

# PHILIPPINES





## FOREWORD

**T**his study defined the farmers' important contribution in the improvement and utilization of plant genetic resources. Conducted by the Community Biodiversity Development and Conservation Programme (CBDC) Bohol project, the study documented the techniques of local farmers in creating new varieties using existing genetic materials.

Bohol farmers are known to prefer red rice for its eating quality and local market value but the national rice breeding program has only been developing white rice varieties. Local farmers have remedied this situation by selecting off-types from the existing rice varieties. Most of the farmers' off-type selections happen to be red rice varieties, in conformity to their preferred trait.

The study showed that local farmers were able to generate new genetic variation and contributed to genetic diversity. While selections were done by individual farmers, evaluation and dissemination of selected plant types were also made by the community. Farmers' selections were able to spread out and be part of the local seed supply. This study identifies ways of supporting the farmers to enhance their existing crop improvement system through participatory plant breeding approaches.

## ABSTRACT

This paper presents the farmers' selection criteria, methods and practices in rice improvement in 17 villages in the nine towns of Bohol, Philippines. Seventeen respondents who were planting farmers' selections and seven farmer breeders were interviewed.

Twelve selections of rice were identified in eight towns. They were slightly different from modern varieties by one or two characteristics, usually the red seed coat.

The farmers' preference for red rice was because red rice is more expensive and appears to have a greater nutritive value and they do not easily get hungry when working in the field. They more often cited red rice as high yielding variety, good cooking and eating quality and high market value.

The study learned that farmers in Bohol employ single plant selection from modern and traditional rice to develop new highly adapted rice varieties. These selections were eventually shared to other farmers.

## INTRODUCTION

Historically, the farmers play a great role in the development of crops. The first breeders were farmers who domesticated wild plants that resulted to the cultivated crops being grown today. With the introduction of high yielding varieties (HYVs) in the late 60's, plant breeding was centralized in research institutions<sup>1</sup>. Since then, the use of HYVs together with chemical fertilizers and pesticides was equated with development. On the other hand, farmers' varieties and breeding methods were considered inferior to that of the formal sector and were labeled as primitive and backward.

In addition, the introduction of HYVs displaced many traditional rice varieties. In the Philippines there were around 3,500 traditional varieties before the government launched Masagana 99, the program that was mandated to distribute HYVs together with chemical fertilizers, pesticides and loans to farmers<sup>2</sup>. Today, there are only three to five varieties for irrigated rice cultivation recom-

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1. Berg, 1994

2. Salazar n.d.

mended by the Philippine Seed Board (PSB) and only a few traditional varieties planted in farmers' fields.

With only a few traditional and formal release varieties available to farmers, they continue to select new varieties that will suit to their needs and preferences and can adapt to local conditions. The farmers in Bangladesh selected a taller variety than IR 8 to suit different flooding depths and duration<sup>3</sup>. A variety can also be selected due to its resistance to a specific pest like the farmers in India who selected an IR 24 rice breeding line that was resistant to plant hopper. In the Philippines, a farmer selected a variety called Bordagol from a promising IRRI line that was tested to be resistant to tungro<sup>4</sup>. An introduced variety from Malaysia that was rejected by breeders because of lodging became popular because of its high tillering capacity and good grain milling quality<sup>5</sup>.

This study was undertaken to understand farmers' processes of varietal selection. It was expected to establish the hypothesis that farmers and breeders are continuously selecting desirable and adapted genotypes in their farms to improve even on HYVs and traditional varieties and produce new and highly adapted varieties.

The general objective of this study was to document farmers' methods of rice improvement. The specific objectives were to:

- identify the different farmers' selections of rice and determine their differences from formal release HYVs;
- determine the agronomic, gastronomic and morphological characteristics of farmers' selections;
- trace the genetic origin of farmers' selections;
- describe breeding methods employed by the farmers; and
- explain farmers' reasons for planting selections over other varieties.

