PN-ABD-278 62757

Adoption And Economic Viability Of The Sloping Agricultural Land Technology On Small Upland Farms, Eastern Visayas, Philippines

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ADOPTION AND ECONOMIC VIABILITY OF THE SLOPING AGRICULTURAL LAND TECHNOLOGY ON SMALL UPLAND FARMS, EASTERN VISAYAS, PHILIPPINES

A Research Report Submitted to:

U. S. Agency for International Development
Washington, D.C.

by:

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July 1989

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NOTE: This study was funded by the United States Agency for International Development (USAID), Washington, DC. Grant No: DAN-5053-G-SS-7063-00.

ACKNOWLEDGEMENT

The research team wishes to express sincere appreciation to the farmers in Leyte who participated in and cooperated with this study.

A study of this nature is not possible without the support and cooperation of several individuals. The research team wishes to extend special acknowledgement and thanks to those individuals. Mr. Floyd O'Quinn, Project Manager, RUR, S&T, USAID, Washington, provided continuous guidance and encouragement throughout this project. Mr. Robert Ressegue, Chief, Agricultural Development Division, USAID-Manila, extended full cooperation and made the Mission facilities available to the research efforts.

Dr. M. R. Villanueva, President, Visayas State College of Agriculture (VISCA), Leyte, Philippines, was highly enthusiastic in arranging the collaboration of VISCA with this study. Dr. Ly Tong, Director, Farm and Resource Management Institute (FARMI), VISCA, and Dr. Eliseo R. Ponce, Director, Center for Social Research in Small-farmer Development (CSR), VISCA, made personnel, informational and other resources of their units available throughout this study. Mr. Rufino D. Ayaso, former Regional Director of Agriculture - Region VIII, and Engineer Felix V. Quero, Project Director, FSDP-EV, offered complete support and made possible a cooperative working partnership with SRMUs at Villaba and Bontoc.

From Clemson University, Dr. J. Edwin Farris, former Director of International Programs, and Dr. Edward L. McClain, former Acting Chairman, Department of Agricultural Economics, helped facilitate a cooperative working arrangement between South Carolina State College and Clemson University.

At South Carolina State College, Dr. Karl S.Wright, Dean, School of Business, and Dr. Emmanuel Onunkwo, Chairman, Department of Agribusiness and Economics, provided continuous administrative support and encouragement to the project. Dr. Patricia A. Frazier, and Dr. Haile Selassie, Associate and Assistant Professors of Agribusiness, respectively, spent considerable time in providing assistance in data analysis. Mr. Christopher Morfaw and Mr. Ezra Catwell, both graduate students in Agribusiness at South Carolina State College, put in extra efforts to help input the voluminous data into the computer. The Assistance of Mr. Chintamani Sahoo, Statistician, 1890 Research and Extension, was highly valuable in the processing and analysis of the data.

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ACRONYMS

BCCI	Bontoc Credit Cooperative Incorperated
CLT	Certificate of Land Transfer
CRS	Catholic Relief Center
CSR	Center for Social Research on Small-Farmer Development Visayas state College of Agriculture, Baybay, Leyte
DA	The Department of Agriculture, Philippines
DAR	The Department of Agrarian Reform, Philippines
FARMI	Farm and Resource Management Institute Visayas state College of Agriculture, Baybay, Leyte
FSDP-EV	Farming Systems Development Project - Eastern Visayas
LIMDEP	Limited Dependent Variable (a computer software package)
LRI	Likelihood Ratio Index
MAD	Man-animal day
MBRLD	Mindanao Baptist Rural Life Center
MD	Man-Day
SALT	Sloping Agricultural Land Technology
SIRSDP	San Isidro Rural Systems Development Project Visayas state College of Agriculture, Baybay, Leyte
SRMU	Site Research Management Unit
UPLB	University of the Philippines at Los Baños
VISCA	Visayas State College of Agriculture Baybay, Leyte, Philippines

SUMMARY

The Sloping Agricultural Land Technology (SALT) involves planting contour/hedgerows of legumes in the uplands to reduce soil erosion and to build soil fertility. SALT was introduced, on an organized basis, on the island of Leyte, the Philippines, by the Farming Systems Development Project - Eastern Visayas (FSDP-EV) in 1983. Several agencies and organizations are trying to encourage further diffusion of this technology on Leyte. This study was undertaken to evaluate the economic viability of SALT and the factors influencing its adoption.

The research data were collected using three different surveys. The first, the Technology Assessment Survey, interviewed 154 farmers (78 SALT adopters and 76 non-adopters) to develop the socio-economic profile of the farmers and their assessment of SALT. The second, the Weekly Data Survey, collected farm input/output data from 84 farmers (43 adopters and 41 non-adopters) on a weekly basis for about six months. The third, the Contour/hedgerow Budget Survey, collected data from 36 adopters to develop cost estimates for the establishment and maintenance of SALT.

The estimated cost of establishing SALT was ₱368 (₱344 for seeds, ₱24 for other material and ₱179 for labor). Additionally, 8.6 man-days per year were required to maintain it. The largest expense item was the cost of seeds. According to the Weekly Data Survey, the required labor was easily available to all the farmers. The benefits of SALT, i.e., the control of soil erosion and enhancing soil fertility, are realized over a period of time. To measure these changes, longitudinal data on crop yields, soil nutrient contents, and the extent of erosion control would be required. Hence, a complete economic analysis could not be done due to the lack of this data.

Most adopters reported no difficulties in implementing SALT. Major problems reported by adopters in maintaining SALT included, the psyllid infestation of Leucaena hedgerows, labor needs of SALT, and the difficulties of working around (weeding and plowing) the hedgerows. Lack of seeds was given as the primary reason for not expanding the area under SALT. A majority of the adopters had less than 0.5 hectares of land initially under SALT.

Reasons for not adopting SALT include, unfamiliarity with SALT, lack of seeds, the labor requirement of SALT, and potential difficulty of working around the hedgerows. The non-adopters were favorably predisposed towards SALT. About 57 percent of the non-adopters indicated willingness to adopt SALT if they could assistance of seeds and technical guidance.

A probit model was developed to evaluate the impact of different variables on the adoption of SALT. An offer of assistance to implement the SALT was the highly significant variable. According to this model, the farm size, age and education of the head of the household, number of work-age children, and the farm income did not significantly impact the adoption of SALT.

Increasing the farmers' awareness of the dangers of soil erosion, offering technical assistance to farmers to construct the hedgerows, and having the seeds or planting material available to the farmers would greatly enhance the diffusion of SALT on Leyte. Since the lack of Leucaena seeds and the psyllid infestation were mentioned as the critical factors in the adoption of SALT, an organized seed program to produce seeds of psyllid resistent varieties of Leucaena is vital to this process.

INTRODUCTION

In the Philippines, it is estimated that approximately 9.4 million hectares of land, or about 31 percent of the country's total land area, is classified as hilly or mountainous (Celestino and Elliott, 1986, p.3). About 4.3 million hectares of this hilly land is under cultivation, mostly by subsistence farmers. Continued cultivation without adequate conservation measures is causing increasing denudation of these already fragile lands and is creating sediment-related problems downstream in the low-lands. The subsistence farmers in the rainfed upland regions constitute a chronic poverty group in the Philippines. These farmers do not have the resources and the motivation to follow necessary soil conservation measures. As additional lands in the upland are brought under cultivation, the soil erosion problem is bound to accelerate. Unchecked soil erosion poses a serious threat to the livelihood of these farmers and a serious ecological problem for the country.

The Philippines has one of the most advanced agricultural research systems in Asia. It has helped the Philippines to make significant improvements in food and fiber production. Earlier efforts to improve agricultural productivity focused on one-commodity technologies, mostly for lowland conditions. Lowland farmers have been the primary beneficiaries of these technological innovations. Traditionally, the uplands have been considered as marginal for farming. Thus, the development of suitable upland farming systems was largely ignored.

