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Increasing Productivity of Rice-Based Cropping System Forlahar Laden Farms

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Abstract: ***Soil productivity is the inherent quality of a soil to support the growth of a specific plant due to its properties, management practices and the environment. The productivity of rice-based cropping system for lahar laden farms is enhanced by undertaking activities such as documentation of existing farmers' practices, and showcasing the use of bioorganic fertilizers in developing the rice-based cropping system. Existing farming practices in lahar-laden areas weresemi-mechanized land preparation. Direct seeding or transplanting method is adopted at a distance of 20cm x 20cm. Synthetic fertilizers and pesticides were applied for cultural management with pump irrigation and harvesting is mechanized while sun-drying is performed after. Performance of five inbred rice varieties were tested with NSIC RC 240 being the best. To improve productivity, the application of Mykoplus with the recommended mixed organic and inorganic fertilizer based on soil analysis was employed giving the highest yield of 4.5 tons per hectare. Bioorganic foliar fertilizer (Fish Amino Acid) sprayed at 10 days interval until flowering was also recommended at the rate of 1 liter/ha mixed with water at the ratio of 1:20. These technologies were showcased to 79 famers through a demo farm and were adopted by 38 farmers in Botolan, San Marcelino and San Narciso. The nutrient content before and after the application of the technology was determined through soil analysis with the percentage of OM increased from 0.77 to 1.56 percent, the Phosphorous content increased from 16 ppm to 168 ppm and Potassium content increased from 40 ppm to 130 ppm. Secondary crops such as sweet potato, corn, mungbean, or peanut can be planted after rice to increase income of farmers whose farms were lahar laden using the production guide developed.***

Keywords: Productivity, Lahar, Rice

1. Introduction

Before the Mt. Pinatubo eruption in 1991, Central Luzon had been known as the Rice Granary of the Philippines. Today, only Bulacan and Nueva Ecija are the top producers with Nueva Ecija remaining the biggest source of rice in the whole Central Luzon. At the height of Mt Pinatubo eruption when lahar devastated residential and agricultural areas in Pampanga, Zambales and Tarlac, rice was under 30-40cm of volcanic ash. About 20,000 hectares of rice farms have already been heavily damaged by lahar (Reyes and Neue, 1991). Rehabilitation of the lahar laden areas was continuously done to become productive especially for rice production.

Zambales shared a total of 118,900 metric tons of palay for the year 2012 (BAS data 11/14/2013), while Pampanga shared 388,187 metric tons and Tarlac 549,299 metric tons. The total production of rice in the 3 provinces may be increased if the vast areas of ricelands which were covered with lahar could be reclaimed for rice production. The suitability of these areas for the production of rice could be improved with the application of bioorganic fertilizer application mixed with inorganic fertilizer at the start and gradually phasing it out to come up with the implementation of RA 10068 – Organic Agriculture Law. The use of biofertilizers is environment friendly and hastens decomposition of organic materials which renders increased availability of nutrients from the soil for plant absorption as well as maintains and conserves the soil to increase productivity. Other than rice, secondary crops such as legumes and root crops will be also planted to maximize the utilization and productivity of these areas.

Objectives

The implementation of the project is aimed in increasing the productivity of rice-based lahar laden farms.

Specifically, the project intended to:

- Document existing farmers' practices on rice-based cropping in lahar laden areas of Central Luzon.
- Conduct research in the use of bioorganic fertilizers for rice production in lahar laden areas.

2. Methodology

a) Project Component

This project consists of three (3) components: first is the Assessment of Existing Rice-based Farming Practices in Lahar-Affected areas in Region 3 as baseline information for the next activities; second, is the conduct of research intervention – Increasing Rice Productivity in Lahar Laden Areas through the Use of High Yielding Varieties and Bioorganic Fertilizer and third is the validation of previously developed Rice-based Cropping Pattern in Lahar Laden Areas in Zambales.

