

# Participatory Assessment of Coconut-based Agroforestry in San Isidro, Bohol<sup>1</sup>

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## Abstract

*The advent of population pressure, less land to cultivate and worsening marginal conditions of farmlands are common problems encountered by farmers in Central Visayas. In response, people resort to either open more timberlands or practice farming systems that would optimize use of limited land resource. One example of the latter is the practice of intercropping or agroforestry in coconut dominated farmlands in San Isidro, Bohol. Using participatory rural appraisal (PRA) techniques, coconut-based agroforestry systems in San Isidro, Bohol were assessed to (i) identify successful systems that could be extrapolated and adapted to other upland areas in the Philippines, and (ii) identify weak components and “links” that could be improved through innovative strategies.*

*It was found that intercropping in coconut-based farms has been practiced for decades now because it increased family income and incurred mutual benefits for intercrops and main crops. The main intercrops include banana, buri, rootcrops and some timber trees. Main farm income was derived from copra sales. Most work in this farming system is handled by men, while women are more involved in the marketing and sales of the products. Unstable market of the farm produce, infestation and diseases were the prominent problems.*

*The study indicated that intercropping or agroforestry systems could be improved by using more strategic plant combinations, plant densities and planting patterns for the different life stages (and related growth patterns) of the coconut trees. Effective erosion control on sloping fields requires the planting of a combination of tree and field crops, the installation of NVS or other vegetative buffer strips, and the application of organic farming practices (mulching, crop residue recycling, composting) to sustain soil fertility. More in-depth studies are required before potentially best-bet coconut-based agroforestry systems can be identified and extrapolated to other areas.*

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# **Participatory Assessment of the Coconut-Based Agroforestry in San Isidro, Bohol, Philippines**

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## **I. Introduction**

Coconut is one of the most important perennial crops in the humid tropics of Asia. In the Philippines it occupies 76% of the perennial crop area and more than 30% of the total cropped area (Price, 1986 p. 160<sup>5</sup>). The adaptability of coconuts to a wide range of geophysical factors and its versatility in terms of utility value makes it a commonly grown crop in the Philippine farming systems. It has been a particularly successful crop since it is well adapted to existing agro-climatic and geo-physical conditions. Other factors contributing to the popularity of this perennial is the relatively simple technology involved in its production and that it is not as input-intensive as the annuals.

Copra produced from coconut is a primary export product of the Philippines. Especially in the central part of the country (Visayas islands), vast lowland and upland areas are being planted with coconut. The advent of population pressure, less lands to cultivate and the worsening marginal conditions of farmlands prompt the need to go into farming systems that would optimize use of the limited land resource, thus intercropping, a form of agroforestry gained popularity among farmers.

The coconut farming system is very promising as spacing is wide, the system affords higher incidence of light under the canopy and the limited effective root zone of the coconuts allows other crops within the grove. Variations in the coconut-based farming systems along the areas of crops grown, planting schemes and intensity among others, affect the productivity and efficiency of the cropping system. Documenting and assessing these practices as affected by other household, institutional and other cultural factors would be worthwhile for a possible extrapolation of successful schemes in a wider scale wherever applicable.

Coconut-based agroforestry is a common practice in the municipality of San Isidro, Bohol. These agroforestry systems seem to form a perfect buffer zone at the base of the severely degraded hillsides (where the indigenous NVS technology is being practiced), leaving the rivers in the lowlands clear and less affected by seasonal changes of water flow.

The assessment of this system may generate information for improving or modifying if needed, the existing practice with appropriate scientific techniques. The assessment process would be more effective if conducted together with the farmers/field practitioners, thus this study was conducted using the participatory approach.

## **II. Objectives of the Study**

The study primarily aimed to assess the coconut-based agroforestry farming systems of San Isidro, Bohol using participatory approach.

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<sup>5</sup> Price, E.C. (1986): Multiple Cropping in Asia. Wisconsin, USA: Lison.

Specifically, it was conducted to:

- a. to document the coconut-based agroforestry farming system in San Isidro, Bohol;
- b. determine the potential of the system for wider extrapolation towards improved coconut-based farming system (CBFS).
- c. to identify weak components and “links” in coconut-based farming systems that could be improved through innovative strategies (based on documented scientific knowledge).