Masagana-99 and Maisan-77 programs were earlier nationwide efforts to improve technologies for rice and corn. Some of the largest cropping systems programs of recent years in the Philippines include: the Multiple Cropping Program at the University of Philippines at Los Baños (UPLB); The Ministry of Agriculture's Second Rural Development Land Settlement Project; KABSAKA Project in Iloilo jointly sponsored by the International Rice Research Institute (IRRI) and the Philippines Council for Agriculture, Forestry, and Natural Resources Research and Development (PCAARD); and the Integrated Agricultural Production and Marketing Project (IAPMP) in Central Luzon. (USAID, FSDP-EV Project paper, 1982). The KABSAKA project developed a cropping system to change

the traditional system of one crop of rainfed rice followed by one upland crop, to a two rice crop and one upland crop type of system. This cropping system requires long rainy season and lower slope to exercise a certain degree of water control - conditions far different than those in Eastern Visayas. The KABSAKA approach of combining adaptive research and extension, however, seems to be effective in developing location-specific technologies throughout the Philippines.

The policy makers and planners in the Philippines have become acutely aware of the importance of introducing appropriate technologies in the upland to assure conservation and to sustain agricultural production. USAID's interest in this issue stems from the FY-82 Country Development Strategy Statement (CDSS). The CDSS identified small farmers in the rainfed and upland areas as a major poverty group. It pointed out several constraints faced by these farmers to improve their living conditions. Three of the most significant constraints are: low-yielding rainfed technology for productive system in use; (2) cost/price squeeze hampering farmer's adoption of more productive technology; and (3) the use of inappropriate farming practices in uplands which contribute to severe soil erosion and run-off (USAID, Project Paper, FSDP-EV, 1981).

The Philippines Government, with funding support from USAID, initiated the Farming Systems Development Project - Eastern Visayas (FSDP-EV) in 1982. The purpose of this project was to improve and strengthen a research system with mechanism to generate, adapt, and transfer agricultural technologies to the resource poor upland farmers of Region VIII (FSDP-EV, Annual Report, 1985). The Department of Agriculture in Region VIII administered the project and the Visayas State College of Agriculture (VISCA) had the responsibility in the area of research and training. Cornell University provided technical assistance to the project. Six research/demonstration sites were selected by FSDP-EV on the islands of Leyte and Samar. They were Basey and Gandara on Samar; and Bontoc, Jaro, Matalom and Villaba on Leyte.

The Sloping Agricultural Land Technology (SALT) was introduced by the FSDP-EV as a part of this technological package. The SALT involves planting contours across the slopes in the uplands with hedgerows of fast growing legumes.

The most commonly used legume in the Philippines is the "Giant" Ipil Ipil (*Leucaena leucocephala* (Lam.) De Wit) sometimes called the "Hawaiian Giant." (Gagni and Tabinga, 1976; Gapas, 1987). The legume helps build soil fertility through the fixation of atmospheric nitrogen, the decomposition of trimmed mulch from the hedgerows, and the reduction of soil erosion. *Leucaena* is also useful as timber, pulpwood and as fodder for livestock. These multifarious benefits from the hedgerows, coupled with increased soil productivity, present a possible avenue for the upland farmers to enhance their incomes and control soil erosion through the adoption of SALT. The Mindanao Baptist Rural Life Center (MBRLC) is generally credited for having developed SALT in 1971 (Watson, 1986). This technology has been disseminated in the Philippines since 1978.

Because of its simplicity and potential long-run benefits, there is significant interest in the Philippines for wider dissemination of SALT. Prior to that, it is essential to assess, at the farm level, the economic merits of SALT, the nature of its acceptance by the farmers, and the farmers' reasons for adopting and not adopting this technology. This study was undertaken to make such examination of SALT introduced by the FSDP-EV. Other nearby SALT sites, not connected with FSDP-EV, were also added to the study to provide a wider assessment of the technology.

Study Objectives

The overall objective of this study was to evaluate the economic viability of SALT and to assess the factors influencing adoption/non-adoption of the technology by the small upland farmers in Eastern Visayas. Specific objectives were:

1. Evaluate the factors influencing farmer adoption/non-adoption of SALT.
2. Determine the cost structure and resource requirements for the implementation and maintenance of the SALT.
3. Conduct an economic analysis of SALT to determine the economic merits of the technology.
4. Examine the effect of SALT on labor requirements and availability.
5. Make policy recommendations towards further development and dissemination of SALT.

STUDY AREA AND RESEARCH PROCEDURES

The Study Area

The FSDP-EV sites of Bontoc and Villaba were initially included in this study. During the first field visit the investigators decided to add other non-FSDP-EV sites to the study. These sites represent, to some extent, a secondary diffusion of technology from the FSDP-EV. They were included to provide a wider and more comprehensive base for technology evaluation. Farmers from fourteen "barangays" (or the villages outlying a municipality) from five municipalities were included in the study. The location of the study area is shown in Figure 1.

The Description of Study Area[1]

The island of Leyte, where the study area is located, is divided into two provinces: Leyte, which makes up the Northern two-thirds of the island, and Southern Leyte. A brief agro-climatic description for the municipalities in the study is given below:

Southern Leyte. The municipality of Bontoc is located on the coast of Southern Leyte. From Bontoc only two barangays, Buenavista and San Vicente, were included in the study because they were the only villages where SALT has been formally introduced. The lowland in this area is flat while the uplands are hilly and mountainous. Two major soil types are Umingan clay and Massin clay.

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[1] Area description based upon the following:

Center for Social Research in Small Farmer Development. Hillyland Development: San Isidro Rural Systems Development Project. VISCA, Leyte, January 1984.

Lightfoot, Clive, F. V. Quero and M. R. Villanueva. Review of Research Methods and Findings, FSDP-EV Report No. 33, VISCA, March 1985.

Parrilla, Leonila S. Socioeconomic Profile of Cagnocot and Barangbang, Villaba, Leyte, FSDP-EV Report No. 25, December 1985.

