International Journal of Agriculture Innovations and Research
Volume 5, Issue 5, ISSN (Online) 2319-1473
Manuscript Processing Details (dd/mm/yyyy) :
Received: 06/03/2017 | Accepted on : 11/03/2017 | Published : 08/04/2017

Rice-Production Practices of Mt. Pinatubo Lahar-Affected Areas in Central Luzon, Philippines

Susana S. Garcia, Dinah E. Abugho and Elizabeth N. Farin*
Research, Extension, Training & Production Department, Ramon Magsaysay Technological University, Iba, Zambales, 2201 Philippines.
*Corresponding author email id: elizabethnfarin@yahoo.com

Abstract **– Rice production in the lahar-affected areas remains the primary source of income in the Philippines. The study was conducted to characterize the farming practices of rice growers in the lahar affected areas Zambales, Tarlac and Pampanga which were severely affected by lahar. Most of the rice farms used for rice production were rainfed and irrigation was supplemented by water pump. Most of the farmers practiced direct seeding due to problem of water availability, land preparation was mechanized for most and the most popular rice variety planted was NSIC-Rc. The rate of fertilizer application was lower than the recommended rate of fertilizer for rice and did not use organic fertilizer. Insecticides were used to control insect pests and herbicides to control weeds. Most of the farmers experienced a reduction of rice yield before and after the lahar flow. In terms of costs and return analysis, farmers in the lahar affected areas had higher net return than in the 2012 average net return in the whole Central Luzon.**

Keywords **– Practices, Rice Production, Mt Pinatubo, Lahar Affected Areas**

I. INTRODUCTION

Rice remains the most important crop in the Philippines as it is the staple of majority of the Filipinos. Rice production is best suited in region 3 owing to its generally plain topography and having endowed with Type A climate that leaves the farmers almost no choice to plant during the rainy season, but rice. The central plains of Luzon is dubbed the rice granary of the region.

However, extensive areas of agricultural land in the region were covered with varying depths of Mt. Pinatubo volcanic materials in 1991 and during the subsequent mud flow in 1993 and 1996. Heavy downpour caused mud flow to cascade from the slopes of the volcano through river systems to as far as 50 km from the mountain (Reyes & Neue, 1991) and the area affected by mud flow increased with every rainy season for 3 to 10 years after the eruption. Consequently, low-lying rice lands were buried with lahar and the most affected were the provinces of Pampanga (Bacolor, Sta. Rita, Guagua, Cabalintian and Floridablanca), Tarlac (Capas, Bamban, and Concepcion) and Zambales (San Marcelino, San Narciso and Botolan), all leading rice-producing areas (Reyes and Neue, 1991). Volcanic ash from Mt. Pinatubo is low in fertility but potentially fertile material upon weathering (Reyes and Neue, 1991). At the start, rice planted on lahar without fertilization did not grow beyond three weeks thus no yield. Application of conventional fertilizers at 150-150-200 do not support rice growth but produced relatively higher when same rate were applied at controlled frequencies (Samonte, et al, 2004). One of the most important problems that beset the mud flow ravaged areas is the lack of water resulting from the siltation of irrigation canals to continue with rice production. The environment that was created by ash fall and mud flow had affected the lives of the people living in the area, particularly, the method of food production to employ such as land preparation, crop establishment and cultural management of crops.

In this regard, various rehabilitation initiatives were conducted particularly, research and development (R & D), to support in the early recovery of mud flow affected communities. According to Yoshinaga (1994), natural regeneration of soil productivity is a long process (100-500 years) as observed in Japanese volcanic soils so that accelerated rehabilitation program would be more suitable to provide greater impact on food production. In Zambales, Tarlac and Pampanga, rehabilitation program initiated by the government like the Department of Agriculture includes the scraping of volcanic debris in shallow mudflow areas and introduction of new crops after rice. Twenty five years later, with so many intervention programs implemented by the government and other concerned sectors and groups, much improvement have taken place in the mudflow stricken rice farms and farming practices may have normalized already.

II. IMPORTANCE OF THE STUDY

This study was conducted to document and assess the practices in rice-basedcropping systems in lahar-affected areas in three provinces of Region 3, Philippinesto provide benchmark data for the continuing efforts to rehabilitate mudflow stricken areas from Mt Pinatubo eruption. It is expected that the study will identify farmers' problems as basis in providing assistance to increase rice productivity in these areas.

III. MATERIALS AND METHODS

Study Sites

The study was conducted in the three provinces of Central Luzon that were heavily affected by lahar namely : Bataan, Pampanga and Zambales (Fig. 1).