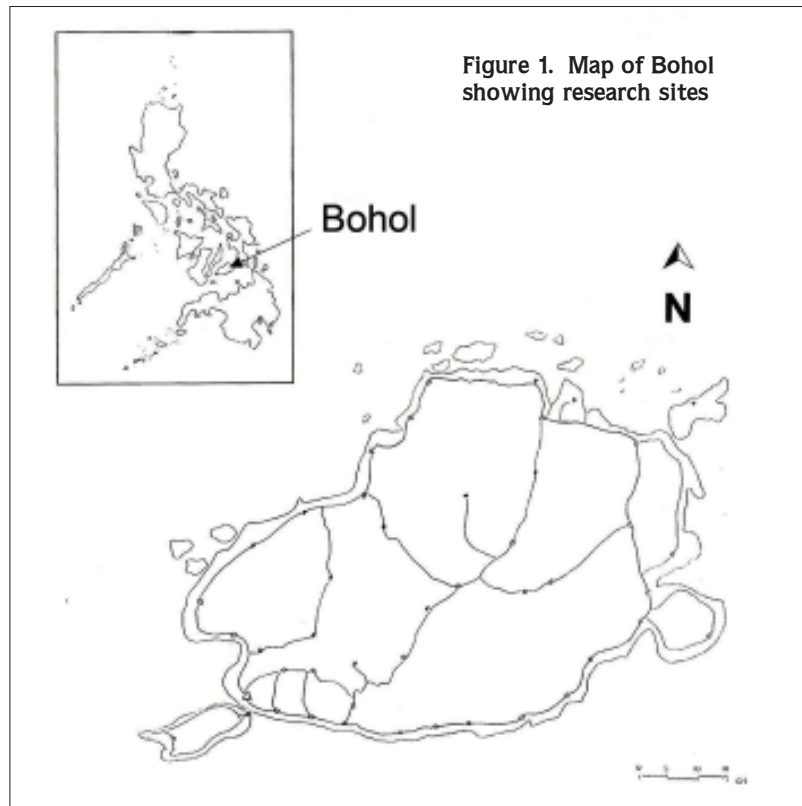
## METHODOLOGY

The study was conducted in 17 villages in the nine towns (Batuan, Bilar, Candijay, Catigbian, Dagohoy, Guindulman, Inabanga, Trinidad, and Ubay) in Bohol where farmers' selections are being grown (Fig 1). Research areas and respondents were identified for the plant

3. Brammer 1980

4. Berg 1995

5. Maurya 1989



genetic resources (PGR) diversity survey.

A total of 21 farmers were interviewed. The respondents were composed of two sets - those who were doing variety selection or plant breeders and those who were planting the farmers' selections.

The respondents who are plant breeders should be known as innovative farmers who are constantly developing new varieties from old varieties. The farmers chose them as those who first selected the varieties they are planting. The data gathered during the interview include name of farmers' selections, name of variety from which the new variety was selected, time when the selection started, reasons for doing the selection, selection criteria, selection methods, and process of multiplication.

The second set of respondents was composed of farmers who are planting the farmers' selections for production. The data gathered during the interview include names of farmers' selections, ag-

ronomic, gastronomic and morphological characteristics of farmers' selections, and their reasons for planting these selections over the other varieties.

Different questionnaires were prepared for each set of farmer respondents. Seven farmer breeders and seventeen farmers were interviewed. Some of the respondents were both, plant breeders and farmers.

The researchers gathered additional information on the morphological characteristics of varieties using the descriptor's lists and collection record sheets. They collected a minimum of 10 rice panicles per variety from each farmer for grain characterization if there were standing crops. The morphology of farmers' selections and PSB released varieties was compared.

## **RESULTS AND DISCUSSION**

Farmers Selections from Modern Varieties<sup>6</sup> defined farmers' varieties as "population or set of varieties formed by constant process of experimentation, evaluation and selection of existing and new varieties." This study identified the 12 farmers' selections that the respondents planted (Table 1) based on the name and morphology.