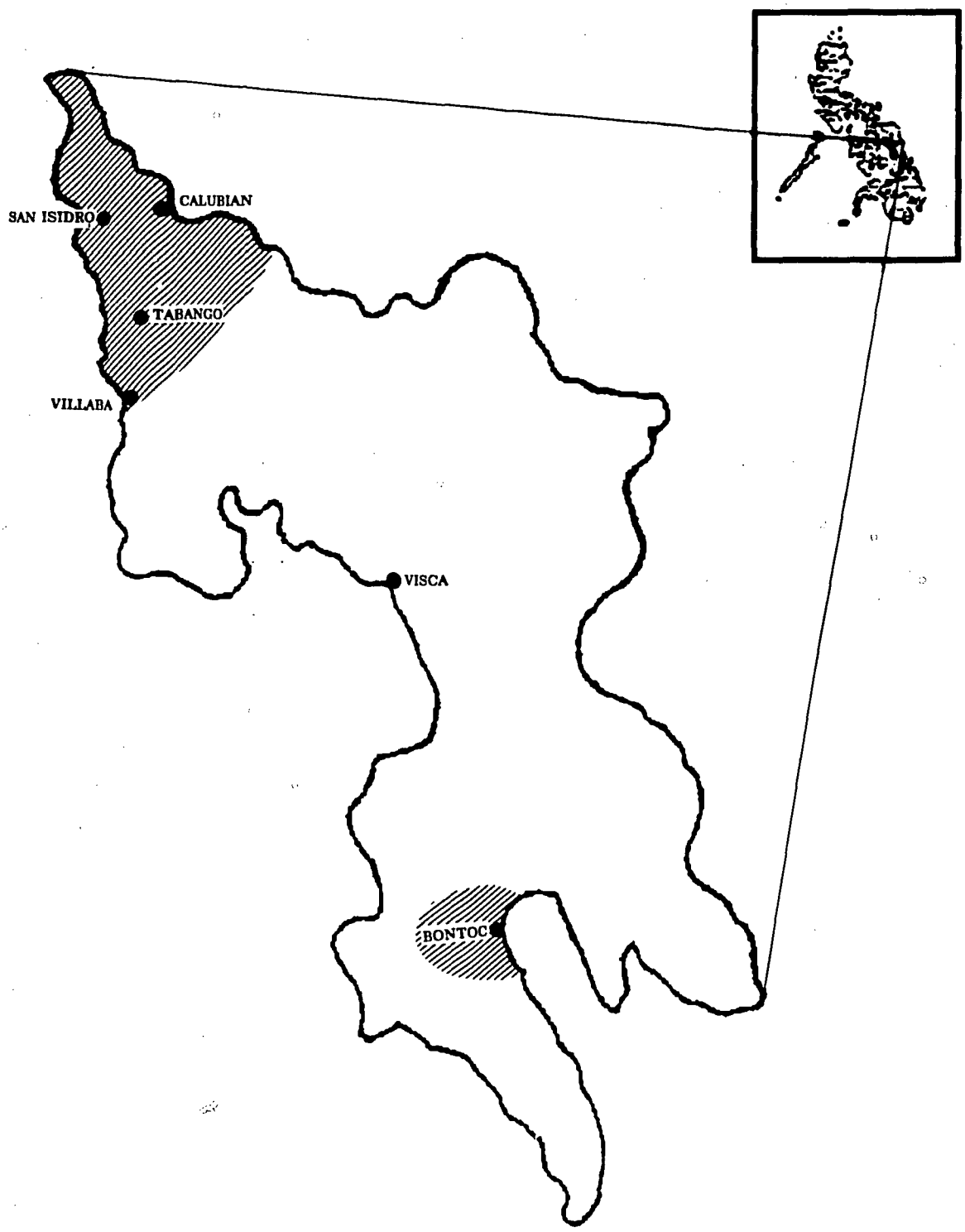


Figure 1: Location of the Study Area, Leyte, Philippines

Umigan clay is good cropping soil and is found mostly in lowlands. It is fairly rich in organic matter and light in texture.

The Massin clay is found in the uplands. It is a heavy clay which has poor internal drainage and consequently is subject to sheet and gully erosion. This soil type is very poor in organic matter and gets sticky when wet. Coconut occupies a larger percentage of total area, but abaca is the dominant crop in the uplands. Corn, upland rice, vegetables and fruit trees are other crop enterprises.

This region of Leyte has two distinct types of climates. One type of climate has a reasonably dry season of 1-3 months from April to September. The other type has heavy rainfall from October to May.

Leyte. The municipalities of Villaba, San Isidro, Calubian and Tabango are located in northern Leyte. The FSDP-EV site is located in the sitio of Barangbang in barangay Cagnocot. It is approximately 15 km from the municipality of Villaba. The remaining three municipalities are to the north of Villaba. The barangays from these municipalities, which were included in the study, lie within a radius of 25 km.

The topography is classified as mostly rolling to hilly with increasing steepness towards the hilltops. A significant amount of erosion is evidenced by barren hilltops, and sharp, deep gullies formed by water run-off. Faraon clay is dominant in the uplands while other variations of clay are found in different areas of low-lands. The soils are extremely sticky when wet and very friable when they are dry. This makes them highly susceptible to soil erosion.

Corn and rice are the principal crops. Other crops grown include peanuts, mungbeans, root crops, banana, melons, and some vegetables. Most crops are grown primarily for subsistence. If there is any surplus, it is sold for cash. Some tobacco is also grown, mostly for domestic use.

There is a dry season between February and April. The rainfall is fairly even throughout the rest of the year. Temperature variation is also minimal.

Sources of Introduction of SALT in the Study Area

There are four institutions and organizations responsible for introducing SALT in the study area: the Bontoc Credit Cooperative Incorporated (BCCI), FSDP-EV, the San Isidro Rural Systems Development Project (SIRSDP), and the Department of Agriculture (DA).

BCCI. The BCCI is a credit union set up by Catholic Relief Services (CRS). It provides credit, training and technical assistance to the farmers. Since 1984, they have established a communal SALT farm in Southern Leyte at San Vicente in Bontoc Municipality. This farm has well flattened contours, gets good yields and has eight cooperator farmers. Only four farmers are among the eight cooperators from this barangay who have implemented SALT. BCCI has made loans to additional farmers, but few have actually begun the adoption process.

FSDP-EV. FSDP-EV has introduced SALT in the barangays of Buenavista, Bontoc and Cagnacot (Barangbang), Villaba. Each site has a Site Research Management Unit (SRMU) consisting of an interdisciplinary team of researchers and extension agents. SRMUs identify problems and develop appropriate farming systems at the sites. SALT is one of the technologies being promoted by the SRMUs since 1983. Farmers were provided with training, technical assistance, use of carabao, and free planting material. Also, they were taken to visit the nearby island of Cebu where SALT has been successfully implemented.

SIRSDP. The SIRSDP is a joint project of the Land Bank of the Philippines and the Center for Social Research in Small Farm Development (CSR) at the Visayas State College of Agriculture (VISCA). It includes the barangays of Hda. Maria, San Miguel, and Daja Daku. Most of the farmers here hold Certificates of Land Transfer (CLT) on lands which were part of three large estates before the land reforms of mid-1970's. This project, initiated in 1983, was designed to introduce new cropping systems to increase farm productivity and to organize a farmers' cooperative in each barangay. The cooperatives organized by the SIRSDP run a dry goods store (sari-sari store), sell farm inputs to members on credit, and market melons which have been introduced as a dry season crop for rice fields. SIRSDP did not give free inputs to farmers. The project provided training and

technical assistance to its members. Furthermore, the planting material for hedgerows (usually ipil ipil seeds) were given to farmers on condition of after-harvest replacement.

DA. In the remaining barangays there is no special organized project. The Department of Agriculture (DA) helps implement SALT as part of its routine operations. In the municipality of Tabango, the DA worked with the local farmers' association to introduce SALT. This group was first exposed to the technology at the FSDP-EV site at Villaba. Now, Tabango also serves as a training site. In the San Isidro barangays of Capinahan, Busay, and Linao, and in Tagharigue, Calubian, the DA works in cooperation with the Department of Agrarian Reform (DAR). The DAR provides training to interested farmers and awards them a cash grant of ₱300. In return, the farmers are expected to adopt and maintain their contour hedgerows.

Research Procedure

Analytical Basis for the Evaluation of SALT

There are several issues involved in examining the economic viability of SALT and the nature of adoption by the upland farmers. An understanding of basic elements of SALT is essential to conduct this examination. A brief description of SALT is attached in Appendix-A. Primary considerations in evaluating SALT are described below:

1. The amount of land occupied by the hedgerows represents an immediate loss from current production. Subsistence farmers must weigh this certain short-term loss against any possible benefits that they may receive in the future from increased soil fertility and reduced soil erosion.
2. Selling of trimmed legume leaves rather than incorporating them in the ground brings immediate cash to subsistence farmers, but it represents a loss towards improving the soil fertility in the long-run. Similar trade-off is involved if the leaves are fed to livestock on the farm.

3. The trimming and maintenance of hedgerows on a continued basis represent added labor requirements for farmers. The opportunity cost for that labor becomes an important consideration for farmers in deciding to adopt SALT.
4. The extent of erosion controlled by the establishment of the hedgerows represents a net long-term benefit to farmers. This is significant from the standpoint of sustainability of the farm production system. Inclusion of the spill-over benefits of erosion control on the downstream in the lowlands gets more involved and complicated.
5. It is important to measure the contribution of hedgerows to the improvement of soil fertility in terms of its organic matter, nutrient contents and the depth of top soil. Subsistence farmers are specifically interested in the transformation of this enhanced soil fertility into increased crop yields and consequently higher farm income.
6. With flattened land and improved fertility, farmers may be able to introduce new cash crops into their cropping pattern. Net benefits from this help enhance farm income.
7. For upland farmers, the initial investment for adopting SALT is minimal; namely, the seeds, the labor for preparing contours and planting hedgerows, and the loss of production from land occupied by the hedgerows. Yet, some farmers choose to adopt SALT and others do not. It is, thus, necessary to examine if there are some other structural, social or non-economic factors that influence farmers' decision process to adopt or not to adopt SALT.
8. A researcher should be cognizant of the possibility of a backward-bending supply curve among the subsistence farmers (Huang, 1976). The supply response to economic incentives from a technology may be different among the commercial farmers compared to that of the subsistence farmers. In other words, the subsistence farmers may not have the incentive to adopt or to fully implement a new technology.