International Journal of Agriculture Innovations and Research
Volume 5, Issue 5, ISSN (Online) 2319-1473

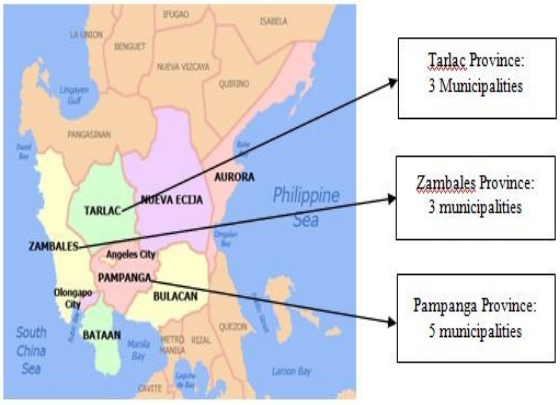

Fig. 1. Project location map

IV. Research Design, Data Gathering and Analysis

Descriptive research was used in this study with survey questionnaire as the major instrument 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 determine the income of farmers from rice production in lahar- affected areas.

Proper coordination with the respective Department of Agriculture –Provincial Agricultural Office and Local Government Unit(DA-LGU) was done to select the respondents of the study and assist in identifying the barangays that were affected with lahar.

V. Respondents

A total of 240 rice farmers were selected from the list of respective DA-LGU as respondents of the study. Simple random sampling was employed using the Slovin formula.

VI. Results and Discussion

Economic characteristics of farmers

The primary source of income of the farmers is rice farming providing at least 12% of their total income as of the study period. Fishing among few farmers provides their major livelihood. There are other various sources of income of the farmers in general to include animal raising, vegetables and other crops production and employment in agriculture and non-agriculture related works (Table 1).

Table 1. Income of farmer respondents from different sources in lahar-affected areas.

Barangay	Source													
	Crop Farming			Animal Raising						Farming Related	Non-farm			
	Rice	Vegetable	Other Crops	Swine	Poultry	Goat	Cattle	Carabao	Fishing	Employment	Employment	Sari-sari Store	Tricycle Operation	Others
1	47,261.54	15,62.00	26,125.00	38,750.00	17,000.00	20,400.00	79,000.00			6,250.00	216,000.00			141,625.00
2	53,182.50	11,812.50	57,045.45	3,000.00	2,250.00	6,620.00	36,000.00	19,200.00						
3	45,558.33													
4	21,067.14	7,737.14	15,270.00	5,111.11	1,514.29	7,500.00	31,000.00		10,000.00		19,302.00	6,600.00	6,000.00	23,000.00
5	35,731.58	15,000.00				4,000.00								
6	15,684.62	1,137.50	17,666.67	2,333.33	3,000.00	5,416.67	15,000.00	8,000.00				5,000.00	200.00	8,250.00
7	25.866.67	11,795.00	16,000.00	14,000.00	1,666.67		22,857.14			2,000.00	3,768.50			9,000.00
8	26,830.00	9,000.00	10,000.00	21,000.00	39,360.00	4,500.00				15,000.00	127,892.67			
9	30,166.67	3,000.00		8,000.00	2,000.00	8,000.00	21,666.67							
10	40,050.00										50,000.00			
11	106,500.00	20,000.00	69,375.00											
12	70,478.00	42,950.00	60,000.00	2,000.00	7,366.67	5,666.67	30,000.00			9,466.67	19,600.00		15,000.00	
13	59,680.00				1,600.00	2,000.00	20,000.00	24,000.00		11,000.00	2,000.00	3,000.00	5,250.00	15,000.00
14	72,340.00	6,800.00	4,666.67	31,000.00		10,000.00	24,600.00		3,000.00	24,500.00		23,250.00		80,500.00
15	71,904.17	11,750.00		50,000.00		15,000.00	27,500.00	40,000.00	300.000.00	8,333.33		11,250.00	18,000.00	120,000.00
16	87,0000.00	24,250.00	45,000.00	30,000.00	32,000.00		15,000.00	54,833.33			30,000.00	20,000.00	31,833.33	
17	107,666.67	50,000.00		40,000.00				250.000.00						
total	**922,967.88**	**230.857.14**	**321,148.79**	**245,194.44**	**107,757.62**	**89,103.33**	**322,623.81**	**396.033.33**	**313,000**	**76,550.00**	**468,563.17**	**69,100.00**	**76,283.33**	**397,375.00**
mean	**54,292.23**	**16,489.80**	**32,114.87**	**20,432.87**	**10,775.76**	**8,100.30**	**29,329.44**	**66,005.56**	**104,333.33**	**10,935.71**	**58,570.40**	**11,516.67**	**12,713.89**	**56,767.86**

Farm Holdings and Tenurial Status of Respondent

Majority of the farmers till an area of 1-2 hectares asowners (36%), tenants (59%) and leaseholder (40%) while there is slightly higher percentage (37) of farmers who owns less than a hectare. Many have farms of less than one hectare whether owned, leased or tenanted (Table 2). The farmers can be owners of the farms they till and tenant or leaseholder at the same time. Very few farmers

own and till an area of 5 hectares and above.

