ENHANCEMENT OF FARM HOUSEHOLD INCOME AND FOOD SECURITY THROUGH INTEGRATED CROP MANAGEMENT FOR INDIGENOUS AND HIGH YIELDING RICE VARIETIES

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ABSTRACT

The study was conducted from April 2010 to December 2011 at the province of Ifugao, Cordillera region, Philippines with the objectives of increasing farm household income and sustained food for the family through integrated crop management practices and organic farming. The study made use of wild sunflower leaves (Tithonia diversifolia), Madre de Cacao leaves (Glicidia sepium), indigenous microorganism (IMO), Papaya Fruit Extracts (FPJ) and botanicals as sources of fertilizer and pesticide to reduce cost of synthetic pesticides and fertilizers. Integrate shells, watercress and other vegetables in farmer’s rice field as additional sources of income and food for the family.

Data on the socioeconomic profile of farmers in the study sites showed an average household number of 8 and consumed their rice harvest for an average of seven (7) months with an average income of P3,555.00/cropping.

The experiment conducted in farmer’s field showed a yield increase for indigenous rice varieties fertilized with organic fertilizers to a highest of 48.64 % and lowest of 8.65 %. Highest net income increase of 75 % and lowest of 0.94 %, highest ROI of 135 % and lowest of 84 % was realized. An increased yield of 22.8 %, highest net income of 62 % and return on investment (ROI) of 560 % was realized for high yielding rice varieties.

Integrating fishes, shells and vegetables in the farm has added income ranging from P 415.00 to P1,840 pesos per cropping giving a net income increase ranging from 23 to 58 %.

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INTRODUCTION

Rationale

Poverty is a widespread phenomenon in the Philippines compared to other Southeast Asian countries, currently, Philippine has a higher poverty rate both in national and international measures (Le Thi Lam, 2005)

More than 70% of the poor in the families live in rural areas. Poor households derive income from entrepreneurial activities mainly farming, fishing, trade, construction and transport system. The number of poor families reached 5.1 million up by 628 thousand families (source: National Statistic Office, FIES, 2000).

Poverty in rural areas is pervasive and persistent. Roughly two-thirds of the entire population of Filipino poor resides in rural areas. Indeed, four out of 10 rural families are poor. The rural poor consist mostly of small and landless farmers, farm workers, fisher folks, and indigenous persons (Lorenzo 2007).

In the Cordillera Administrative Region (CAR), the percentage of families below the poverty threshold based on the National Statistics Office, 2005 Family Income and Expenditures Survey (FIES) was 33 percent.

Ifugao is a province situated in the central Cordillera region in North Luzon. The geography of the area is characterized by mountains and an extensive system of the rice terraces. These rice terraces are considered to be one of the best-built soil and water structures and were awarded with the status of being a UNESCO world heritage site in 1996. Local culture is built up around the rice production, with various cultural expressions among the Ifugao people.

State of the Art

Ifugao are among the 10 poorest provinces in the country with a total population of 180,711 people living on a 251,778 hectares of land, with an agricultural land area of 25,290 hectares. Of its 11 towns, only two can be considered urban areas. The average family size in the province hews close to the national figure of five to six members, but in some towns, the poorest families can have as many as a dozen (Cimatu, 2007).

Rice is the major source of food and income of the people hence rice production in Ifugao province ranks number one in terms of area planted. Of the total agricultural areas of 25,290 hectares, 15,883 hectares are planted with irrigated and non-irrigated rice (Source: National Statistics Coordination
Board (NSCB), 2003). Indigenous rice varieties occupy a total area of 17,175 hectares, the rest of the areas are planted with high yielding rice varieties (source: Bureau of Agricultural Statistics, Ifugao 2005).

The low yield of indigenous rice varieties is associated with poor soil fertility. The continuous cultivation for hundred of years may have depleted soil fertility and organic matter content of the soil resulting to low or poor tillering ability of the rice plants that eventually affect yield. High yielding varieties on the other hand require high inputs for high yield.

The problems on low rice production, high cost of inputs for high yielding varieties, technical assistance to farmers and capability building remains a challenge to the local government and institutions in agriculture.