9. Farmers' perception of risk involved in the adoption of SALT is an important factor to consider in studying the adoption of the technology.

A thorough examination of the above issues under different agro-climatic conditions over an extended period of time represents an ideal framework to evaluate the merits of SALT. The present study was unable to consider all these issues because of contractual time limitation (one year) and unavailability of some vital baseline and time-series data. The precise dimensions of the present study are described in the following pages.

Data Needs and Availability

There are two basic approaches to assessing the impact of technology: (1) the "before and after" approach, and (2) the "with and without" approach. For the "before and after" approach, it is difficult to measure the increases because of natural growth (Ranaweera, 1987). Also, to make "before and after" comparisons of changes in soil fertility, soil erosion, yields, incomes, and resource requirements it is necessary to have baseline and longitudinal data. Such data were not available. Some summary aggregates on the level of living for the FSDP-EV cooperators were available. But, these could not be used in the context of the present study. Impact evaluation of the SALT differs considerably compared to that of one specific technology. Adoption of SALT involves short-term costs and benefits, which are realized in the long-run. Baseline information, therefore, on specific adopters is vital in measuring the impact of SALT over time.

It was, therefore, decided to use the "with and without" approach. This approach presents difficulty in assessing the situation at the time when the technology was originally introduced. The "with and without" approach in this study involved a cross-sectional comparison of adopters and non-adopters of SALT. Three types of surveys were conducted to gather data for this study.

1. Contour/hedgerow Budget Survey - This was a one-time survey administered to the adopters to seek data concerning the establishment and maintenance of contour/hedgerows. It sought information concerning costs and labor requirements for constructing, replanting and trimming the hedgerows. SALT budgets were developed based on this data.

2. Technology Assessment Survey - This one-time survey had two components. The first part sought data on farm demography, resource base, household possessions, production, marketing and financial practices, and farm and off-farm incomes. The views and assessment of SALT by adopters and non-adopters was sought in the second part of this survey.

3. Weekly Data Survey - This survey sought information on farm income, expenses and labor use on a weekly basis. Labor data consisted of the contribution of farmer, spouse, children, others in family, exchange work and hired labor. It also accounted for the off-farm work of farm family. Cash and non-cash income from farm and off-farm sources was recorded in the income/expenditure component. This involved weekly visits to each selected adopter and non-adopter for approximately six months. Farmers in this survey were the subset of those in the Technology Assessment Survey.

Sample Selection and Data Collection

1. With the help of the personnel of FSDP-EV, SIRSDP, DA and other local officials a spot map of SALT adopters was prepared. A total of 137 farmers were identified as adopters in the study area.
2. Areas with wider adoption of SALT were identified for inclusion in the study.
3. Most of the adopters identified in Step #1 were visited to determine the extent of their SALT adoption and to seek cooperation if they were selected in the sample. Adopters with nominal or "paper adoption" of technology and those remotely located or otherwise inaccessible were excluded from consideration in the sample. The adopters to be surveyed were then selected on a cluster basis. Neighboring farmers of these adopters who were not using SALT were selected as non-adopters to be included in the survey. The number of adopters and non-adopters surveyed from different barangay are shown in Table 1.

Organization and management of Field Work

This study was conducted in collaboration with the Visayas State College of Agriculture (VISCA), Baybay, Leyte. Two units of VISCA were involved in the study: (1) The Farm and Resource Management Institute (FARMI), and (2) the Center of Social Research for Small Farmer Development (CSR). The FSDP-EV

TABLE 1: NUMBER OF FARMERS SURVEYED BY LOCATION AND THE TYPE OF SURVEY, 1988

MUNICIPALITY	BARANGAY	TECHNOLOGY ASSESSMENT SURVEY			WEEKLY DATA SURVEY		
		Adopter	Non Adopetr	Total	Adopter	Non Adopter	Total
Bontoc	Buenavista	8	8	16	.	.	.
	San Vicente	4	4	8	.	.	.
	Sub Total	12	12	24	.	.	.
Villaba	Barangbang I & II	10	10	20	7	7	14
	Total	10	10	20	7	7	14
Tabango	Omaganhan/Tambis	8	8	16	7	7	14
	Sub Total	8	8	16	7	7	14
Calubian	Tagharigue	3	3	6	3	3	6
	Garrido	2	3	5	.	.	.
	Patag	4	3	7	.	.	.
	Sub Total	9	9	18	3	3	6
San Isidro	Capinaham	2	2	4	2	2	4
	Busay	3	3	6	2	2	4
	Linao, Cadlum	6	6	12	6	5	11
	Hda. Maria	8	9	17	5	5	10
	San Miguel	11	9	20	6	5	11
	Sitio Laray	5	5	10	3	4	7
	Daja Daku	4	3	7	2	1	3
	Sub Total	39	37	76	23	21	44
GRAND TOTAL		78	76	154	43	41	84

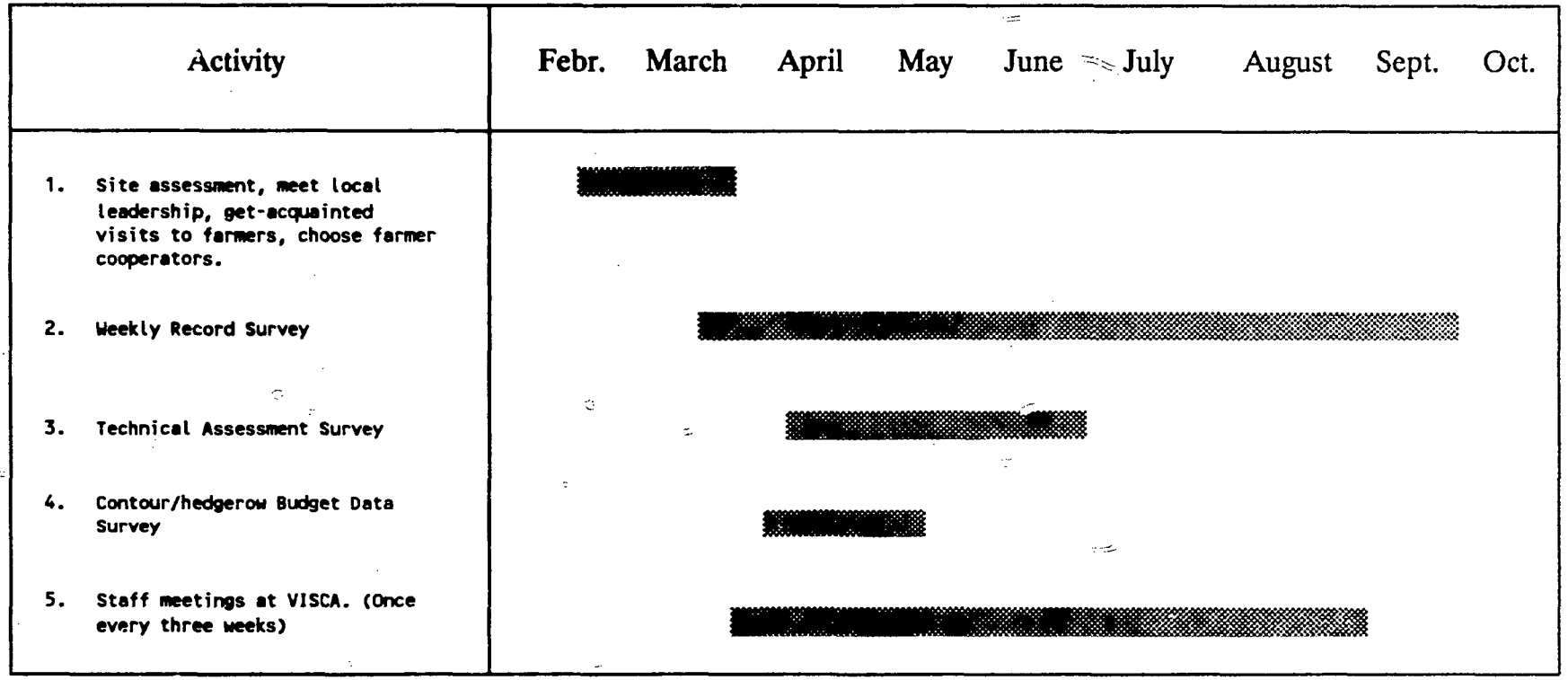
activities of research and training at VISCA were handled through FARMI. A staff agricultural economist from FARMI was assigned as an associate researcher to work with this study. The principal responsibility of this person was to handle administrative details for the Research Assistants, and translate and edit the questionnaires as they came from the field. CSR, in cooperation with the Land Bank of the Philippines, was conducting the SIRSDP in the study area. A senior agricultural economist was assigned by CSR to work with this study as a

consultant. This person was responsible for providing insight and guidance to the research team in conducting the study. Both of these individuals were stationed at VISCA.