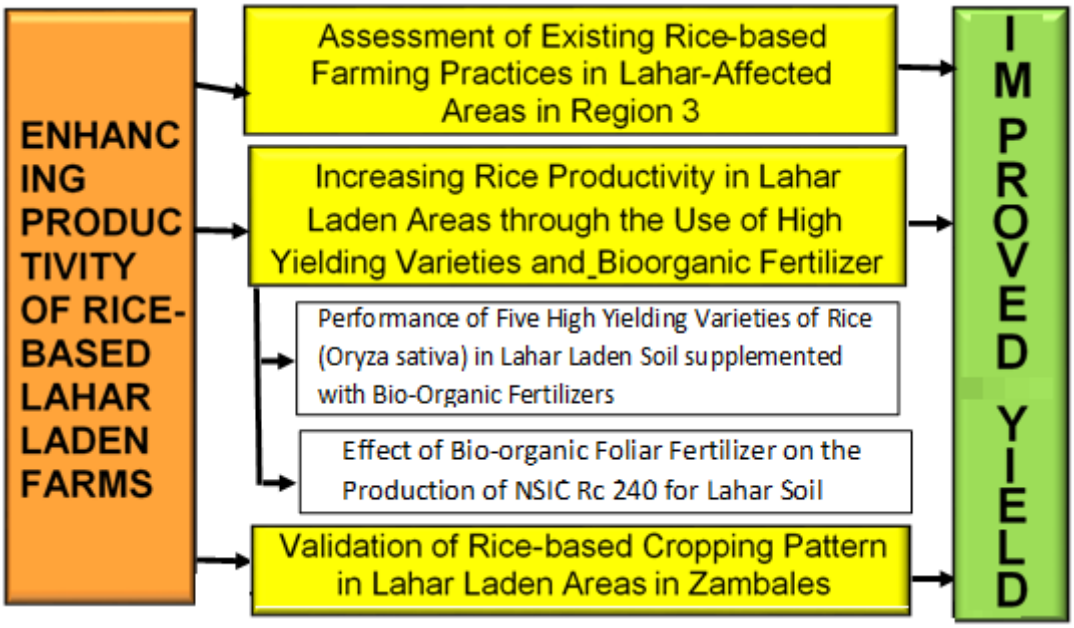

Figure 1: Conceptual Framework

b) Procedure

Project 1: Assessment of Existing Rice-based Farming Practices in Lahar-Affected Areas in Region 3

Descriptive research was used in this study with survey questionnaire as the major tool used in data gathering. Interview of respondents was done integrating it with focus group discussion (FGD) to facilitate data gathering.Data gathered were analyzed using means, frequencies and percentages. Simple cost return analysis was done to reflect income of farmers from rice production in lahar- affected areas.

Project 2: Increasing Rice Productivity in Lahar Laden Areas through the Use of High Yielding Varieties and Bioorganic Fertilizer

Activity 1: Performance of Five High Yielding Varieties of Rice (Oryzasativa) in Lahar Laden Soil supplemented with Bio-Organic Fertilizers

Four NSIC rice varieties (Rc 208, Rc 222, Rc 238 and RC 240) and IR 42 were used which served as the main treatments while the use of Mycorrhizae as inoculant is the sub-treatment. Treatments were replicated three times. Layout of experimental field and data analysis was done using split plot design.The following cultural management practices were followed:

Land Preparation: The area was plowed and harrowed twice. Final harrowing was performed using a peg-toothed harrow drawn by a carabao to level the field. After lay-outing the area, dikes were constructed along the sides to each plot to ensure that water will not transfer from plot to plot.

Planting: Before planting, seed inoculation was done using Mycorhizae which was also used as bio-organic fertilizer. Inoculation of seeds was done following the recommendation of manufacturer. The inoculated seeds were directly seeded at the rate of one hundred fifty grams per 15 square meters using drill method in furrows spaced at 20 cm apart.

Fertilizer Application: Fertilizer application was based on soil analysis as reflected in Table 1.

Table 1: Schedule of Fertilizer Application

Fertilizer Material	Time of Application	Amount (grams)
Compost	Basal	2,050
Complete	15 DAE	140
Urea	30 DAE	116
Ammonium phosphate	50 DAE	262.5

DAE – days after emergence

Pest and Disease Management: The attack of insect pests was controlled by spraying with Lambdacyhalothrin solution at early vegetative stage (20 DAE) and at tillering stage (45 DAE) to control various species of leaf folders and stem borers (*Scripophagainsertulas*).

Irrigation: Because of unavailability of rain, the area was flooded using water pump at a depth of 5 cm. Irrigation was done three times with five days interval during tillering stage.

Harvesting and Threshing: The test plants were manually harvested when 85% of the grains turned golden yellow. These were also threshed manually by foot.

Study 2. Study on the Effect of Bioorganic Foliar Fertilizer on the Production of NSIC Rc 240Rice Variety for Lahar Soil.

This study was conducted to assess and determine the performance of NSICRc 240 the recommended variety to be grown under lahar soil condition when applied with bioorganic foliar fertilizers which served as the treatments.

Land Preparation: The first plowing was done using a four-wheel tractor with disc plow to till the soil followed by harrowing to remove the weeds. After five days, second plowing and harrowing was done to ensure the complete

removal of weeds and cleanliness of the field. Final harrowing was performed using a peg-toothed harrow drawn by a carabao to level the field. Experimental area was laid out by constructing 24 plots which measure 4m x 5m following the Randomized Complete Block Design (RCBD) with a distance of 1meter in between plots.