Table 2. Farm area and tenurial status of farmers.

Farm Area (HA)	Tenurial Status							
	Owned		Leasehold		Tenanted		TOTAL	
	F	%	F	%	F	%	F	%
>6	0	0	0	0	1	1	1	0.3
5-6	8	5	1	5	6	4	15	5
3-4	28	18	6	32	25	19	59	19
1-2	60	39	8	42	62	46	130	42
<1	59	38	4	21	41	30	104	
TOTAL	**155**	**100**	**19**	**100**	**135**	**100**	**309**	
Grand Total – 319*								

Farm Implements/Equipment Owned and Used by Farmer Respondents

More farmers have sprayer (knapsack), native plow and harrow being utilized as farm implements with majority of them having a unit (92%), two units (6%) and three units (2%) of it (Table 3.) These appears to be the basic farm tools/implements of farmers not only in lahar-affected areas but in almost all rice growing regions in the country.

Table 3. Farm Implements Owned and Used by Farmers.

Farmers Farm Implement	1 unit		2 unit		3 unit		>3 unit		TOTAL	
	F	%	F	%	F	%	F	%	F	%
a. Tractor/ hand tractor	64	90	7	10	0	0	0	0	71	100
b. Irrigation Pump	67	93	5	7	0	0	0	0	72	100
c. Sprayer	151	92	10	6	4	2	0	0	165	100
d. Plow	139	89	11	7	7	4	0	0	157	100
e. Harrow	121	88	16	11	1	1	0	0	138	100
f. Carabao (Draft Animal)	92	60	23	15	19	13	18	12	152	100

Carabao as a draft animal is also owned by some farmers with some having three heads of the animal. Carabao-drawn harrow particularly, the comb-tooth, is necessary in levelling the farm for transplanting rice seedlings which cannot be done effectively with hand tractors. With the increasing number of farmers using direct seeding in rice production, carabao may reduce its utility among rice farmers in the future.

B. Management Practices Employed

Method of Planting

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.

The method of planting rice in lahar-affected areas did not change much before lahar and after the lahar flow in the study areas. However, practice of direct seeding method in lahar-affected areas is increasing, presumably due to the change in the environment.

Land Preparation

Land preparation is largely mechanized except for levelling, the last operation which 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.

Variety Used and Source of Seeds

The variety used for planting by most rice farmers is the NSIC-Rc (83%) followed by IR 42 (7%) and other varieties (Table 4).The seeds are sourced from DA (RFO3/PAO/LGU) (58%), from co-farmers, recycled or exchange (44%) and the rest from the market, RMTU and other sources (25%).

Table 4. Rice Varieties Used for Planting

Variety	Frequency	Percentage
NSIC-Rc	156	83
Pigmented	2	1
Grain Super Rice	3	1
Hybrid	6	3
IR 42	16	7
Others	11	5
TOTAL	**224**	**100**

Nutrient and Water 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. supplied by 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 so irrigation water is supplemented by water pump.

Control of Major Pests of Rice

The major insect pests identified by farmers attacking their crops are hoppers, stem borers, armyworms, looper, leaf folder, caseworm and bugs. Insecticides (at least 2 liters per ha.) are commonly used to control insect pests. The farmers are very much aware of the ill effects of chemical sprays to human health and the environment, but these are extensively used since these are available and easily accessible compared to alternative means of controlling insect pests. Herbicides are also used for weed control at the rate of 1-2 liters/ha. especially for directly-seeded crops.

Harvesting and Postharvest Management Practices

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.

International Journal of Agriculture Innovations and Research
Volume 5, Issue 5, ISSN (Online) 2319-1473

In most farms in Tarlac, harvests are sold to machine owners, who are also traders, fresh weight just after sharing to eliminate the burden of drying. However, sun drying is still prevalent using highways and sidewalks.

Rice Yield

Palay yield before the Pinatubo eruption was recorded at below 30- 200 cav/ha with more farmers obtaining a yield ranging from 101-200 cav/ha. The mean yield was recorded at 82.65 cav/ha. Few years after the lahar flow incidence, farmers obtaining 101-200 cav/ha decreased by 79% while those producing 30 cav and below increased by 79% also. After mudflow, the mean yield was 61.02 cav/ha. (Table 8) and most farmers are harvesting 51-80 cav/ha. compared to 101-200 cav/ha before the Mt Pinatubo eruption.

In general, rice production in the lahar-affected areas in Region 3 has gained momentum but have yet to recover the before lahar yield per hectare data. The recorded mean yield of 82.65 cav./ha. is a little lower (<13%) compared to the Central Luzon data of 4.8mt or 96 cav/ha. (CL Profile, 2013).