The team of enumerators consisted of three Filipino Research Assistants (RAs) and one graduate student from the United States. The study area was divided into three segments, and one RA was assigned to each. The RAs lived in their respective areas to develop a rapport with their respective communities. They were in the field for about eight months. The U.S. graduate student stayed for about six months at one of these locations and supervised day-to-day details of data collection for all three RAs.

The RAs, the U.S. graduate student and the two researchers from VISCA met at VISCA as a group every three weeks to discuss the problems arising in collection of data, and in editing and translating the questionnaires. A chart describing the details of various field activities is shown in Figure 2.

Figure 2: Time Chart of Field Activities, February-October, 1988



FARMER-RESPONDENT PROFILE

A total of 154 farmers (78 adopters and 76 non-adopters) were interviewed in the six study sites. The interviews provided information for a socioeconomic profile of the farmers and for the identification of similarities and differences among adopters and non-adopters. The information was collected by the field team members as part of the Technology Assessment Survey. Data collected included information on the family members (age, education, occupation, family size), land resources, livestock ownership, orchard ownership, housing, household possessions, farm equipment possessions, marketing, and sources of household cash income.

Demographic Characteristics

Head of the Household

Household members include all those individuals living in the family residence at the time of the interview. Seventy-six (97 percent) of the adopter households and seventy-four (97 percent) of the non-adopter households had male household heads.

The average age of the adopter household heads, as shown in Table 2, was 42 and for the non-adopter household heads it was 44. The non-adopter household heads were generally older than the adopter household heads at all the study sites.

TABLE 2: AVERAGE AGE, HEAD OF HOUSEHOLD, BY SOURCE OF SALT, TECHNOLOGY ASSESSMENT SURVEY

SOURCE OF SALT	ADOPTER	NON-ADOPTER	TOTAL
DA	41.57	43.43	42.50
FSDP-EV-BONTOC	46.33	47.50	46.92
FSDP-EV-VILLABA	39.70	45.00	42.35
SIRSDP	41.07	42.62	41.81
TOTAL	41.88	44.00	42.93

The average number of years of education of adopter household heads was 4.6 years and of non-adopter heads was 3.3 years (Table 3). A detailed frequency distribution of education is shown in Table 4. Over 63 percent of the adopters and 50 percent of the non-adopters had four or more years of education. The farmers, both adopters and non-adopters, at the FSDP-EV Bontoc site had the highest level

TABLE 3: AVERAGE YEARS OF EDUCATION, HEAD OF HOUSEHOLD, SOURCE OF SALT, TECHNOLOGY ASSESSMENT SURVEY

	ADOPTER	NON-ADOPTER	TOTAL
DA	5.39	3.18	4.29
FSDP-EV-BONTOC	6.58	4.17	5.37
FSDP-EV-VILLABA	2.20	2.40	2.30
SIRSDP	3.89	3.23	3.57
TOTAL	4.63	3.25	3.95

of education (5.4 years) compared to the farmers at the other sites. The adopters at the Department of Agriculture (DA) sites and at the FSDP-EV Bontoc site had, on an average, over two years more education than non-adopters. Six of the adopters and one non-adopter had attended high school. Five of the adopters and one non-adopter had attended college. All of the farmers who had attended college were either from DA sites or the FSDP-EV Bontoc site.

Farming was the major occupation for almost all of the farmers surveyed. Of the only two adopter household heads not reporting farming as their major occupation, one reported fishing and the other reported being a high school principal. The minor occupations of the farmers surveyed are shown in Table 5. Forty-one percent of the adopter household heads and 43 percent of the non-adopter household heads reported that they had no minor occupation. The primary

TABLE 4: YEARS OF EDUCATION, HEAD OF HOUSEHOLD, BY SOURCE OF SALT, TECHNOLOGY ASSESSMENT SURVEY

SOURCE OF SALT	EDUCATION	ADOPTER		NON-ADOPTER		TOTAL	
		NO	%	NO	%	NO	%
DA	3 OR BELOW	9	32.1	14	50.0	23	41.1
	4-6	13	46.4	14	50.0	27	48.2
	7-9	3	10.7	.	.	3	5.4
	10-12	2	7.1	.	.	2	3.6
	OVER 12	1	3.6	.	.	1	1.8
	SUB TOTAL	28	100.0	28	100.0	56	100.0
FSDP-EV-BONTOC	3 OR BELOW	1	8.3	4	33.3	5	20.8
	4-6	7	58.3	7	58.3	14	58.3
	7-9	2	16.7	.	.	2	8.3
	10-12	2	16.7	1	8.3	3	12.5
	SUB TOTAL	12	100.0	12	100.0	24	100.0
FSDP-EV-VILLABA	3 OR BELOW	7	70.0	7	70.0	14	70.0
	4-6	2	20.0	3	30.0	5	25.0
	7-9	1	10.0	.	.	1	5.0
	SUB TOTAL	10	100.0	10	100.0	20	100.0
SIRSDP	3 OR BELOW	12	42.9	13	50.0	25	46.3
	4-6	16	57.1	12	46.2	28	51.9
	7-9	.	.	1	3.8	1	1.9
	SUB TOTAL	28	100.0	26	100.0	54	100.0
TOTAL	3 OR BELOW	29	37.2	38	50.0	67	43.5
	4-6	38	48.7	36	47.4	74	48.1
	7-9	6	7.7	1	1.3	7	4.5
	10-12	4	5.1	1	1.3	5	3.2
	OVER 12	1	1.3	.	.	1	0.6
	TOTAL	78	100.0	76	100.0	154	100.0

minor occupation among farmers, for both adopters and non-adopters, was farm laborer. Forty percent of the adopter household heads and 41 percent of the non-adopter household heads reported farm laborer as their minor occupation. A variety

TABLE 5: MINOR OCCUPATION, HEAD OF HOUSEHOLD, BY SOURCE OF SALT, TECHNOLOGY ASSESSMENT SURVEY

MINOR OCCUPATION	ADOPTER		NON-ADOPTER		TOTAL	
	NO	%	NO	%	NO	%
Farm Labor	28	35.9	31	40.8	59	38.3
Farming	1	1.3	.	.	1	0.6
None	32	41.0	33	43.4	65	42.2
others	17	21.8	12	15.8	29	18.8

of other minor occupations were reported by the remaining farmers. These included, in order of frequency, fish vendor, carpenter, fishing, seamstress/tailor, farm product vendor, and "tuba" (a fermented coconut wine) vendor.

Spouse

The average age of the spouse of adopters and the spouse of the non-adopter was 37 and 39, respectively. Over 70 percent of the spouses of adopters and over 50 percent of the spouses of non-adopters had four or more years of education. Again, the spouses at the DA sites and the FSDP-EV Bontoc site had the higher levels of education.