Analysis of the Problem

In a study conducted by the proponent in 2006, titled “Native Rice Based Farming System in Ifugao” it was found that farmers own an average rice paddy that ranges from 1000-2000 square meters to feed an average family of six (6) children. Majority (52 %) derived their income from farming aside from rice production with an annual household income of less than 80,000.00 pesos. Problems associated with indigenous rice production are low yield, presence of giant earthworms, diseases, natural calamities and others. However, low yield comprises the main problem in indigenous rice production. In an effort to increase food supply about 40 % of the traditional farmers plant high yielding varieties as a second crop after indigenous rice. Unfortunately, high yielding rice varieties require high inputs of fertilizers and pesticides and besides, these inputs particularly synthetic pesticides are harmful to the health of the family and the environment as a whole. The cost of inorganic fertilizers and pesticides are rising up and farmers can no longer afford to buy these inputs.

With this background, concern from the national, local government, private sectors and international institution is urgent to help provide immediate short term, and more importantly, long term sustainable solution to this food crisis and help farmers increase yield and farm household income.

Conducting researches on how to increase yield using natural/organic resources available in the community and integrating other crops, edible fishes and shells in the farm is a collective effort to alleviate the socioeconomic status of the rural people. Thus, this study was conducted with the following goals and objectives.
Objectives

1. Determine the potential of wild sunflower leaves (*Tithonia diversifolia*) leaves, “Madre de cacao” or “kakawate” (*Gliricidia sepium*) indigenous microorganism (IMO), Papaya Fruit Juice (FPJ) and Banana Fruit Juice as sources of fertilizers to increase yield for indigenous rice and reduce cost of production for high yielding rice varieties.

2. Assess the efficiency of nine (9) indigenous botanical pesticides in the management of insect pests, diseases, rodents, golden apple nail and other endemic pests.

3. Evaluate the cost and return analysis of integrating water cress, indigenous fishes and shells in the rice field.

Review of Literature

Rice is the major source of food and income of the people hence rice production in Ifugao province ranks number one in terms of area planted. Of the total agricultural areas of 25,290 hectares, 15,883 hectares are planted with irrigated and non-irrigated rice (Source: National Statistics Coordination Board (NSCB), 2003). Indigenous rice varieties occupy a total area of 17,175 hectares, the rest of the areas are planted with high yielding rice varieties (source: Bureau of Agricultural Statistics, Ifugao 2005).

Natural organic farming system is a technology in agriculture that uses environmentally sound techniques for crops that are free from most synthetic pesticides, growth hormones and fertilizers. Organic farming typically relies on pesticides and fertilizers derived from plants, animal waste, and minerals. They incorporate biological methods, such as the use of one organism to suppress another, to help control pests. The methods used in organic farming seek to increase soil fertility, balance insect population, and reduce air, soil and water population (Winter C. 2000).

Organic farmers rely on locally available natural resources to maintain soil fertility and to combat pests and diseases (Chin L. 2002).

Organic rice is fat free and has high carbohydrate content. Red and brown rice have higher fiber value than white rice. When 45 grams of organic rice is eaten, 160 calories of carbohydrates is consumed. Organic rice has low sugar content. Studies in North America show that the coarse grind and low sugar content of organically processed cereals and breads results in less tooth decay. When a child or adult eats a high sugar food item, the pancreas produces too much insulin, causing blood-sugar level to drop. This short change produces the brain of glucose which results in mood swings and an inability to concentrate. (Source: [http://www. Phippscountry.com/ricelist.htm](http://www.Phippscountry.com/ricelist.htm)).
Agriculture Secretary Arthur Yap encouraged the country’s 1.87 million hectares of rice farms nationwide to go organic as one of the government’s roadmaps to address poverty and hunger. The secretary gave full support to the advocacy of various local governments units and academe and promotes organic farming to help solve the country’s food crisis (Agriculture Philippines, News, Empowering Filipino Farmers, Oct. 6, 2008).

The fertilizer value of wild sunflower has been confirmed in recent researches done by the Department of Agriculture-Philippine Rice Research Institute (DA-PhilRice, 2002).