Sowing and Transplanting: Seed sowing was done in beds for the growing of seedlings. After 21 days seedlings were pulled and transplanted to each of the plots at the rate of 1 seedling per hill with a distance of 20 x 20 cm between hills.

Fertilizer Application: Fertilizer application was based upon the result of soil analysis with a recommendation of (80-7-7) kg inorganic fertilizers and 20 bags of organic fertilizer per hectare for dry season were used. Kind, time of application and amount of fertilizer applied is shown in Table 2.

Table 2: Schedule of fertilizer application

Fertilizer Material	Time of Application	Amount (bags/ha)
Compost	Basal	20
Complete (14-14-14)	1st Topdress at 10 DAT	1 bag
Urea	1st Topdress at 10 DAT 2nd Topdress at 40 DAT	1.5 bag 1.75 bag

DAT – days after transplanting

The application of foliar fertilizers as treatments was applied every 10 days starting at 10 days after transplanting until the formation of grains at the rate of 1 liter per hectare.

Pest and Disease Management: The attack of insect pests and incidence of pest and diseases was monitored regularly. No chemical pesticides applied.

Irrigation. Because of unavailability of rain, flooding was doneusing diesel fuel irrigation pump during the growing stage at a depth of 5 cm. Irrigation was done three times with five days interval.

Harvesting and Threshing: Plants were manually harvested when approximately 85% of the grains turned golden yellow. These were also threshed manually by foot. One square meter area was designated as samples.

Project3: Validation of Cropping Pattern in Lahar Laden Areas in Zambales

***Pre* –Implementation:** The project was properly coordinated with DA-LGU of Botolan, San Narciso and San Marcelino, Zambales. Data on the hectarage of lahar affected areas and list of farmers affected were obtained. Together with the farmer leaders and agricultural technicians in each municipality, the validation of farmers and farms were scheduled.

Selection of Cooperators and sites: This project was conducted in three (3) municipalities in Zambales. Eleven (11) farmers from Carael, Botolan, 10 from San Narciso and 5 from San Marcelino, Zambales were selected as cooperators following the criteria:

- area is affected by lahar
- he/she willing to use and the technology
- he/she is willing to accept the terms and conditions of the project regarding production expenses
- he/she is willing to conduct field day

Selection of cooperators was done in coordination with the Municipal Agriculture Office. Ocular inspection to the identified sites were done with the assistance of the Office of the Municipal Agriculturist. Each cooperatorwere provided with initial input (seeds, fertilizers and chemicals). The proceeds of which was plowed back to the succeeding production season to determine its sustainability. Regular monitoring was done to ensure application of the technology.

Orientation–Workshop: After the identification of cooperators, an orientation workshop along with MOA signing were conducted prior to the rice planting season (main crop). The full package of technology were discussed as well as the monitoring schemes. In the workshop, the cropping pattern develop was presented and discussed.

3. Results and Discussion

Project 1: Assessment of Existing Rice-based Farming Practices inLahar-Affected Areas in Region 3

Farmers who were affected with lahar were mostly male with average age of 54, married with an average household members of four, elementary graduate and members of an organization where 78% of them attended Farmers 'Field School (FFS on rice) conducted by DA-LGU. Because of busy schedule, far distance and bad road condition from the town to his farm were some of the causes why 22% were not able to attend trainings.Most farmers were tenants or lease-holders with 36% own an average of 1 to 2 hectares. Most of them own a carabao as draft animal with plow and harrow together with a knapsack sprayer or farm management practices, almost equal number of farmers employ direct seeding (48%) and transplanting (52%) methods of planting rice. Broadcast on wet soil is largely used in direct seeding method and random transplanting is followed at a distance of 20 x 20 cm using 3-4 seedlings per hill. Land preparation is largely mechanized except for levelling, the last operation is done with carabao-drawn tooth harrow. Plowing is done once with a tractor if weeds are not prevalent but may require two times if otherwise. Harrowing is mostly done once. Plowing and harrowing are done at one-week interval between operations. The variety used for planting by most rice farmers is the NSIC (57%) followed by RC lines (26%). For nutrient, water and pest management; farmers depend largely on inorganic/chemical sources of fertilizers to maintain their crops. Only about 2-3 individuals use chicken manure as organic fertilizer. The rate of application is generally low at 77.5-21-21 kg NPK/ha. from 3 bags complete fertilizer, (14-14-14); 2 bags Urea (46-0-0) and 1 bag Ammonium sulfate (21-0-0). Most farms are rainfed, irrigation is supplemented by artificial source (water pump). The major insect pests identified by farmers attacking their crops are hoppers, stemborers, armyworms, looper, leaf folder, caseworm and bugs. Insecticides (at least 2 liters per ha.) are commonly used to control insect pests. Herbicides are also used for weed control at the rate of 1-2 liters/ha. especially for directly-seeded crops.