It can be observed from Table 6 that 56 percent of the adopter spouses and 55 percent of the non-adopter spouses reported farming as their major occupation. Twenty-five percent of the adopter spouses and 35 percent of the non-adopter spouses reported having no major occupation. The major occupations of the remaining 19 percent of adopter spouses and 10 percent of non-adopter spouses included food vendor, "tuba" seller, store owner, seamstress and school teacher. In response to questions concerning their off-farm activities, 93 percent of the adopter and the non-adopter spouses reported having no minor occupation. It should be noted that the majority of spouses were female and that homemaking, although not reported in the survey, was the primary occupation.

TABLE 6: MAJOR OCCUPATION OF SPOUSE, SOURCE OF SALT, TECHNOLOGY ASSESSMENT SURVEY

MAJOR OCCUPATION, SPOUSE	ADOPTER		NON-ADOPTER		TOTAL	
	NO	%	NO	%	NO	%
Farming	41	56.2	39	54.9	80	55.6
None	18	24.7	25	35.2	43	29.9
others	14	19.2	7	9.9	21	14.6

Children

The family size is important in terms of family labor, farm production and household consumption to the subsistence farm family. Table 7 shows the average family size at various study sites. The average adopter family size was 4.3 compared to 4.6 for the non-adopters. Non-adopters had larger family sizes at all the study sites. At the FSDP-EV Bontoc site the average family size was 6.4 for both adopters and non-adopters. This was relatively higher compared to the average family sizes at the other sites.

TABLE 7: AVERAGE FAMILY SIZE, BY SOURCE OF SALT, TECHNOLOGY ASSESSMENT SURVEY

SOURCE OF SALT	ADOPTER	NON-ADOPTER	TOTAL
DA	4.21	4.32	4.27
FSDP-EV-BONTOC	6.42	6.50	6.46
FSDP-EV-VILLABA	3.90	4.00	3.95
SIRSDP	3.61	4.35	3.96
TOTAL	4.29	4.63	4.46

In terms of providing labor to farm operations, it is not the overall family size but the availability of work-age children which is more significant. As shown in Table 8, the average number of work-age children (defined as being eight years of age or older) in adopter households was 1.6 and in non-adopter households was 1.3. At all the SALT sites, except for Bontoc, the adopter households had relatively more work-age children at home than the non-adopters. Overall, the FSDP-EV Bontoc site had the highest number (2.17) work-age children while FSDP-EV Villaba had the lowest (1.00). The larger family size at the FSDP-EV Bontoc site is attributed to a larger number of work-age children.

TABLE 8: AVERAGE NUMBER OF WORK-AGE CHILDREN AT HOME, SOURCE OF SALT, TECHNOLOGY ASSESSMENT SURVEY

SOURCE OF SALT	ADOPTER	NON-ADOPTER	TOTAL
DA	1.86	1.29	1.57
FSDP-EV-BONTOC	2.08	2.25	2.17
FSDP-EV-VILLABA	1.10	0.90	1.00
SIRSDP	1.36	1.08	1.22
TOTAL	1.62	1.32	1.47

The majority of children of adopters and non-adopters work on the farm. The young men are required to help in planting, weeding, plowing, harvesting and thrashing of rice, while the young women are asked to help in preparing food, taking care of younger siblings, and helping with some farm activities. Approximately 15 percent of adopter children and 17 percent of non-adopter children have indicated employment outside the household. Their occupations include domestic helper, farm laborer and fishing.

Farm Characteristics

Farm Size

Landholdings varied among farmers and sites. The adopters owned slightly larger farms than the non-adopters. The overall farm size (combined land area of all parcels) of adopters was 2.12 hectares compared to 1.8 for non-adopters. The detailed distribution of farm size is presented in Table 9. It can be observed from Table 9 that farms of less than one hectare were reported by 15 percent adopters and 31 percent of the non-adopters. Similarly, farms of over two hectares were reported by 44 percent adopters and only 30 percent of the non-adopters.

TABLE 9: AVERAGE FARM SIZE IN HECTARES, BY SOURCE OF SALT, TECHNOLOGY ASSESSMENY SURVEY

ADOPTION TYPE	FARM SIZE	SOURCE OF SALT									
		DA		FSDP-EV-BONTOC		FSDP-EV-VILLABA		SIRSDP		TOTAL	
		NO	%	NO	%	NO	%	NO	%	NO	%
ADOPTER	1. < 1 hectare	4	14.3	2	16.7	5	50.0	1	3.6	12	15.4
	2. 1 - 2	8	28.6	2	16.7	5	50.0	17	60.7	32	41.0
	3. 2 - 3	8	28.6	2	16.7	.	.	9	32.1	19	24.4
	4. 3 - 4	4	14.3	3	25.0	.	.	.	.	7	9.0
	5. 4 or more	4	14.3	3	25.0	.	.	1	3.6	8	10.3
	SUB TOTAL	28	100.0	12	100.0	10	100.0	28	100.0	78	100.0
NON-ADOPTER	1. < 1 hectare	12	42.9	3	25.0	4	40.0	5	19.2	24	31.6
	2. 1 - 2	10	35.7	.	.	5	50.0	14	53.8	29	38.2
	3. 2 - 3	4	14.3	3	25.0	1	10.0	2	7.7	10	13.2
	4. 3 - 4	2	7.1	1	8.3	.	.	2	7.7	5	6.6
	5. 4 or more	.	.	5	41.7	.	.	3	11.5	8	10.5
	SUB TOTAL	28	100.0	12	100.0	10	100.0	26	100.0	76	100.0
ROW TOTAL	1. < 1 hectare	16	28.6	5	20.8	9	45.0	6	11.1	36	23.4
	2. 1 - 2	18	32.1	2	8.3	10	50.0	31	57.4	61	39.6
	3. 2 - 3	12	21.4	5	20.8	1	5.0	11	20.4	29	18.8
	4. 3 - 4	6	10.7	4	16.7	.	.	2	3.7	12	7.8
	5. 4 or more	4	7.1	8	33.3	.	.	4	7.4	16	10.4
	TOTAL	56	100.0	24	100.0	20	100.0	54	100.0	154	100.0

The average number of parcels owned by adopters and non-adopters was 3.0 and 2.5, respectively. The largest number of parcels owned by both adopters and non-adopters was six with an average parcel size of approximately 0.8 hectares. The farmers at the FSDP-EV Bontoc site had slightly larger parcels while those at the DA sites had generally smaller parcels.

Ownership/Tenure

Land ownership and the type of tenure arrangement are important considerations when introducing a long-run technology such as SALT. The types of tenure status for adopters and non-adopters for their major parcel are shown in Table 10. Complete ownership is indicated by 12 percent adopters and 5 percent of non-adopters. After that, CLT and sharecropping are the most predominant tenure arrangements. Sharecropping is relatively more prevalent among non-adopters (35 percent) compared to the adopters (27 percent). CLT arrangement is fairly even among both the groups at about 53 percent.

The primary sharing arrangement between the landlord and the farmer is a 75 percent share to the farmer and a 25 percent share to the landlord. In the case of farmers with a CLT, the landlord was the land bank which wanted its share in cash payments. In the case of farmers, who were sharecropping or leasing, the payment could be either a share of the harvest or a cash payment.

The average number of years of possession of the primary parcel of land for adopters and non-adopters was 15 and 17 years, respectively. For the second parcel, the average number of years of possession for adopters was 13 years and 12 years for non-adopters. For the third parcel of land, the average number of years of possession for adopters was 11 years and for non-adopters, 10 years.

Farm Power and Equipment

Ninety-nine percent of the adopters and 93 percent of the non-adopters used carabao (water buffalo) for farm power. Approximately 72 percent of the adopters and 75 percent of the non-adopters owned or had a share ownership of a carabao. Twenty percent of the adopters and 22 percent of the non-adopters owned two carabao.