### III. Location and Description of the Study Area

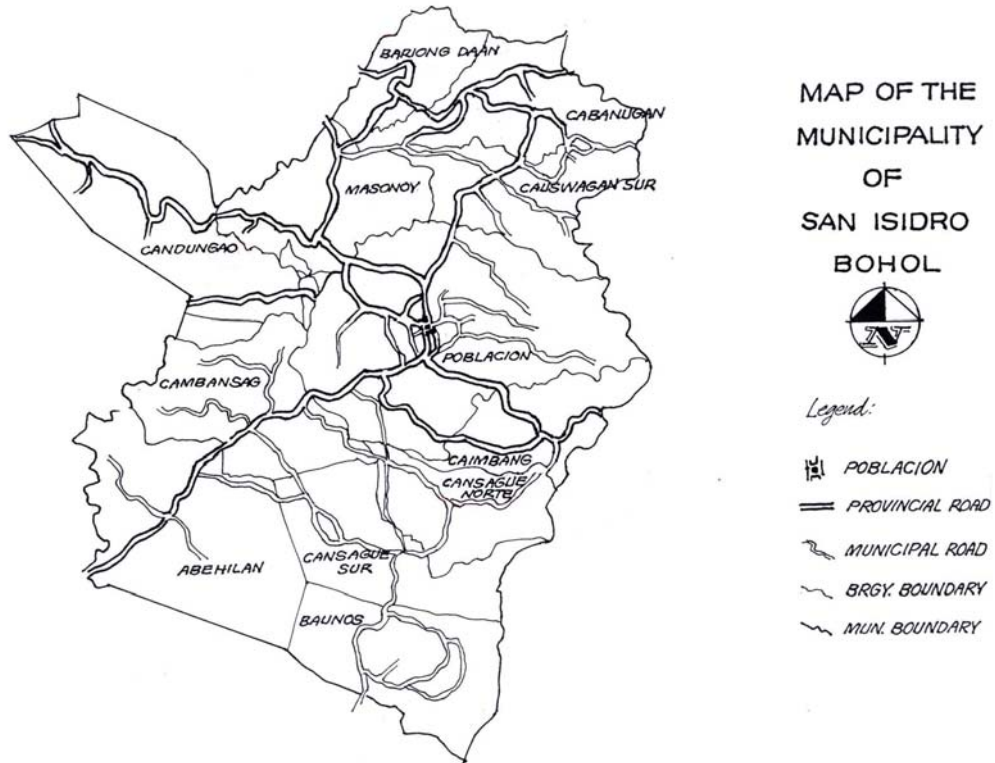
San Isidro is located about 32 km from the island capital, Tagbilaran City. It has a total land area of 5,943 hectares. It is bounded by Tubigon town on the north; Antiquera on the south; Catigbi-an on the east and Calape on the west. It belongs to the fourth climatic type, which is characterized by a more or less even distribution of rainfall throughout the year with pronounced dry season from January to May. The rest of the year is generally wet. The average annual rainfall is about 1,944 mm.

Two sedimentary rock formations covered the municipality: Maribojoc Limestone (55%) and Carmen Formation (45%). Soil cover consists of different sorts of clay, such as Batuan clayloam, Annam clay and Batuan-Faraon complex and was perceived as loamy, clay-loam, sandy-loam, stony in some spots and *panason* in many areas (San Isidro CLUP). *Panason* means the underlying limestone material is very shallow and even exposed in some areas. Soil pH was generally neutral in all terrain except a few slopy areas, which were slightly acidic. Organic nitrogen was of medium content in flat and rolling areas and low in slopy areas. Potassium content was generally sufficient in all three topographic types. Phosphorous was generally of medium content while low in a few areas and high in a few areas.

Except Poblacion, which had more plain areas, the study sites were more of rolling topography (44%), 33% slopy to moderately steep and about 23% plain. Elevation ranges from 100-400 meters above sea level. Mass movement of soil had been observed in slopes/top slopes. This was very noticeable in Baryong Daan. Accordingly these areas had been farmed incessantly for several decades without the inclusion of higher vegetation with deeper root system like trees, which could have lent stability to the area. The underlying limestone material aggravated this condition.

San Isidro is already devoid of a good forest cover. The remaining small patches of trees were of secondary growth and generally scrubby which was locally described as *lati*. The respondents in all sites were unanimous in saying that the *lati* condition had been like that even during the war period in the early '40s.

Figure 1. Map of San Isidro, Bohol.