Rice crops are harvested using machine (harvester or combine harvester-thresher) by most farmers following a sharing scheme of 11:1 sacks for farmer and machine-owner respectively. Many though, still employ manual method of harvesting. Intraders most farms in Tarlac, harvests are sold to machine owners, who are also, fresh weight just after sharing to eliminate the burden of drying. However, sun drying is still prevalent using highways and sidewalks. Palay yield before the Pinatubo eruption was recorded with a mean of 82.65 cavans per hectare. After the lahar, the mean yield was 61.02 cav/ha with Return Over Expense of 101% for direct seeding and 82% for transplanting method.

Problems among rice farmers in lahar-affected areas based on direct observation and interview of farmers were as follows: High input costs, relatively low support price for palay, inadequate credit support for the purchase of production inputs, poor access to good quality seeds and postharvest infrastructure support such as irrigation and postharvest facilities.

Project 2: Increasing Rice Productivity in Lahar Laden Areas through the Use of High Yielding Varieties and Bioorganic Fertilizer

Activity 1. Performance of Five High Yielding Varieties of Rice (Oryzasativa) in Lahar Laden Soil supplemented with Bio-Organic Fertilizers

In terms of growth performance, those inoculated with Mycorrhizae were slightly taller with an average of 82.44 cm while Rc 208, Rc 238 and RC 240 were significantly taller than IR 42. However, no significant effect was noted for the interaction of the variety and inoculation.

There were more productive tillers when rice seeds were inoculated with an average of 64tillers per linear meter. IR 42 as the check variety had the greatest number of both productive and unproductive tillers. No significant effect as to interaction between the main and sub treatments. The panicle length is insignificant.

More filled grains were counted in each panicle for those which are inoculated at an average of 70 grains per panicle with Rc 240 having the most filled grains for both sub-treatments. Higher grain yield was obtained when rice seeds were inoculated compared to those inoculated with 3.88 tons/ha and 3.62 tons/ha resulting to a 260 kg/ha increase. Likewise, among the varieties tested, Rc 240 was the highest yielder with 4.63 tons/ha. (Table 3).

Table 3: Growth and yield performance of different rice varieties grown in lahar soil

Inoculant Application	Variety	Plant height (cm)	Panicle length (cm)	Grain data			
				Yield (tons/ha)	Filled	Percentage of Filled	Unfilled
With *Mycorrhizae*	NSIC RC 222	80.5	21.50	4.45	69.20	83	14.10
	NSIC RC 240	92.7	22.53	4.63	101.67	81	23.30
	NSIC RC 214	82.7	22.17	4.01	68.92	86	10.86
	NSIC RC 238	83.9	22.30	4.15	59.47	75	12.06
	IR 42 (Control)	72.4	19.20	2.17	51.10	72	19.23
	Average	*82.44*	*21.54*	*3.88*	*70.07*	*79.4*	*15.91*
Without *Mycorrhizae*	NSIC RC 222	78.8	21.30	4.20	70.93	83	14.33
	NSIC RC 240	94.5	21.93	4.38	91.27	83	19.07
	NSIC RC 214	87.8	23.97	3.64	54.87	75	17.77
	NSIC RC 238	80.3	19.80	4.05	60.27	80	14.77
	IR 42 (Control)	69.8	18.91	1.83	19.33	67	14.80
	Average	*82.22*	*21.18*	*3.62*	*59.33*	*77.6*	*16.15*

The use of MykoPlus as inoculant rendered higher income than those without inoculant. Rc 240 gave the highest return on investment at 28.82 % while a negative net income was obtained from IR 42 (Table 4). Thus, IR 42 is not suitable to be grown in lahar laden soil.