TABLE 10: TYPE OF TENURE FOR PARCEL-1, BY SOURCE OF SALT, TYPE OF ADOPTION, TECHNOLOGY ASSESSMENT SURVEY

ADOPTION TYPE	TENURE CLASS	SOURCE OF SALT									
		DA		FSDP-EV-BONTOC		FSDP-EV-VILLABA		SIRSDP		TOTAL	
		NO	%	NO	%	NO	%	NO	%	NO	%
ADOPTER	1. SHARECROP	12	42.9	6	50.0	1	10.0	2	7.1	21	26.9
	2. CLT	10	35.7	.	.	9	90.0	23	82.1	42	53.8
	3. OWN	3	10.7	6	50.0	.	.	.	.	9	11.5
	4. FAMILY SHARED	1	3.6	.	.	.	.	.	.	1	1.3
	5. LEASEOUT	.	.	.	.	.	.	3	10.7	3	3.8
	6. LEASEHOLD	2	7.1	.	.	.	.	.	.	2	2.6
	SUB TOTAL	28	100.0	12	100.0	10	100.0	28	100.0	78	100.0
NON-ADOPTER	1. SHARECROP	13	46.4	8	66.7	1	10.0	4	16.0	26	34.7
	2. CLT	11	39.3	.	.	8	80.0	20	80.0	39	52.0
	3. OWN	1	3.6	3	25.0	.	.	.	.	4	5.3
	4. FAMILY SHARED	.	.	1	8.3	1	10.0	.	.	2	2.7
	6. LEASEHOLD	3	10.7	.	.	.	.	.	.	3	4.0
	SUB TOTAL	28	100.0	12	100.0	10	100.0	25	100.0	75	100.0
ROW TOTALS	1. SHARECROP	25	44.6	14	58.3	2	10.0	6	11.3	47	30.7
	2. CLT	21	37.5	.	.	17	85.0	43	81.1	81	52.9
	3. OWN	4	7.1	9	37.5	.	.	.	.	13	8.5
	4. FAMILY SHARED	1	1.8	1	4.2	1	5.0	.	.	3	2.0
	5. LEASEOUT	.	.	.	.	.	.	3	5.7	3	2.0
	6. LEASEHOLD	5	8.9	.	.	.	.	.	.	5	3.3
	TOTAL	56	100.0	24	100.0	20	100.0	53	100.0	153	100.0

Approximately 90 percent of the adopters and non-adopters owned a moldboard or chisel plow. Almost all the farmers, both adopters and non-adopters, owned a bolo (a machete like tool used for digging, weeding and for a variety of other farm activities). They also owned shovels and scythe's (for harvesting). Several of the farmers in FSDP-EV Bontoc owned coconut dryers.

Farm production, Consumption, and Marketing

The majority of adopters (60 percent) and non-adopters (56 percent) kept all of their crop production for their own home consumption. Twenty-two percent of the adopters and 18 percent of the non-adopters took their production to middlemen for marketing. Ten percent of the adopters and 26 percent of the non-adopters had middlemen come to their home to pick-up the crop for marketing. The remaining farmers, both adopters and non-adopters, marketed their production, in order of frequency, through a cooperative (especially at the SIRSDP site), through wholesalers, or directly to the consumer.

Housing Characteristics and Household Possessions

One indicator of the economic well being of people is the type of dwelling in which they live. Ninety-four percent of the adopters and the non-adopters owned their home. The remaining farmers rented their houses.

The majority of both adopters (83 percent) and non-adopters (85 percent) lived in what are considered to be temporary houses. These dwellings were essentially the same for all the farmers. Houses constructed with wood for structural posts and light materials such as bamboo, nipa, cogon grass, and/or coconut leaves for other parts of the structure are considered temporary. The houses were constructed of wood and/or bamboo frame with bamboo walls and floor and cogon grass or nipa palm roof.

Fourteen percent of the adopters and 13 percent of the non-adopters lived in houses considered to be semi-permanent (combination of strong - concrete, galvanized iron sheeting and wood - and light materials). Three percent of the adopters and two percent of the non-adopters lived in housing considered to be permanent, that is, constructed of strong materials.

The majority of houses owned by both adopters (61 percent) and non-adopters (65 percent) had one room. Only six percent of adopters and four percent of non-adopters had houses with three or more rooms. The majority of adopters (90 percent) and non-adopters (95 percent) owned one-story houses.

In addition to housing, the household possessions owned by people provides

a good indication of economic condition. The farmers were asked whether or not they owned variety items. Only one farmer, an adopter, owned a television. Four adopters and two non-adopters owned phonographs. Two adopters owned refrigerators. Six adopters and four non-adopters owned motorcycles. The ownership of china dishes, wall clocks, and sala sets were equal among both adopters and non-adopters. The majority of farmers, both adopters and non-adopters, owned pails, clay water jars and water basins.

ECONOMIC ANALYSIS OF SALT

The Sloping Agricultural Land Technology is relatively simple and flexible. Its primary short-run costs are the planting material and labor required for the establishment of hedgerows. Costs thereafter include the labor necessary for the maintenance of hedgerows and the costs associated with the loss of production from the land occupied by the hedgerows. Potential benefits of SALT, however, are clearly long-term in nature. Specifically, an increase in soil fertility as a result of nitrogen fixation by the legume and the addition of organic matter from the hedgerow clippings, is a gradual and continuous process over the years. Similarly, the flattening of contours and reduction of soil erosion is also a long-run process. Economic viability of SALT depends upon the net trade-off between these long-term benefits and the above mentioned costs.

It was relatively easy to measure the costs associated with the establishment of the hedgerows. Thirty-six SALT adopters were surveyed to develop the budget for the establishment and maintenance of hedgerows. The budget is presented later in this section.

It was not possible, however, to get a precise measure of the potential benefits of SALT within the time constraint of this study. Ideally, it is essential to have the current and pre-SALT data on soil fertility (crop yields) and soil erosion to assess the changes in them as a result of SALT. Such data were not available and the comparative approach of "before and after" SALT could not be followed. An attempt was made to use the "with and without" SALT approach by collecting weekly farm input-output data from a group of 43 adopters and 41 non-adopters of SALT for a comparative analysis. This Weekly Data Survey was designed to collect this information and the results are presented later in this section.

Contour/Hedgerow Budget

As mentioned previously, the contour/hedgerow budget was developed from the survey of 36 SALT adopters. The budget is based on the following assumptions:

1. The distance between the hedgerows was six meters.

2. A plow, bolo and hoe required for the establishment of hedgerows are not considered as capital investments because farmers usually own these items and are not used exclusively for SALT.
3. The budgets are based upon *Leucaena* hedgerows because that is the most prevalent legume used by farmers in SALT.
4. One man-day (MD) is eight hours and on the basis of the opportunity cost is valued at ₱10 per day. One man-animal-day (MAD) is also eight hours and is valued at ₱20 per day. One MAD consisted of one man and a carabao.
5. The cost estimates are for the construction and maintenance of hedgerows only. It does not take into account the field crops because the farmers can use different cropping patterns to suit their particular farm management priorities.

The cost estimates based on these assumptions for the establishment and maintenance of SALT are shown in Table 11. It can be seen from Table 11 that the cost of seeds is the most significant item accounting for about 63 percent of the SALT establishment cost. The labor requirement is 16.6 man-days with an opportunity cost of ₱179. The maintenance of the hedgerows in terms of gully repair, and trimming and weeding of hedgerows requires 8.6 man-days per year with an opportunity cost of ₱86.

Analysis of Weekly Survey Data

As mentioned earlier, a sample of 84 farmers (43 SALT adopters and 41 non-adopters) was used to gather weekly farm input-output data. The data on labor use consisted of the distribution of labor for the head of the household, the spouse, children, others in the family and the hired labor for different activities in different parcels. Off-farm labor of the farmers was also recorded each week during the survey period. Cash and non-cash transactions related to the farm business operation were also recorded on a weekly basis. This data collection was started on March 14 for a few farmers with a gradual addition of other farmers. By April 11 all 84 farmers were part of the Weekly Data Survey. This survey lasted until October 2, 1988.

TABLE 11: ESTIMATED COSTS PER HECTARE FOR ESTABLISHING AND MAINTAINING SALT, LEYTE, 1988.