For example, the variety "66 puwa" was selected by a farmer from the paddy planted to IR 66, a HYV released by International Rice Research Institute. The name given by the farmer to the variety is a combination of the name of the HYV from where it was selected and the local term for red, referring to its red seed coat. 66 Puwa was considered a farmer's selection because this variety resembles the morphological and gastronomic characteristics and agronomic performance of IR 66 except for its red seed coat.

### **Bohol**

The identified farmers' selections were lowland rice varieties. According to interviews conducted with the farmers, most of these selections were of medium maturity (90-120 days), lodging resistant, with grain yield ranging from 1.5 to 4.2 tons/ha and with high milling recovery (Table 1).

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6. Bellon, 1996, p10

**Table 1. Agronomic characteristics of farmer's selections**

Farmers selections	Tillering ability	Lodging character	Maturity Days after sowing (DAS)	Yield (t/ha)	Milling recovery
39	High	R	110	2.5	High
24 Puwa	High	R	110	***	***
36 Puwa	High	S	100 - 120	2.5-4.2	High
42 red	High	S	120	3.75	High
66 Puwa Bordagol Dash	High	R	90 - 100	2	Medium
3 Mag	High Medium	R	100 - 120	3	Medium
91 RC	High Medium	R	97 -100	3	High
10 Puwa	Medium High	R	110 - 115	***	***
Red 15	High	R	96	3	High
Red 18		R	90-120	1.5-2.5	High
Red 77		S	120	***	Medium
		R	96	2.1	High

Note: \*\*\* data not available R = resistant, S = susceptible Selections

**Table 2. Resistance of farmer's selections to insect pests and diseases**

Farmer's Selections	Resistance to disease				Resistance to insects		
	Blast	Bacterial Blight	Grassy Stunt	Tungro	Stemborer	Rice Bug	Leaf Folder
39	R	R	R	R	R	MS	MR
24 Puwa	R	R	R	R	R	R	***
36 Puwa	R	R	R	R	R	MS	R
42 Red	MR	MR	MR	R	MR	MS	MR
66 Puwa	R	R	R	R	R	***	***
Bordagol	R	R	R	R	MR	R	R
Dash 3	R	R	R	R	MR	MR	R
Mag 91	MS	MS	R	R	MS	MS	***
RC 10 Puwa	R	R	***	R	MS	***	***
Red 15	R	R	R	R	R	S	R
Red 18	MR	MR	***	R	MR	MS	MR
Red 77	R	R	R	R	MR	***	***

Note : \*\*\* data not available

R = resistant, MR = moderately resistant, S = susceptible, MS = moderately susceptible

The farmers said majority of these varieties were resistant to diseases such as blast, bacterial blight, grassy stunt and tungro (Table 2). Some were relatively resistant to leaf folder and stem borer but susceptible to rice bug. Most of these varieties have red seed coat and are non-scented to lightly scented (Table 3). They also cited these selections because they are heavy, round, full and large grains, long and heavy panicles and good tillering ability, all of which are the characteristics associated with high yield.

The other major reasons were good eating and cooking quality and high market value (Table 4). Palatability and good cooking quality were important for these farmers since most of them are producing mainly for home consumption while the rest of the produce was sold to the market. McArthur (1989) observed the same trend for these varieties.

Seed coat color is very important for Boholanos because they are known to prefer red rice than the others. According to farmers, red rice is more filling than white rice and is said to provide more energy while working in the field. During the survey, respondents always associate good eating quality with red rice. Moreover, red rice commands higher price than white rice.