Table 4: Cost and Return Analysis of a Hectare RiceWith or Without Mycorrhizae

Item	Quantity	RC 222		RC 240		RC 214		RC 238		IR 42	
		With Mycorrhizae	Without	With Mycorrhizae	Without	With Mycorrhizae	Without	With Mycorrhizae	Without	With Mycorrhizae	Without
I. Gross Income	Dry Wt in kg @P18.00/kg	80100	75600	83340	78840	72180	65700	74700	72900	39060	32940
II. Expenses											
Operating Expenses Labor											
Tractor Operation	1 hr @P3000/ha	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000
2nd Plowing	1 hr @P500/hr	500	500	500	500	500	500	500	500	500	500
Harrowing - Kuliglig	1 mmd@P 1000/mmd	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Leveling	1 mad @P500/md	500	500	500	500	500	500	500	500	500	500
Fixing Dikes	3 md	750	750	750	750	750	750	750	750	750	750

Item	Quantity	RC 222		RC 240		RC 214		RC 238		IR 42	
		With Mycorrhizae	Without	With Mycorrhizae	Without	With Mycorrhizae	Without	With Mycorrhizae	Without	With Mycorrhizae	Without
	@P250/md										
Pulling Seedlings	5md @P250/md	1250	1250	1250	1250	1250	1250	1250	1250	1250	1250
Transplanting	15md @P250/md	3750	3750	3750	3750	3750	3750	3750	3750	3750	3750
Weeding	2md @P250/md	500	500	500	500	500	500	500	500	500	500
Fertilizer Application	2md @P250/md	500	500	500	500	500	500	500	500	500	500
Harvesting	15md @P250/md	3750	3750	3750	3750	3750	3750	3750	3750	3750	3750
Hauling	2mad @P500/mad	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Threshing	10% of total harvest	8010	7500	8334	7884	7380	6570	7470	7290	3906	3294
Drying	5md @P250/md	1250	1250	1250	1250	1250	1250	1250	1250	1250	1250
Sub Total		25760	25250	26084	25634	25130	24320	25220	25040	21656	21044
III. Material Inputs											
Seeds	40 kg	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
Organic Fertilizer	16 bags @P320/bag	5120	5120	5120	5120	5120	5120	5120	5120	5120	5120
Complete Fertilizer	3 bags (14-14-14) @P1200/bag	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600
Urea	1 bag @P1,140/bag	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140
Sub Total		10960	10960	10960	10960	10960	10960	10960	10960	10960	10960
IV. Miscellaneous Expenses		2650	2650	2650	2650	2650	2650	2650	2650	2650	2650
Land Rent	30% of total harvest	24030	22680	25002	23652	21654	19710	22410	21870	11718	9882
Total Production Cost		63400	61540	64696	62896	60394	57640	61240	60520	46984	44536
Net Income		16700	14060	18644	15944	11786	8060	13460	12380	-7924	-11596
Return On Investment		**26.34%**	**22.85%**	**28.82%**	**25.35%**	**19.52%**	**13.98%**	**21.98%**	**20.46%**	**-16.87%**	**-26.04%**

Varietal preference

One of the most important components for establishing the acceptability of rice varieties is through evaluation of rice farmers/growers and consumers. 30 respondents were identified and invited to assess the acceptability of the tested rice varieties based on sterility, leaf senescence, phenotypic acceptability, panicle exertion and grain preference. Assessment was done one week before the scheduled harvesting. About 70% of the respondents prefer NSIC RC 240 because it is highly fertile for both treated and untreated with *Mycorrhizae* and for outstanding the other varieties. All of the tested varieties manifested an intermediate yellow upper leaf that reflected the gradual ageing of the plant during maturity. In terms of panicle exertion for both inoculated and not , farmers preferred NSIC Rc 222 and NSIC Rc 238. Thus, NSIC Rc 240 is the recommended rice variety to be grown under lahar condition and it must be inoculated.

Activity 2. Study on the Effect of Bioorganic Foliar Fertilizer on the Production of NSIC Rc240 RiceVariety for Lahar Soil.

Results of the study showed that plant height, panicle length and number of unfilled grains were not significantly affected with the application of foliar fertilizers but significantly affected in terms of number of productive tillers, number of field grains and yield per hectare at 5% level of significance.

The use of Fish Amino Acid (FAA) attained the highest number of productive tillers, highest number of filled grains/panicle and highest yield/ hectare with 4.87 per hill, 577.67 grains/panicle and 3.19 tons/ha respectively however, in terms of number of filled grains/panicle, the use of FAA is not significantly different with the use of IMO. Lowest yield was obtained from plants without any foliar fertilizer applied (table 5).Again, the use of FAA rendered the highest net income of PhP 14,765 equivalent to 34.61% return over the production cost of PhP 42,655. A negative return was obtained without application of foliar fertilizers (Table 6).