#### **IV. Methodology**

The study was conducted from July to November 2002 in five barangays of San Isidro, Bohol, namely: Poblacion, Caimbang, Causwagan Sur, Masonoy and Baryong Daan. Two full days were spent in each barangay for the primary data collection. Barangay officials, the San Isidro Municipal Agriculture Officer and key officers of the coconut farmers' organizations recommended these areas for the study on the basis of having existing agroforestry farming systems with coconuts. CVSCAFT and ICRAF staff and municipal LGU officials made a field visit prior to final selection of sites.

*The Research Team.* The team mainly consisted of two CVSCAFT research staff who were lead researchers and five forestry student-researchers. Three other CVSCAFT personnel were involved in the PRA work.

*Coordination Activities.* A research permit was secured from the Mayor's Office. Then the research team sat in a joint meeting of the barangay councils where the nature and purpose of the study was explained and schedule for each barangay was set.

*Secondary Data Gathering and Informal Interviews.* Information and data relevant to coconut farming were extracted and analyzed from books, journals, previous researches, government reports and website postings. During this secondary data search, PCA and DA key persons, including San Isidro-based personnel were casually interviewed on the status of coconut farming in the area as well as in the whole province. Study sites profile was taken from the municipal and provincial government files.

*Selection of Participants.* With the help of the barangay leaders, the 119 participants were selected based on the following criteria: a) with considerable experience and knowledge on coconut farming; b) representing at least 30% of the coconut farming households and c) gender balance.

*Preparation and utilization of the Semi-structured Questionnaire.* A 4-page questionnaire was constructed and designed to gather household information, socio-economic profile and coconut farming practices/experience. This was filled up individually and during a plenary session with the facilitator reading aloud each question. The method afforded a uniform understanding of each question as well as the immediate response to queries and verifications.

*Primary Data Collection by Study Barangay.* Along with the individual questionnaire, the PRA approach was mainly used with the participants working in properly represented subgroups. The following tools were used:

- a) Matrix listing. With prepared data matrices on manila papers, this method was employed to gather information on biophysical factors, coconut farming and product processing technologies, organizations profile and gender balance.
- b) Venn Diagramming. The social structure of the barangay was depicted with the use of round paper cutouts in various sizes and colors arranged and pasted on a paper spread to show the level and degree of significance to the community life.
- c) Resource Mapping. Using colored paper cutouts symbolizing the various resources, participants pasted these on a skeleton barangay map taking note of resource location and density (for plants).
- d) Time Line. The evolution of coconut farming was traced using this tool.
- e) Transect Walk. Cutting through the entire length of the barangay covering the lowest and highest points, the participants and researchers made a walkthrough to actually observe the various

resources, farming systems and its opportunities and problems. Soil samples were also gathered during the transect walk. A transect map was produced after this activity.

- f) Validation. All sub-group data were validated and critiqued at plenary.
- g) Debriefing and Planning Activities. At the end of each day, the whole team would meet to discuss the day's activities, examine the data gathered and looked for gaps, and planned for the next day's activities.
- h) Data Analysis. Questionnaire data were summarized and analyzed using coding guides and the simple percentage analysis. After making summaries, quantitative and qualitative conclusions were drawn out from the other data sets.
- i) Data Utilization. The results will be fed back to the farming community. The same will also be furnished to the barangay and municipal government units and other interested groups for development activities or for further research. The results may also be published as agreed upon by the research partners.

## V. Results and Discussion

### Evolution of Coconut Farming in San Isidro, Bohol

Coconuts covered 50 – 75 % of the study sites. Only Baryong Daan had lesser groves covering about less than 50% of the whole barangay. The coconuts were mostly spaced at 10 X 10 meters, a few 8 x 8 meters. The native variety has been grown in the area ever since. Only very few planted the hybrid dwarf varieties. Coconuts were still few in the early part of the 1900s. Coconut groves began to get dense in the late '40s.

Intercropping within the coconut groves was not popular in the early days because there was still plenty of space to plant the agronomic crops. A few intercropping was noted as early as the 1930's and 40's. Corn, sweet potato, cassava, and later banana, were the pioneer intercrops in this period. The whole area was plowed first before planting the coconuts usually at a spacing of 10 x 10 meters or 8 x 8 meters. The cash crops then were planted after setting in the coconuts.

It was recalled that gabi, native coffee and native ipil-ipil began to be intercropped in the '50s. The ipil-ipil intercrop was believed to enhance the growth of the coconuts. Buri and giant ipil-ipil were notably intercropped during the second half of the '70s along with a few vegetables like beans and squash. Jackfruit and santol were also noted this time. Bananas had been intercropped during this time until today. Teak was introduced in 1983 by the government. Mahogany and gmelina were intercropped in the mid '80s as well as pineapple.