PhilRice researches have found that wild sunflower leaves have high nitrogen content (2.9 percent oven dry weight) and that fresh sunflower leaves can give an equivalent of 60 N kg/ha. In rice seedbeds, wild sunflower is incorporated into the seedbed to serve as fertilizer for the rice seedlings. From 15 to 25 pieces of sunflower tops are needed to fertilize a square meter of the seedbed.

In irrigated lowland rice paddy, sunflower is applied eight days before transplanting or during the last harrowing to maximize the nitrogen it releases. Aside from being locally available and for free, wild sunflower easily decomposes (7-10 days) and also hastens the decomposition of other weeds. In sloping mountains, it helps prevent soil erosion.

Botanical pesticides are numerous in the province, in a research conducted by the proponent titled “Survey and Characterization of Botanical Pesticides in Ifugao”, in one town alone there are about 38 botanicals found in which many farmers are not aware of its importance in agriculture.

**Conceptual Framework**

Rice is the major source of income for millions of farmers in the country. Increasing yield of rice through the use of natural or organic source of inputs is sustainable and economical hence, promote food security and increase income of farm household.

The province is blessed with numerous plant species that ranges from grasses, herbs and trees that serve as sources of inputs in rice farming.
MATERIALS AND METHODS

Collection of socioeconomic data

Social and economic data collection was conducted on April and May 2010 in four barrios in four municipalities where the project was conducted.

The data gathered were the following:

a. Farm size in square meters.
b. Household income per year from rice and other sources.
c. Cost of labor and material inputs in rice production.
d. Yield of rice in terms of kilograms for both indigenous and high yielding rice varieties.
e. Number of months the harvested rice supplied the rice of the family.

Collection of data for integrated crop management for indigenous rice varieties

Using the Minus One Element Technology (MOET) the soil samples were collected by the farmer-cooperators and conducted right in their field. The nutrient deficiency symptoms of the rice plants with the MOET technology was used as basis for applying the right amount of fertilizer.

The research sites were laid out in a Randomized Complete Block Design (RCBD) with three treatments replicated 3 times. For each variety used, the area was equally divided into three equal blocks and each block was further subdivided into 3 small paddies to represent the following treatments:

T₁ – Farmer’s practice (control)
T₂ – Wild Sunflower + IMO + FPJ (Fermented Papaya Juice)
T₃ – Madre De Cacao + IMO + FPJ (Fermented Papaya Juice)
Farmer’s practice of land preparation, planting, water and weed management was adopted during the conduct of the study.

Nine (9) indigenous botanical pesticides were collected, combined as one, pounded and applied in the field as repellant. A handful of these pounded botanicals were place in open banana bract and applied once (1x) in the field during heading stage of the rice plants to control insect pests like stem-borers, rice bugs, leaf folders and other insect pests. Damage caused by stem-borers was assessed following the scale below.

**Extent of damage caused by insect pests was measured by the following the rating scale below.**

<table>
<thead>
<tr>
<th>Scale</th>
<th>Qualitative</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sound</td>
<td>No injury</td>
</tr>
<tr>
<td>3</td>
<td>Slight</td>
<td>1-25 % leaves/grains/stems damage</td>
</tr>
<tr>
<td>5</td>
<td>Moderate</td>
<td>26-50 % leaves/grains/stems damage</td>
</tr>
<tr>
<td>7</td>
<td>Severe</td>
<td>71-75 % leaves/grains/stems damage</td>
</tr>
<tr>
<td>9</td>
<td>Very severe</td>
<td>&gt;76 % leaves/grains/stems damage</td>
</tr>
</tbody>
</table>

**Harvesting**

Since the different varieties used differs in their maturity periods, harvesting was done on staggered basis. As soon as the palay matured they were harvested and yield were recorded accordingly. Harvested palay were bundled, weighed and recorded properly.
Since these indigenous fishes and shells are becoming extinct, collection from places where they are abundant was done and introduced in the paddy one month after transplanting the rice seedlings. Water was continuously supplied in the paddy (farmer’s practice) to sustain life of the fishes and shells.

Legumes like pole snap beans and pechay were integrated in both high yielding rice and indigenous rice varieties where watercress can not survive. These crops are planted in the dikes and some below the dikes.
RESULTS AND DISCUSSION

Social and economic data collection was conducted on April and May 2010 in four barrios in four municipalities namely: Payawan, municipality of Lamut, Kiangan, Hingyon & Banaue where the project was conducted. In order to have direct information on the necessary data to be gathered, the research assistants conducted face to face interview with the rice farmers with the use of structured questionnaire as guide. An average of 37 farmers were interviewed per barangay as respondents.