Table 5: Growth and yield performance of NSIC Rc240 applied with bioorganic fertilizers

Treatments	Plant Height (cm)	No. of Productive tillers	Panicle Length (cm)	Filled Grains (no)	Unfilled (no)	Percent Filled	Yield (ton/ha)
1 – No application	77.30	3.30	23.47	345.33cdef	205.00	62.75	2.02 ns
2 – Vermi Tea	84.47	3.97 abcd	23.60	389.10bcdef	131.20	74.78	2.75 abcd
3 – FFJ	94.17	4.63 ab	25.20	442.37bcd	134.43	76.69	2.98 ab
4 – IMO	84.97	3.70 cd	27.67	482.57a	178.73	72.97	2.90 abc
5 - FAA	84.50	4.87 a	25.33	577.67a	142.77	80.18	3.19 a
6 – Com. inorganic foliar fert.	89.44	3.67 cd	23.27	375.97bcd	145.77	72.06	2.66 abcde
7 - FPJ	82.90	4.17 abc	24.07	370.47bcde	179.50	67.36	2.39 abcdef
8 - LAS	84.30	4.07 abcd	24.60	411.97bc	161.07	71.89	2.54 abcdef
Mean	85.26	4.05	24.65	424.43	159.81	72.34	2.68

Table 6: Cost and Return Analysis of a Hectare Rice Applied with Bioorganic Foliar Fertilizers

Item	Quantity	No application	Vermi tea	FFJ	IMO	FAA	Com inorganic foliar fert	FPJ	Lactic acid serum
I. Gross Income (PhP)	Dry Wt in kg @P18.00/kg	(2.02 tons) 36,360	(2.75 tons) 49,500	(2.98 tons) 53,640	(2.90 tons) 52,200	(3.19 tons) 57,420	(2.66 tons) 47,880	(2.39 tons) 43, 020	(2.54 tons) 45,720
II. Expenses									
Operating Expenses Labor									
Tractor Operation	1 hr @P3000/ha	3000	3000	3000	3000	3000	3000	3000	3000
2nd Plowing	1 hr @P500/hr	500	500	500	500	500	500	500	500
Harrowing - Kuliglig	1 mmd @ P1000/mmd	1000	1000	1000	1000	1000	1000	1000	1000
Leveling	1 mad @P500/md	500	500	500	500	500	500	500	500
Fixing Dikes	3 md @P250/md	750	750	750	750	750	750	750	750
Pulling Seedlings	5md @P250/md	1250	1250	1250	1250	1250	1250	1250	1250
Transplanting	15md @P250/md	3750	3750	3750	3750	3750	3750	3750	3750
Weeding	2md @P250/md	500	500	500	500	500	500	500	500
Fertilizer Application	2md @P250/md	500	500	500	500	500	500	500	500
Harvesting	15md @P250/md	3750	3750	3750	3750	3750	3750	3750	3750
Hauling	2mad @P500/mad	1000	1000	1000	1000	1000	1000	1000	1000
Threshing	10% of total harvest	8010	7500	8334	7884	7380	6570	7470	7290
Drying	5md @P250/md	1250	1250	1250	1250	1250	1250	1250	1250
Sub Total		25760	25250	26084	25634	25130	24320	25220	25040
III. Material Inputs									
Seeds	40 kg	1200	1200	1200	1200	1200	1200	1200	1200
Organic Fertilizer	20 bags @P320/bag	6400	6400	6400	6400	6400	6400	6400	6400
Complete Fertilizer	1 bag(@P1200/bag	1200	1200	1200	1200	1200	1200	1200	1200
Urea	3.25bag@P1,100/bag	3575	3575	3575	3575	3575	3575	3575	3575
Foliar fertilizer	10 L	0	3000	1750	1200	2500	4500	1300	2000
Sub Total		14775	12375	14125	13575	14875	16875	13675	14375
IV. Miscellaneous Expenses		2650	2650	2650	2650	2650	2650	2650	2650
Total Production Cost		43185	40275	42859	41859	42655	43545	41545	42065
Net Income		-6825	9225	10789	10341	14765	4335	1475	3655
Return Over Production Cost		**-15.80%**	**22.90%**	**25.17%**	**24.70%**	**34.61%**	**9.96%**	**3.55%**	**8.69%**

Activity 3: Validation of Rice-based Cropping Pattern in Lahar Laden Areas

The conversion of irrigated riceland into a rainfed one due to lahar deposits makes the area unproductive for two cropping seasons, hence, a shortage in rice supply. It is this context that the development of cropping pattern was conceptualized and developed. The effectiveness of the developed rice-based cropping pattern was validated and evaluated based on profitability.

Pre –Implementation

The project was properly coordinated at the DA-LGU of Botolan, San Narciso and San Marcelino, Zambales. Data on the hectarage of lahar affected areas and list of farmers affected were obtained. Together with the farmer leaders and agricultural technicians in each municipality, the validation of farmers and farms were scheduled.