*Robusta* and *excelsa* coffee were intercropped as encouraged by Nestle during the '90s. But the price of coffee beans has dropped below profitable levels for small-scale production. They are currently not being cared for, and they have been in many cases replaced with other intercrops. Today, banana, buri, gabi, sweet potato, ipil-ipil, gmelina and vegetables continued to be intercropped to coconuts.

Intercropping was acknowledged as most valuable with the additional income through the intercrops. The coconuts are also benefited with the cultural practices applied to the intercrops like weeding and fertilization in a few cases.

It was notably observed that trees like gmelina, mahogany and ipil-ipil would adversely affect the growth of the coconuts especially if these overtopped the latter and also when planted closely. Some intercrops also performed low under the coconuts due to over-shading. Compared to the other barangays only fewer people practiced intercropping in Baryong Daan. Also, it has fewer coconuts compared to the other four barangays.

Intercropping in the study sites leaves much to be desired especially in the spacing scheme, control of shading and species-site consideration. Further studies could be explored along this line. Care and maintenance also was needed especially for the bananas and coconuts in some cases.

Livestock raised include carabaos, pigs, chickens, goats, cattle and a few horses and ducks. The ruminants were pastured, tethered and also fed through cut-and-carry method.

### Coconut Farming System in San Isidro, Bohol

#### ***Gender Roles***

Some 80 to 90% of the work in coconut farming, harvesting and product processing were handled by men. The women took the lighter tasks in farming like planting and cleaning. The women had a higher role in marketing and sales keeping. The children helped around the farm but not much if they are schooling.

#### ***Socio-Economic Profile, Experience in Farming***

Farm sizes range from 0.25 to 2 hectares. Sixty-five percent of the coconut farmers own the land they cultivate, the remaining are tenants.

Both sexes were amply represented among the 119 respondents although the men were a little more in number. Most were 45-50 years old. Some 13% were 70-80 years old. About 50% of the men and women attained elementary education followed by those who finished the primary grades. About 12 % reached college level. Family dependents ranged from 1 to 5.

Results show that 99% of the dependents shared with the farm work. About 17% had 26-30 years of farming experience followed by 13.44% with 36 to 40 years experience. On the overall, 66 % had farming experience over 26 years and as high as 60 years.

Sixty-five percent (65%) owned lands from  $\frac{1}{4}$  - 2 hectares. About 40% were tenants and also cultivating lands ranging from  $\frac{1}{4}$  to 2 has. Cultivated lands seemingly covers equally all topographic types. Land tenure did not pose any serious problem at all.

Seventy percent (70%) indicated of having pure coconut farming experience of 20 years and above. Twenty percent (20%) of this had 30-40 years and above of the same experience. Causwagan and Masonoy respondents had more experience than the rest. Some 51% had 10-30 years experience of intercropping. This includes part of those with pure coconut farming experience, meaning a grower may have both kinds of coconut farming schemes. Of the 51%, 30% said they had intercropping experience of 30-40 years and a few above 40 years. Fifty percent (50%) indicated of cultivating one hectare or less to pure coconuts. Seventy percent (70%) indicated having 1-3 hectares devoted to intercropping. More income was realized from intercropping where 46% indicated of earning P1000-3,000 from the intercrops for every cropping. This mainly came from bananas, rootcrops and assorted vegetables.

### ***Problems in coconut farming.***

The very unstable market for copra, rat infestation and poor growth/nut production were the prominent problems. Cleaning the crown area and surroundings was the more common practice (47%) in controlling rat infestation. Rat traps (20%) were also resorted to by others.

Soil erosion remains to be a serious problem on sloping lands when only field crops (e.g. maize), and no perennials, are planted in combination with the coconut trees.

### Coconut Production Technologies

Generally, farming and product processing technologies were all **indigenously developed** and were handed down from generation to generation.

*Varietal choice.* The native, tall varieties especially *pilipog* and *lupisan* varieties have been favored over the new hybrid dwarf varieties because the latter has been observed to have a shorter life span, inferior bole clearance, having small-size nuts and are susceptible to pests and diseases. Planting stock also is limited. The only advantage is its low height at maturity which facilitates nut-picking and tuba-tapping. The native tall varieties were most useful for lumber.