Table 5. Rice Yield Before and After Lahar Flow

Rice Yield (cav/ha.)	**Before Lahar Flow**		**After Lahar Flow**		**% Increase/ (Decrease)**
	F	%	F	%	
101-200	47	23	10	6	**(79)**
91-100	28	14	10	6	(64)
81-90	18	9	9	5	(50)
71-80	23	11	26	15	11
61-70	13	7	24	14	46
51-60	23	11	28	16	18
41-50	19	10	20	11	5
31-40	24	12	20	11	(16)
30& below	6	3	28	16	**79**
Total	**201**	**100**	**175**	**100**	

Mean Yield/Ha. Before lahar flow=82.65 cav/ha
Mean Yield/ha. After lahar=61.02 cav/ha

Current Cost return analysis for one hectare rice production in lahar-affected areas

Simple cost return analysis on a particular farm in Bamban, Tarlac yielded higher production and net return per hectare compared to the Central Luzon 2012 profile both for transplanted and directly-seeded crops. Zambales on the other hand, recorded Lower Return Above Cost compared to Tarlac and CL-2012 data (Table 6). This implies that lahar-affected areas have almost recovered from the negative effects of lahar flow and rice productivity may even improve in the near future if problems being raised by farmers will be properly addressed.

Table 6. Palay Costs and Returns of Production in Central Luzon and Lahar-affected areas.

Item	**Central Luzon yield in 2012**	**Lahar –Affected Areas**	
		Tarlac	**Zambales**
Cost of Production	53, 835.00	37,488.00 (Direct Seeding) 43,288.00 (Transplanted)	38,101.00
Net Returns	30, 333.00	40,712.00 (Direct Seeding) 34,912.00 (Transplanted)	14,964.51
RAC	56.34%	108.6% (Direct Seeding) 80.6% (Transplanted)	39.27%

Problems Encountered by Farmers in Lahar-Affected Areas

Problems among rice farmers in lahar affected areas based on direct observation and interview of farmers include high input cost, relatively low support price for palay, inadequate credit support for the purchase of production inputs, poor access to good quality seeds and postharvest and low infrastructure support such as irrigation and postharvest facilities. Rice production practices follows the conventional method with increasing number of farm mechanization for land preparation and harvesting practices.

VII. Summary

Yield before and immediately after the lahar incidence decreased (26%) quite significantly. However, with rehabilitation initiatives from concerned agencies, rice yield is almost back to the original data. Recent Cost-Return analysis in Tarlac obtained 80.6% RAC for transplanted and 108.6% for directly seeded rice which is higher than the Central Luzon data with 56.34% RAC. Zambales however recorded a lower RAC (39.27% compared to CL-2012 data.

VIII. Conclusion

Rice farming is the primary source of income among the farmers in lahar-affected areas of the region with very few along the coastal areas of Zambales who are engaged in fishing. Generally, the respondents are small-scale farmers with most tilling 1-2 hectares of land either as landowner, tenant or leaseholder.

Acknowledgement

This research was part of the project Enhancing the Productivity of Lahar - Affected Areas in Central Luzon, Philippines funded by the Department of Agriculture Regional Field Office.

Conflict of Interest:
There was no conflict of interest in conducting the research.

REFERENCES

[1] **Dacanay, E.V**. 1997. Restoring the productivity potential of Mt. Pinatubo-affected soils. Volume 78 of the series Developments in Plant and Soil Sciencespp 557-558

[2] **Mercado, R.A, Bertram J.T. Lacsamana, and Pineda G.L.** 1999. https://pubs.usgs.gov/pinatubo/mercado/

[3] **Philippine Statistics Authority**. 2013. Regional Profile Central Luzon 2013

[4] **Reyes R.Y and Neue, H.U**. 1991. Characterization of the Volcanic Ejecta from Mount Pinatubo and Its Impact on Rice Production. Philippine Journal Crop Science 1991. 16(2) 69-73

[5] **Samonte, H.P, Sheehy, J.E, Minzava, M, Cassman, K.G, Mitchell, P.L, Pablico, P, Robles, R.P, Lales, J.S, Ferrer, A.B**. 2004. Temporal origin of nitrogen in the grain of irrigated rice in the dry season: the outcome of uptake, cycling, senescence and competition studied using a ^{15}N-point placement technique. http://www.sciencedirect.com/science/journal/03784290.

[6] **Yoshinaga, N., Henmi, T., Nakai, M., Nakata, T.**1994. Removal of Phosphorus by Utilizing Clays of Volacanic Ash Soil and Weathered Pumice. Memoirs of the College of Agriculture, Ehime University, pp. 17-24