**Table 3. Gastronomic characteristics of farmer's selections**

Farmers Selection	Seed Coat Color	Scent	Eating Quality	Cooking Quality
39	White	Non scented	Good	Good
24 Puwa	Red	Non scented	Good	Good
36 Puwa	Red	Non scented	Good	Good
42 Red	Red	Scented	Good	Good
66 Puwa	Red	Lightly scented	Good	Good
Bordagol	White	Lightly scented	Good	Good
Dash 3	White	Lightly scented	Good	Good
Mag 91	White	***	***	***
RC 10 Puwa	Red	Scented	Good	Good
Red 15	Red	Scented	Good	Good
Red 18	Red	Non scented	Good	Good
Red 77	Red	Lightly scented	Good	Good

Note : \*\*\* data not available

**Table 4. Reasons for planting farmer's selections**

Reasons for planting farmer's selections	Number of Respondents
<b>I. Agronomic</b>	
> Yield	
- grains (heavy, round, full, large, clear)	10
- panicles (long, heavy)	5
- good filling ability	5
- good milling recovery	4
- high yielding	2
- low sterility	1
> Response to biotic/abiotic factors	
- lodging resistant	2
- disease resistant	1
- heat resistant	1
- low shattering	1
> Others	
- high germination	2
- early maturing	2
- presence of awn	1
- thin hull	1
<b>Total</b>	<b>38</b>
<b>II. Gastronomic</b>	
- good eating quality	7
- good cooking quality	6
- pleasantly filling	3
- red grains	2
- aromatic	2
<b>Total</b>	<b>20</b>
<b>III. Socio-economic</b>	
- high market value/demand	7

### Farmers as Breeders

The 7 farmer breeders went into selection to look for a better variety than the existing rice variety they are using. One farmer started selection as early as 1970s while the others started later, in the 1980s and early 1990s (Table 5).

Majority of the selections come from IR 66 and IR 36 while some farmers selected from the traditional varieties. Long and droop-

**Table 5. Selection history and criteria of seven farmers in Bohol**

Name of farmer	Year started selection	Origin of farmer's selections	Farmer's selections	Selection criteria
Concon, Margarito	1992	IR 66	66 Puwa	Similar to IR 66 but with red seed coat
Salces, Cisenio	1990	IR 66	Kasini Puwa	Red seed coat Full grains Long panicles
			Kasini Puti	White seed coat Full grains Long panicles
Jamil, Carmelo	1989	IR 66	Off-type	High percentage filled grains
		Miracle Puwa	look like Mestfisa variety	Drooping panicles
		IR 36	look like C4	Long panicles
Salas, Adolfo	1987	IR 36	36 Red	Red seed coat Good eating quality Short, stubby grains
		IR 74	Off-type	Good grains
Anora, Abundio	1970's	IR 36	Off-type	Red seed coat Drought tolerant
Puracan, Exequiel	NA	Unknown		Long drooping panicles Same maturity with his variety Fine grains
		Murayag		Large panicles
Carnice, Demetrio	1994	Unknown	C4	High yield Good eating quality
			Kalagnon Karonsing Iligan	Good germination Heavy grains Good eating quality

ing panicles and full and heavy grains were their selection criteria. They said drooping panicle is an indicator of heavy grains that will result to more yield. The farmers used practical indicators in evaluating a certain variety. Four out of the seven respondents said that red seed coat is one of their selection criteria. Fujisaka, et al (1993) mentioned that “many of the criteria used by farmers in selecting cultivars are the same as those used by breeders, but in some cases farmers can contribute criteria about which breeder know little particularly those related to cooking qualities and palatability.” In this

