the gap between research findings and on-farm development. It was also observed that farmers were participative if the introduced program is sustainable and had significant profits.

The involvement of the community is considered an efficient strategy in. agricultural productivity. Adoption of the *Bhoochetana* or Yamang Lupa Program initiatives had significantly increased farm yield as high as 66% and increased farm income of 92%. Specifically, the introduction of Soil Health Card contributed to the enhanced knowledge of farmers in fertilizer management. It is therefore recommended that the Yamang Lupa Program will be replicated to other Regions in the country.

REFERENCES

Brejda JJ, Moorman TB (2001) Identifcation and interpretation of regional soil quality factors for the Central High Plains of the Midwestern USA. In: Sustaining the global farm-selected papers from the 10th International Soil Conservation Organization Meeting (ISCO99).

Chikaire, J.U., Ani, A.O., Atoma, C.N. and Tijjani, A.R. 2015. Capacity Building: Key to Agricultural Extension Survival. Scholars Journal of Agriculture and Veterinary Sciences. Sch J Agric Vet Sci 2015; 2(1A):13-21. e-ISSN 2348–1854.

Development Fund. 2011. *Banking for the Future: Savings, Security and Seeds*. Oslo: Development Fund. Accessed 1 May 2019.

Fageria, N.K. and Baligar, V.C., 2005. in Encyclopedia of Soils in the Environment. https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/nutrient-availability.

ICRISAT, 2011. Bhoochetana, a compendium of success stories, research report IDC-3, ICRISAT Development Center.

ICRISAT, 2013. Research Report no. 59. Bhoochetana: Innovative Institutional Partnership to Boost Productivity of Rainfed Agriculture in Karnataka, India.

Lokesh Kumar Jat, et. Al., 2015. Does integrated nutrient management enhance agricultural productivity, Department of Agriculture Institute of Agricultural Sciences, Banaras Hindu University Varanasi-221001, India.

Malavath, R. and Kumar, B. K., 2017. Importance of soil health card to sustain the living dynamic system. DOI: 10.15740/HAS/AJSS/12.1/217-220.

Msuta, P. B and Urassa, J. K., 2015. The contribution of farmers' organizations to smallholder farmers' well-being: A case study of Kasulu district, Tanzania. Vol. 10(23), pp. 2343-2349, 4 June, 2015 DOI: 10.5897/AJAR2014.9261 Article Number: 924D89853332 ISSN 1991-637X Copyright ©2015. African Journal of Agricultural Research.

Philippine Council for Agriculture and Resources Research and Development. 1986. The Philippines Recommends for Small Water Impounding Projects. PCARRD Tehnical Bulletin Series No. 61. National Science and Technology Authority and the Bureau of Soils. Los Baños, Laguna.

Sabry G. Elias, 2018. Oregon State University, USA, the importance of using High quality seed in agriculture system, April 25, 2018.