*Seed-nut selection.* Coconuts that showed good fruit-bearing performance and a general vigorous appearance were considered as source of planting materials. Seed-nuts for planting were taken from the lower tip of the bunch of fully mature nuts as these were usually the biggest and most robust ones. As experienced these are the nuts that naturally fall first when the whole bunch is fully mature. When germinated only those with shoots emerging off-center were used for planting. It was a common observation that coconuts grown from seedlings with shoots coming out of the “eye” or point of attachment of the peduncle would produce weak bunching. There were a few who didn’t care at all where the shoot emerged especially if there’s a scarcity of planting materials.

*Pre-germination treatment.* A portion near the top of the nut, where the shoot is believed to best emerge from, is scarified using a sharp bolo. The thinned husk in this portion facilitates water absorption thus hastening germination. Some practiced the hanging of the scarified nuts, bunched by pairs, on a bamboo pole as if it’s a clothesline, to avoid being eaten by animals once germinated.

*Land preparation.* Brushing, cleaning and hole digging were the main activities in preparing the planting area. If intercropping is intended to be done, the area would be plowed. The general practice is spacing the holes at 10 x 10 meters apart. A few spaced it at 8 x 8 meters.

*Some planting practices:* 1) Seedlings were planted before the roots were one foot long; 2) Timed usually during the full moon; others said 3 days after the new moon when the sun and moon are more or less of the same size. All these were believed to enhance growth and nut bearing; 3) The dug top soil is returned to the hole; 4) *Pitogo* (a cycad) leaves are placed at the bottom of the planting hole before setting in the seedling. By doing so it is hoped that, like the *pitogo*, the coconut would not grow very tall so harvesting the nuts would not be a problem; 5) The planter walks slowly towards the planting hole so the plants would not grow very tall; 6) The planter would carry either a baby or a basket on his back while planting. The belief: it will promote a good bunching of coco fruits; 7) The planter would avoid being hit by the shadow of the coconut seedling because it was believed that he would have a shorter life span if the seedling’s shadow fell on him. The practices were inherited from the ancestors. Not everybody practiced numbers 4-7.



*Farm Maintenance.* Only a few practiced fencing the farm due to the costs involved. Those few who did, used bamboo slats or barbed wire as fencing material. Fencing was to keep away animals from the area. The main maintenance activity is brushing or cleaning. Smudging also was practiced by many. When cash crops are intercropped, the coconuts are usually benefited from the maintenance operations for intercrops including fertilization. Fertilization is seldom practiced. Only during rare occasions when the PCA would dole-out coconut fertilizers usually potash. Since 1987 PCA began to dole-out fertilizers like ammonium sulfate and potash through the municipal government. The supply was very limited and only a few could avail. A 5-year program of fertilizer dole-out was launched by the PCA in 1990. The dole-out accordingly has stopped in the last 4 or 5 years.

### Coconut Products Processing and Marketing

Copra, tuba and bahalina production involved indigenously developed technologies and use of available local resources like indigenous platform dryer, fuel and the method of drying.

#### **Copra Production**

Income from copra sales was a very important source of income. The highly unstable copra price has been perceived a perennial problem and a major drawback for coconut farmers.

#### **Tuba Production**

Tuba production was still on a low scale but was also an important source of income. The technologies involved are fairly simple and most of the needed paraphernalia can be manufactured from locally available resources like the bamboo culms which can be fashioned into various tuba production equipment. The financial setback is in the needed cash to buy the dye. Tuba tapping/gathering also involves high risk in falling from the coconut tree which is fatal in most cases.

#### **Bahalina Production**

Although bahalina commands a higher market price than tuba only a few ventured into this enterprise for three main reasons: 1) there is not much tuba around to process; 2) the ever present need for immediate cash makes it practical to sell the tuba immediately and 3) the process is meticulous than tuba production and takes a long time. Some would produce it for special orders or for special family and other social gatherings like *fiesta*.

#### **Marketing Flow**

For copra, if it's only a few bags / sacks they would be sold to the local middlemen who would in turn sell it to Tagbilaran or Cebu. But if there are plenty these are transported and sold in Tagbilaran where it goes next to Cebu and other destinations for processing into various products. Tuba is also sold locally in the town, Tubigon, Antequera or Tagbilaran. Same marketing path holds for bahalina and other farm products like bananas and vegetables. Access to good roads and the unstable markets were the main constraints for some in marketing their products.

### Effects of intercropping in coconut farms

**Intercropping increases income** from the coconut plantation, but copra production remains to be the main source of income.

**Intercropping generally benefits the coconut trees**, due to the positive effects of the cultivation practices applied to the intercrops, such as weeding and fertilizing.