Interview for the socio-economic profile of the farmers

The socio-economic data of farmers in the different research sites shows that the average number of household is 8 with an average rice farm size of 3,382 m² and an average yield of 1,569 kilograms. The harvested rice supply the rice needs of the family for an average of 7 months only which shows that the rest of the months the farmer will have to buy rice for their family. The income from rice (those who sell some of their harvest) and other sources average to P3,555 per month which is not enough to meet the basic needs of a family of 8 not to include the education and health of their children.
Yield (kg), % Increase in Yield and Net Income per Treatment for High Yielding Rice Varieties

Result showed a yield increase of 7.62 and 5.0% respectively with a net income increase of 84.17 and 82.08 percent respectively for high yielding rice varieties.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Yield (kg)</th>
<th>% Increase</th>
<th>Net Income</th>
<th>% Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 - Farmer’s practice</td>
<td>51.43a</td>
<td>-</td>
<td>335a</td>
<td>-</td>
</tr>
<tr>
<td>T2 - Wild Sunflower + IMO + FPJ</td>
<td>55.35a</td>
<td>7.62a</td>
<td>617b</td>
<td>84.17</td>
</tr>
<tr>
<td>T3 - Madre de Cacao + IMO + FPJ</td>
<td>54.0a</td>
<td>5.00a</td>
<td>610b</td>
<td>82.08</td>
</tr>
</tbody>
</table>

Yield (kg), % Increase in Yield and Net Income per Treatment for Indigenous Rice Varieties

Result showed a yield increase of 42.69 to 41.98% with a net income increase of 43.54 and 8.90% for indigenous rice varieties.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Yield (kg)</th>
<th>% Increase</th>
<th>Net Income</th>
<th>% Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 - Farmer’s practice</td>
<td>7.05a</td>
<td>-</td>
<td>335a</td>
<td>-</td>
</tr>
<tr>
<td>T2 - Wild Sunflower + IMO + FPJ</td>
<td>10.06b</td>
<td>42.69</td>
<td>617b</td>
<td>43.54a</td>
</tr>
<tr>
<td>T3 - Madre de Cacao + IMO + FPJ</td>
<td>10.01b</td>
<td>41.98</td>
<td>610b</td>
<td>38.90a</td>
</tr>
</tbody>
</table>

Additional Net Income from Watercress, Fishes, Shells and Vegetables

An additional income of P3,760,000.00 was obtained from integrating watercress, fish, shells and vegetables in indigenous rice production.

<table>
<thead>
<tr>
<th>Location</th>
<th>Net Income (P)/Cropping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banaue</td>
<td>1,600.00</td>
</tr>
<tr>
<td>- Watercress</td>
<td></td>
</tr>
<tr>
<td>- Beans</td>
<td>100.00</td>
</tr>
<tr>
<td>- Pechay</td>
<td>260.00</td>
</tr>
<tr>
<td>- Shells</td>
<td>480.00</td>
</tr>
<tr>
<td>Hingyon</td>
<td>1,000.00</td>
</tr>
<tr>
<td>- watercress</td>
<td></td>
</tr>
<tr>
<td>- Pechay</td>
<td>120.00</td>
</tr>
<tr>
<td>- Beans</td>
<td>50.00</td>
</tr>
<tr>
<td>- Shells</td>
<td>150.00</td>
</tr>
<tr>
<td></td>
<td>3,760.00</td>
</tr>
</tbody>
</table>
Percent Increase in Net Income from rice, water cress, beans, pechay, shells and fishes

For high yielding rice varieties, an increase of 41 % net income was realized and 69 % increase for Indigenous rice varieties.
SUMMARY AND CONCLUSION

The result of the experiment conducted in farmer’s field showed an increase yield of indigenous rice varieties fertilized with organic fertilizers to a highest of 48.64 % and lowest of 8.65 %. The yield of high yielding rice varieties fertilized with organic fertilizers was increased to a highest of 22.8 % and lowest yield increase of zero. The C-18 variety fertilized with wild sunflower leaves combined with Indigenous Microorganisms (IMO), Fermented Papaya Fruit Juice (FPJ) gave the highest percent yield increase of 22.8 % and highest net income increase of 62 %. Buldagol variety fertilized with Madre de Cacao, IMO, FPJ gave the highest return on investment (ROI) of 560 %.