Orientation-Workshop

After the identification of cooperators, an orientation workshop along with MOA signing were conducted prior to the rice planting season (main crop). The full package of technology was discussed as well as the monitoring schemes.

Farmer Cooperators

Out of the 79 participants, 38 were selected as cooperators, 14 from Botolan, 16 from San Narciso and 7 from San

Marcelino, Zambales. They were selected as cooperators following the criteria:

- Area is affected by lahar
- He/she willing to use and the technology
- He/she is willing to accept the terms and conditions of the project regarding production expenses
- He/she is willing to conduct field day

Selection of cooperators was done in coordination with the Municipal Agriculture Office. Ocular inspection to the identified sites were done with the assistance of the Office of the Municipal Agriculturist. Each cooperatorwas provided with initial input (seeds, fertilizers and chemicals). The proceeds of which was plowed back for the succeeding production season for sustainability. Regular monitoring was done to ensure application of the technology.

Farmer cooperators briefing and orientation

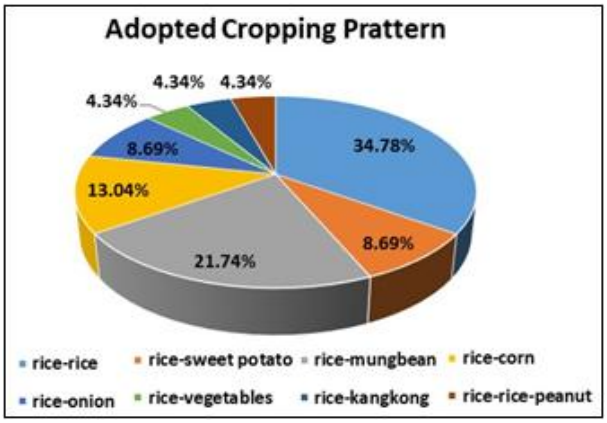

Figure 2: Percentage of farmer adopters

Out of the 38 selected cooperators, 23 of them signed the Memorandum of Understanding, there were nine from Carael, Botolan, 8 from Grullo, San Narciso and six in Burgos, San Marcelino. There were eight (34.78%) who adopted the rice-rice cropping pattern, two (8.69%) followed the rice-sweet potato cropping pattern, five followed the rice-mungbean cropping, three (13.04%) followed the rice-corn cropping pattern, two (8.69%) followed the onion cropping pattern but was not able to continue because of insufficient water supplyand one (4.34%) followed the rice-rice peanut cropping pattern.

It was observed that planting of rice after rice in an area without irrigation rendered negative net income while that with irrigation had more than PhP 30,000 of net income and a third crop is also possible. Rice crop followed with sweet potato as second crop gave the highest net income at PhP 68,173.80.

Based on the cost and return analysis, the rice-rice cropping pattern is possible on areas where water is sufficient. Other crops like sweet potato and upland kangkong are also possible since their water requirement are lesser than rice. Rice-rice-peanut is also possible in areas where water system is available. Compared to the previous harvest, an average increase in income of Php 31,466.00 for the rice-rice cropping pattern in areas where lahar deposit is below 20 cm and Php 19,951.16 in areas where lahar is higher than 20cm are obtained. For the Rice-sweet potato pattern an increase in income of Php 50,206 is possible. Planting of Upland kangkong after rice gained an increase in income of Php 6,225.00. In areas where Rice-rice-peanut pattern was applied, an increase in income of Php 3,780.83 was gained.

Table 8: Cost and Return Analysis for each cropping pattern applied

Particulars	Manuel Diez	Enrique Diez	Laureano Evangelista	Nestor Duron	PRMSU
Baseline (before)					
Harvest (kg)	1500	2000	2000	3800	3335
Income (17.00)	25,500.00	34,000.00	34,000.00	64,600.00	56,695.00
Expenses	32,000.00	33,400.00	33,400.00	33,200.00	24,825.00
Net Income	-6500.00	600.00	600.00	31,400.00	31,870.00
RAC (%)		1.80	1.80	94.58	128.38
INTERVENTION	Rice-Rice	Rice-Sweet Potato	Rice-rice	Rice-Upland Kangkong	Rice-rice-peanut
	3600	4266.67	5200	3400	2772
	61,200.00	72533.00	88.400	57,800.00	64,124.00
	29,500.00	39,093.33	45,898.67	32,550.00	25,000.00
	31,700.00	33,439.67	42,501.33	25,250.00	39,124.00
	107.45	85.53%	92.59	77.57	156
2nd Crop					
Harvest (kg)	4160	102.4 sacks	1920	20000 bundles	3515
Income (17.00)	70,720.00	81,920.00	32,640.00	100,000.00	59755.00