Figure 2. 66 puwa

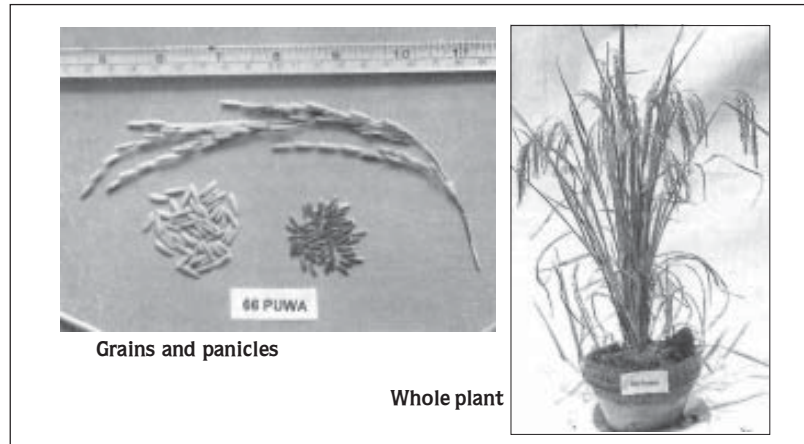
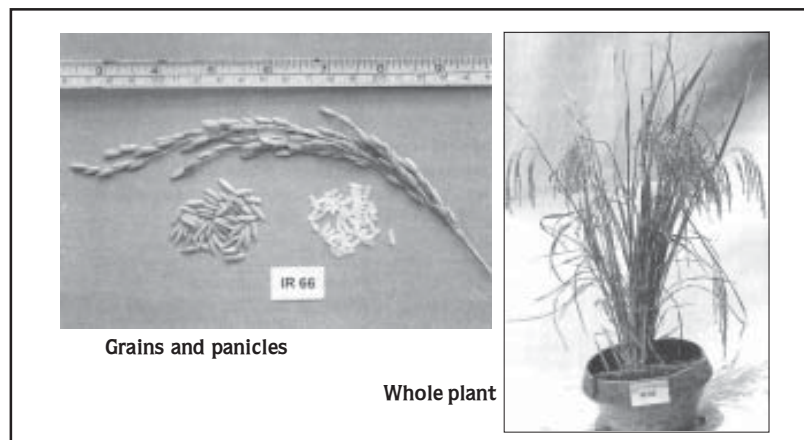


Figure 3. IR 66



case, high yield was a major selection criterion for farmers that was also a major concern for breeders. While some modern varieties like IR 66 met some of farmers' selection criteria, they still selected from it to satisfy their preference.

For example, Mr. Concon was continuously looking for a variety with the same characteristics as IR 66 but instead, of white with red seed coat. Another farmer selected a variety from IR 36 because it was appropriate to his field where supply of water was not continuous. He selected a variety with a red seed coat and with the capacity

to withstand drought unlike IR 36 that thrived only in a field with continuous water supply. From these cases, we can say that farmers used a complex and broadly encompassing set of selection criteria which included more than yield.

The farmers also did rigorous screening of the selected varieties. The farmers multiply the selected panicles of a desired variety in the first screening. They plant the selections in a small separate plot and evaluate their agronomic and gastronomic performance in the second screening. If the selections performed well, the farmers plant these in a larger production area in the third screening. The fourth screening involves the testing of these selections by other farmers through the prevailing informal system of seed exchange in the community.

The selections shared with the other farmers in the community weighed up to one cavan (approximately 50 kg) per farmer. These were even spread to as far as other towns in Bohol. Thus, the screening of farmers' selections passed through at least four stages.

Mr. Salces, one of the farmer respondents was interested in producing a new variety through hybridization, aside from selection. Based on his observation, two corn plants with different kernel colors and planted side by side, would tend to cross-pollinate each other. Applying the same thing in rice, he planted two rice varieties, one with white seed coat and another with red seed coat, in alternate rows to induce cross-pollination. He had wanted to develop a variety with the combined superior features of the two varieties. He maintained this experiment for 6 seasons but no crossings between the two varieties occurred. Therefore, like breeders in research institutions, he had specific breeding objectives that he tried to achieve through experimentation.

The study also traced the parentage of the varieties mentioned by the farmers and found no red seed coat among the formal-released varieties. The red seed coat variety was possibly developed from the following processes:

- 1) selection of farmers of off-types in the field brought about by mechanical mixtures;
- 2) introgression between varieties since there are many red rice in the area;

- 3) environmental stress, specifically drought<sup>7</sup>
- 4) mutation

The development of new varieties by the farmers showed their intervention in improving the varieties based on their selection criteria. The preference of Boholanos for red rice contributed to the pressure to develop these kinds of varieties. Furthermore, selection methods used by farmers without actual hybridization proved to be successful in improving varieties adapted to their locality.