**Ipil-Ipil and timber trees, such as mahogany and gmelina, adversely affect copra production,** especially, when these trees are being planted too close to the coconuts and/or if they overtop the main crop. Likewise, farmers observed some light competition from the coconut trees on the intercrops.

## VI. Conclusion

The study concluded that the intercropping systems could be improved (i.e. made more productive) by using more strategic plant combinations, plant densities and planting patterns for the different life stages (and related growth patterns) of the coconut trees. Effective erosion control on sloping fields requires the planting of a combination of tree and field crops, the installation of NVS or other vegetative buffer strips, and the application of organic farming practices (mulching, crop residue recycling, composting) to sustain soil fertility. More in-depth studies are required before potentially best-bet coconut-based agroforestry systems can be identified and extrapolated to other areas. The planting of fast-growing and tall timber trees under coconut is not recommended (coconut is a C-4 plant and more than 30 % shading adversely affects its growth). Only shallow-rooted and shade-tolerant intercrops should be planted within a 3-meter radius around the coconut trees.

The following are the other conclusion made from the findings:

- Edaphic and climatic factors generally favor the growing of coconuts in San Isidro town. But the area is already devoid of higher vegetation except coconuts. Due to the absence or non-inclusion of higher vegetation in other farms some areas have gone very unstable as evidenced by mass soil movement like in Baryong Daan.
- San Isidro constituents are much involved into coconut farming where household income is significantly sourced from, but owned or available lands for cultivation is only small.
- Copra sales is a major source of household cash along with sales from bananas, rootcrops and *tangkis* (buri) fibers.
- Intercropping in coconuts is really acknowledged to have increased family income and incurred mutual benefits for intercrops and main crop (coconut).
- However, with the positive perception on intercropping are realistic problems/constraints encountered which could be divided into *internalities* and *externalities*:  
Prominent of the *externalities* is the very unstable market price of copra. A minor one is access to market roads or transportation problem.  
The foremost urgent problem on *internalities* is rat infestation on coconuts and “bogtok” problem on bananas. Adverse effects on growth and yield of the coconuts and intercrops were highly observed as well.
- Farm sanitation, cleaning of the coconut crown area and adoption of a planting spacing that allows a broken canopy are the most potential and practical measures of controlling the rat problem.
- The *interplay* among various factors on specific site characteristics, planting spacing, crop combination, control of shading and cultural treatments like fertilization and sanitation obviously is causing problems on growth and yield of coconuts and the intercrops.
- Intercropping started when there were limited lands to cultivate.
- Production technologies involved in coconut farming, copra, tuba and bahalina and even in *tangkis* (buri fiber) production were indigenously developed and handed down from ancestors.

- Men handled the heavy farm work while the women assisted in the lighter activities. But the women played a higher role in marketing and sales keeping. The gender roles created no social problem. Nobody was coerced or forced to do his role and no abuse is evident. It was all based on practical thinking and mutual understanding.

## **VII. Recommendations**

Based on the results of the study the following recommendations were developed:

- The intercropping schemes needed to be improved in the area of species choice and combination, shading control, spatial distribution and maximization in various life stages of the coconuts or the degree of canopy closure. Further researches or studies are highly called for along these areas.
- Timber trees intercropped with the coconuts needed to be controlled. These should not be planted too closely with the coconuts and overtopping of the same should not be allowed as the coconuts being C-4 plants are adversely affected above 30% shading. The farmers may be sufficiently informed that intercrops within a 3-meter radius around the base of the coconuts should be the shallow-rooted types and shade tolerant ones.
- Some of the veteran coconuts which exhibited reducing fruiting capacity may be replaced with newly planted ones to optimize nut production. Intercropping be applied or intensified in wanting areas.
- Organic fertilization to the coconuts and other cultivated plants through mulching and use of compost, manure, and farm residues should be more practiced.
- The "bogtok" - viral disease of bananas that significantly reduced the quality and usefulness of its fruits should be looked into and possible control measures be employed especially that banana is a major source of income along with copra.
- Soils in many areas especially along the slopes were greatly destabilized as evident by massive soil movement as a result of continuous cultivation of pure agronomic cash crops. These lands should be revegetated either with mixed tree stand or trees in combination with other crops.
- Contour farming as initiated in Baryong Daan with the employment of NVS coupled with other contour plants to further stabilize the contours should be applied to more areas/ other barangays that need it.
- An IEC on improved intercropping practices with coconuts be conducted.