Expenses	39488.00	13,746.20	35239.00	50,000.00	24,825.00
Net Income	31,232.00	68,173.80	-2,599	50,000.00	34,930.00
RAC (%)	79.09	495.95		100	140.70
3rd Crop					
Harvest (kg)					1,847.82
Income (40.00)					73,913.00
Expenses					41014.49
Net Income					32,898.51
RAC (%)					80.21

Based on partial budget analysis, planting of sweet potato and upland kangkong after rice were more profitable than second crop of rice. Likewise, planting of rice as 2nd crop and peanut as 3rd crop was the most profitable.

Table 9: Partial Budget Analysis for each of the Cropping Pattern Applied

Rice–Rice Cropping Pattern

Income reducing	Amount (Php)	Income increasing	Amount (Php)
Added Cost		Added Return	
Planting of rice after rice	37,363.50	Sales	51,685.00
Total	37,363.50		51,685.00
Net Financial Impact = PhP51,685.00 – 37,363.50 = PhP 14,321.50			

Rice-Sweet Potato Cropping Pattern

Income reducing	Amount (Php)	Income increasing	Amount (Php)
Added Cost Planting of Sweet Potato after rice	13,746.20	Added Return Sales	81,920.00
Total	13,746.20		81,920.00
Net Financial Impact = PhP81,920.00– 13,746.20 = PhP68,173.80			

Rice- Upland Kangkong Cropping Pattern

Income reducing	Amount(Php)	Income increasing	Amount (Php)
Added Cost Planting of Upland Kangkong after rice	50,000.00	Added Return Sales	100,000.00
Total	50,000.00		100,000.00
Net Financial Impact =PhP 100,000.00 –50,000.00= PhP50,000.00			

Rice-rice-peanut cropping pattern

Income reducing	Amount (Php)	Income increasing	Amount (Php)
Added Cost		Added Return	
Planting of rice after rice	24,825.00	Sales	59755.00
Planting of peanut after rice (2nd crop)	41014.49		73,913.00
Total	65,839.49		130,668.00
Net Financial Impact = PhP130,668.00 –65,839.49= PhP64,828.51			

4. Conclusion Recommendation

Farming practices of farmers affected with lahar was assessed. It was found out that most of the farmers aged 54 years old, graduate of elementary school, members of an organization, attended Farmer's Field School but were tenants or lease-holders of 1 to 2 hectares farm. They employ either direct or transplanting method at a distance of 20cm x 20cm. Land preparation is largely mechanized except for land levelling which is done with the use of carabao-drawn tooth harrow. Farmers depend largely on chemical fertilizers and pesticides. Rice crops are harvested using a reaper or combine. Sun-drying method to reduce moisture content is still prevalent.

To increase productivity of lahar laden farms, the application of organic fertilizer and inorganic fertilizer as recommended based on soil analysis be employed with the addition of MykoPlus as inoculant using inbred rice varieties. The use of MykoPlus from Biotech was tested using five inbred rice varieties. It was found out that Rc 240 had the best performance in terms of growth and yield with the highest yield of 4.5 tons per hectare. The use of bioorganic foliar fertilizer Fish Amino Acid at the rate of 1 liter per hectare mixed with water at the ratio of 1:20 sprayed to the plants every 10 days until flowering increased yield.

The technology developed on the use of Mykoplus with organic and inorganic fertilizers were showcased through the establishment of 6 demo farms and were adopted by 38 farmers from Botolan, San Marcelino and San Narciso. The average yield of farmer cooperators before the project implementation was 2,527 kg/ha but after the implementation of the project their rice production was increased to 3,319 73 kg/ha with a percentage increase of 31.37%. The soil properties before and after the application of the technology was determined through soil analysis. It was found out that the percentage of OM increased from 0.77 to 1.56 percent, the Phosphorous content increased from 16 ppm to 168 ppm and Potassium content increased from 40 ppm to 130 ppm.

Secondary crops such as sweet potato, kangkong, or peanut can be planted after rice to increase income of farmers using the production guide.

It is then recommended that Mycorhizaeas bioorganic fertilizer be used in addition to the use of organic and inorganic fertilizer based on soil analysis to increase yield of rice. The use of Fish Amino Acid at the rate of 1 liter per hectare mixed with water at the rate of 1:20 parts can be used as foliar bioorganic fertilizer applied every 10 days until flowering. Sweet potato, kangkong or peanut can be planted to have additional income; thus, increasing the productivity of the lahar laden farms.

References

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