The yield of indigenous rice can be increased to a highest of 48.64 % depending on the variety with using organic-based fertilizers as inputs in rice production. Organic-based fertilizers reduced cost of production in high yielding varieties and resulting to a high return on investment for high yielding rice varieties.

Integrating fish in small portion of the farm for high yielding rice varieties and planting of legumes in the dikes increase income and added source of food for the family. Planting watercress in rice paddies where it is suitable after harvesting the indigenous or native rice varieties increased family income.

The use of botanicals in insect pest management particularly stem borers is an effective approach to pest management in rice production.

Implication and Recommendation

To increase family income among the farmers, it is recommended that farmers use available organic fertilizers and botanicals to increase yield and reduce cost of production particularly for inorganic fertilizers and synthetic pesticides use in high yielding rice varieties. To increase income and have additional source of food to feed the family, it is recommended that farmers maintain to integrate fishes, vegetables and legumes in the rice field so that there will be continuous supply of these foods throughout the year.
LITERATURE CITED


Carandang G.A. Beneficial Indigenous Microorganisms (BIM) for Natural Farming System in the Philippines. (www.herbanafarms.com)


ACKNOWLEDGEMENT

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Integrated Crop Management for Indigenous Rice Production in the Municipality of Banaue, Ifugao

Field lay out and land preparation by the research assistant & farmers

Conduct of soil analysis through the Minus-one Element Technology (MOET)
The researcher visited the 2-week old transplanted Indigenous rice varieties

The research site planted with indigenous rice varieties
Spraying of liquid fertilizers from wild sunflower and Madre de Cacao leaves extracts

Researcher visits the research site. Indigenous rice varieties at their tillering stage
Indigenous Rice Varieties at their reproductive stage. The rice plants grew so tall that the treatments/blocks signs are covered/hidden.

One of the varieties planted. Panicles are colored red and grains are heavy.

Researchers & a visiting PhD student from U.S.A visits the research site

The research aide fixing the block & treatments signs.
Researcher monitored the research site during their reproductive stage.

Farmers harvesting the four (4) indigenous rice varieties

Hired farmers carry harvested & bundled indigenous rice
Harvested palay are weighed for data gathering.

Indigenous water cress planted where the water falls & above the rice paddy.

Indigenous fish harvested by the farmer & indigenous shells slowly restored in the rice paddy.
Integrated Crop Management for High Yielding Rice Varieties in the Municipality of Kiangan, Ifugao

Land Preparation & Field Layouting

Seedbeds of the two high yielding rice varieties

The experimental field lay out
The conduct of the Minus One Element Technology (MOET)

Transplanting high yielding rice varieties in the experimental site
Pole snap beans planted in the dikes of rice paddy as intercrop & additional source of food & income.

Research site in Kiangan, Ifugao
Rice plants at their reproductive stage

Rice plants are harvested by the farmers

Hired farmers harvest the rice plants in Kiangan, Ifugao

Researcher monitored the project during harvesting
Integrated Crop Management for Indigenous Rice Varieties in Hingyon, Ifugao

The research experimental lay out view in two rice paddies

The research aide helps in laying out the experimental area

Hired farmers uproots rice plants for transplanting
The conduct of Minus-One Element Technology

Researcher monitored the experimental site
Pechay plants planted below the dike of the rice paddy
The principal researcher on her way to the research site.

Rice paddies planted with Indigenous rice varieties

The researcher helps harvest matured indigenous rice palay.
Hired farmers harvest indigenous rice plants in the research site.

Harvested bundled palay weighed for data gathering

Hired farmers continue harvesting the rice panicles in the afternoon.
Legumes plants planted below the dikes as additional source of food & Income.

Farmers harvest rice panicles with the use of indigenous tool called “gamulang”.

Harvested bundles of palay

Corn intercropped with peanut planted below the dikes in between rice paddies as additional source of food and income.