## CONCLUSIONS AND RECOMMENDATIONS

The results of the case study confirmed the hypothesis of Community Biodiversity Development and Conservation Programme (CBDC) that farmers are breeders and continuously select even from high yielding modern varieties like IR 36 and IR 66. They selected off-types for potential varieties that would suit their needs, preferences and specific agro-ecological conditions. They employed single plant selection most of the time to find a new variety. Thus, despite the limited germplasm and technology available to them, the farmers continuously improve their crops through selection.

While yield is a major concern for both breeders and farmers, the environment from which the varieties were selected is very much different from each other. Breeders in research stations conduct their field trial in a favorable environment i.e. with fertile soil, continuous supply of water, adequate supply of chemical fertilizers and pesticides. In contrast, farmers' selection were often done in fields that lack continuous supply of water, had poor soil condition and lacking in inputs as those of the breeders.

Selection for high yield by breeders does not necessarily result to high yield in farmers' conditions. The desirable qualities of the rice variety probably did not adapt to the farmers' environment during the selection process. According to Cecarrel in 1989, "direct selection in the target environment is the most efficient strategy." Thus, selection process should be performed in farmers' field conditions.

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7. De personal comm Sept. 97

The farmers should also be involved in the selection process so that the selected varieties would reflect their specific requirements. This process would pave the way for diverse materials since each farmer has different selection criteria.

To further strengthen the production of diverse material, farmers should be provided with more materials that are available for the farmers choose from and improve on. This will facilitate increase of diversity as farmers will develop varieties that are specific to their conditions.

To further enhance the breeding methods of farmers, they should be taught with hybridization to help them develop varieties specifically suited to their actual field conditions and cultural preferences. This will eliminate the cost and time of varietal trials in different locations as practiced by the formal sector because farmers can develop varieties that are appropriate and adapted to their environment. In the end, farmers will again be able to control the kind of seeds they are using.

### **Appendix 1: Farmers' selection methods and criteria.**

#### **Case Study 1**

Mr. Concon is a 48 - year old farmer from Causwagan, Catigbian town who owns half a hectare of land. Aside from farming, he also produces tuba, an alcoholic brew made from coconut sap.

He started selection activities in 1992 to come up with a variety similar to IR 66 but with red seed coat. In one of his visits to his paddy planted to IR 66, he saw a rice plant that was slightly taller than IR 66 but had red color seed coat. He marked this plant by tying the tillers and covering the three panicles of the plant together.

He planted the grains from the three panicles and was able to produce one ganta. He planted all seeds in a separate paddy at one seed per hill the following season. From one ganta, he was able to harvest three cavans or approximately 150 kgs.

Seeing the superior performance of the selection, Mr. Concon's neighbors began asking for seeds to be used as planting materials. From then on, the selection spread out to the barangay and to neighboring towns like Clarin, Cortes and Inabanga.

There was a time when the price of red rice in the area went down due to oversupply of harvest from this rice selection. Mr. Concon named the selection “66 Puwa”, with 66 referring to the name of the variety (IR 66) from where he selected it and “puwa”, meaning red in the dialect.

### **Case Study 2**

Mr. Salces is 33 years old and residing Barangay Campagao, Bilar town. He was able to study college in a nearby agricultural school and is now tending a half-hectare of land. Aside from farming which is his major source of income, his family also owns a small store.

In 1990, Mr. Salces simply selected off-types from his field planted with IR 66 variety. He selected plants with red seed coat, full grains and long panicles similar to IR 66. His neighbors named it “Kasini Puwa”. The name Kasini is derived from the prefix “Ka”, meaning “from”, and Sini, the nickname of Mr. Salces. “Puwa” indicates the variety's red seed coat.

Later, he was able to develop another variety that was called, “Kasini White” because it had white seed coat. His neighbors were able to obtain planting materials from Mr. Salces' selections at a maximum of one sack per farmer.

Mr. Salces observed that two varieties plants with different kernel colors, planted side by side, would tend to cross-pollinate each other. He did the same with rice and he planted two rice varieties, one with white seed coat and another with red seed coat, in alternate rows to induce cross-pollination. He wanted to develop a variety that will bring together the superior features of the two varieties. He maintained this experiment for 6 seasons but no crossings between the two varieties occurred.

### **Case Study 3**

Mr. Jamil is a tenant-farmer of 1.24 hectares of land in Barangay Aloja, Batuan. He also does carpentry jobs to supplement his income.

He started selection in 1989 to come up with high quality variety with long panicles and large grains. He was able to select a variety from an off-type that looked like the C4 variety in his field

planted with IR 36. He selected it, mainly for its long panicles. Mr. Jamil was able to plant this variety for two seasons but stopped after he observed its declining seed fertility.

In 1991, he selected an off-type from Miracle Puwa, believed to be another selection that looked like a variety called Mestisa. Later, he selected off-types from IR 66. High fertility with high percentage of filled grains was one of his selection criteria of off-types, aside drooping panicles that usually indicates that the grains were heavy.

When Mr. Jamil was able to make selections from a paddy, he germinated small samples and planted these in a separate portion of the field to avoid mixing with other varieties. If the selection performed well, he gradually multiplied the planting area in the succeeding seasons until such time when the yield started to decline.

#### **Case Study 4**

Mr. Puracan is from Hinlayagan-Ilaud, Trinidad who farms a three-hectare land. Aside from being a farmer, he is a pastor of one of the churches.

According to him, variety selection was motivated by continuous search for a better variety. His main selection criterion for a variety was the presence of panicles that are bending or drooping very low indicating full grains. He also selected plants with long panicles and with the same maturity as the origin of the variety. He planted these in a separate paddy.

He later gave or exchange seeds with other farmers interested to try his selection. He reported that he was able to select a variety named Murayag, earlier. It has fine grains but large panicles.

#### **Case Study 5**

Mr. Salas is a 48 - year old farmer from Tubod, Candijay. He started selection in 1987 to come up with a variety with full grains.

His participation in a training conducted by a non-government organization motivated him to do plant selection. Like the other key informants, he planted the selection first in a separate paddy then maintained it in a larger plot if the performance was satisfactory.

One of the varieties he selected in 1987 came from IR 36, a high yielding formal release variety. It was named IR 36 Red because

unlike the original IR 36, it had red seed coat. He selected it due to its good cooking quality and short and stubby grains. In 1995, he was able to select from IR 74 that according to him had good grains.

### Case Study 6

Mr. Anora is 42 years old and a farmer from Cambitoon, Inabanga. He started selecting in the 1970's for a variety that was high yielding with more grains in a panicle. He selected off-types, designated a paddy for these selections and multiplied if the result is good.

One of his selections also came from IR 36 but had red seed coat. In contrast to the original IR 36 that thrived well in a field with continuous supply of water, this selection was reported to be relatively tolerant to drought.

### Case Study 7

Mr. Carnice is a 66 - year old farmer from San Francisco, Ubay. This farmer is cultivating a two-hectare land awarded to him through the Comprehensive Agrarian Reform Program (CARP) of the government.

He started hybridization in 1994 after attending a seminar conducted by a non- government organization. He wanted to return to traditional varieties because these required less inputs and were relatively resistant to diseases.

Among his selections were:

- Karonsing - heavy grains
- Iligan - good eating quality
- Kalagnon - good germinability
- C4 - high yielding and good cooking quality
- La Fortuna - lodging resistant
- Arab - red grains and good eating quality.

Mr. Carnice followed the same procedure as the other key informants did in maintaining these selections. He planted his selection in one paddy and multiplied in a bigger area when it performed well. He exchanged his selections with his neighbors and other people who wanted to try these.