I. Establishment of Hedgerows:

1. Material Cost-

a. Ipil-Ipil seed, 8 gantas @ ₱ 43 /ganta	₱344
b. A-frame, stakes, and string	₱24
Direct (material) Cost	₱368

2. Labor Cost-

a. Lay-out contour lines, 2.7 MD @ ₱10/MD	₱27
b. Plow/harrow contour lines, 1.3 MAD @ ₱20/MAD	₱26
c. Plant seed, 2.0 MD @ ₱10/MD	₱20
d. Weeding Hedgerow, 2 times, 4.0 MD @ ₱10/MD	₱40
e. Thinning and Replanting, 1.3 MD @ ₱10/MD	₱15
f. Trim Hedgerow Two times, 5.30 MD, @ ₱10/MD	₱53
Labor Cost	₱179
Total SALT Establishment Cost	₱393

II. Maintenance of Hedgerows:

Labor Cost-

a. Trim Hedgerow, Two times/year, 5.3 MD @ ₱10/MD	₱53
b. Weed Hedgerow, 1.3 MD @ ₱10/MD	₱13
c. Gully Repair, Two times/year, 2.0 MD @ ₱10/MD	₱20
Total Maintenance Cost/year	₱86

The labor use and income summaries from this data will be discussed in the remainder of this section. The variation of different parameters between the adopters and non-adopters cannot be attributed directly to SALT adoption or non-adoption. There are several reasons for this: (1) The average farm sizes were different for both groups, and (2) Under mixed cropping, when a parcel had more than one crop, exact area under each crop could not be ascertained for precise input-output measurements. Also, the data for one complete production cycle of one year could not be collected because of the contractual time constraint of the project. In spite of these difficulties, brief summaries for labor use and income from the available data will be presented here. Three farmers, all adopters, were excluded in calculation of summaries because of their excessively large farm sizes and very high levels of off-farm incomes. Inclusion of these farmers would have given an unrealistic readings for different parameters for the adopters.

Income Analysis. Weekly cash farm income, off-farm income, and total income for farmers in the Weekly Data Survey are reported in Tables 12, 13 and 14, respectively. These figures represent a duration of about six months of the survey. It can be seen from Table 12, that 33 percent of the adopters and 68 percent non-adopters had no cash farm income during the survey period. Thirty percent of adopters and 15 percent of non-adopters reported receiving more than ₱25 per week. On an average, the farm income of adopters was ₱20.17 per week compared to ₱10.84 for non-adopters during the reporting period .

Off-farm income is an important source to supplement income for subsistence farmers. Twenty-three percent of the adopters and 15 percent non-adopters did not have any off-farm income. An off-farm income of less than ₱25 per week was reported by 43 percent adopters and 56 percent non-adopters. On an average, the weekly off-farm income was ₱20.44 and ₱16.23 for adopters and non-adopters, respectively. Total household income for farmers reflecting the combination of farm and off-farm incomes is shown in Table 14.

TABLE 12: FARM INCOME PER WEEK, FARMERS SURVEYED, WEEKLY DATA SURVEY

INCOME PER WEEK (PESOS)	ADOPTER		NON-ADOPTER		TOTAL	
	NO	%	NO	%	NO	%
1. None.	13	32.5	28	68.3	41	50.6
2. 1-25	15	37.5	7	17.1	22	27.2
3. 26-50	4	10.0	2	4.9	6	7.4
4. 51-75	2	5.0	.	.	2	2.5
5. 75-100	1	2.5	3	7.3	4	4.9
6. > 100	5	12.5	1	2.4	6	7.4
TOTAL	40	100.0	41	100.0	81	100.0

TABLE 13: OFF-FARM INCOME PER WEEK, FARMERS SURVEYED, WEEKLY DATA SURVEY

INCOME PER WEEK (PESOS)	ADOPTER		NON-ADOPTER		TOTAL	
	NO	%	NO	%	NO	%
1. None.	9	22.5	6	14.6	15	18.5
2. 1-25	17	42.5	23	56.1	40	49.4
3. 26-50	5	12.5	8	19.5	13	16.0
4. 51-75	2	5.0	.	.	2	2.5
5. 75-100	2	5.0	1	2.4	3	3.7
6. > 100	5	12.5	3	7.3	8	9.9
TOTAL	40	100.0	41	100.0	81	100.0

TABLE 14: TOTAL INCOME PER WEEK-ALL SOURCES, FARMERS SURVEYED, WEEKLY DATA SURVEY

INCOME PER WEEK, (PESOS)	ADOPTER		NON-ADOPTER		TOTAL	
	NO	%	NO	%	NO	%
1. None.	3	7.5	2	4.9	5	6.2
2. 1-50	22	55.0	31	75.6	53	65.4
3. 51-100	9	22.5	4	9.8	13	16.0
4. 101-150	3	7.5	1	2.4	4	4.9
5. 151-200	1	2.5	.	.	1	1.2
6. > 200	2	5.0	3	7.3	5	6.2
TOTAL	40	100.0	41	100.0	81	100.0

Income from the sale of *Leucaena* leaves and seeds during the survey period is shown in Table 15. Eighty percent of the adopters and 93 percent of non-adopters had no income from *Leucaena*. Only 8 adopters, or 20 percent of those surveyed, reported selling varying amounts of *Leucaena* leaves and seeds. Three of the non-adopters also reported sales of ₱51-₱150 during the survey period. It should be pointed out that although the non-adopters do not have *Leucaena* hedgerows, some of them have traditionally broadcasted *Leucaena* on their farms. It should also be pointed out that it is recommended in SALT that *Leucaena* trimmings be turned into the soil to enhance soil fertility. Any cash sales, thus, represent a loss towards that objective.

Sources and Use of Weekly Labor. The labor component of the Weekly Data Survey recorded the amount of labor use towards different farm and non-farm activities. Total labor use for working with *Leucaena* is shown in Table 16. Fifty percent of the adopters did not spend any time working with the hedgerows during the reporting period. Thirty percent of the adopters spent a total of up to 20 hours, i.e., 2.5 man-days, during the survey period. The remaining 15 percent of the adopters spent more than 20 hours working with the hedgerows. These data

TABLE 15: INCOME FROM LEUCAENA SALE OF LEAVES AND SEEDS, FARMERS SURVEYED, WEEKLY DATA SURVEY

SALE OF LEUCAENA LEAVES AND SEEDS (PESOS)	ADOPTER		NON-ADOPTER		TOTAL	
	NO	%	NO	%	NO	%
1. None.	32	80.0	38	92.7	70	86.4
2. 1-50	3	7.5	.	.	3	3.7
3. 51-1,00	2	5.0	1	2.4	3	3.7
4. 101-150	2	5.0	2	4.9	4	4.9
5. > 150	1	2.5	.	.	1	1.2
TOTAL	40	100.0	41	100.0	81	100.0

TABLE 16: LABOR HOURS FOR WORKING WITH LEUCAENA, FARMERS SURVEYED, WEEKLY DATA SURVEY

WEEKLY LABOR HOURS	ADOPTER		NON-ADOPTER		TOTAL	
	NO	%	NO	%	NO	%
1. NONE	22	55.0	35	85.4	57	70.4
2. < 11 Hrs/wk.	6	15.0	2	4.9	8	9.9
3. 11-20 Hrs/wk.	6	15.0	.	.	6	7.4
4. 21-30 Hrs/wk	1	2.5	.	.	1	1.2
5. > 30 Hrs/wk	5	12.5	4	9.8	9	11.1
TOTAL	40	100.0	41	100.0	81	100.0

suggest that the time spent on working with the hedgerows is considerably less than indicated by the SALT budget. This can be attributed to the fact that during the year prior to the survey there was psyllid infestation which had seriously damaged the hedgerows. At the time of the survey, the hedgerows were recovering and were coming out with new foliage. Also, farmers were reluctant to trim the hedgerows for fear that it might trigger psyllid infestation again.

As the SALT budget indicates, after the SALT is established its maintenance requires 8.6 man-days (MD) of labor per hectare per year. Table 17 shows the total hours, farm and off-farm together, the head of the household works per week. Ninety percent of the adopters and 83 percent of the non-adopters worked less than 30 hours per week during the survey period. This indicates the potential availability of farmer's labor towards the maintenance of SALT. A farmer's labor can also be supplemented with the labor from other family members and also from the hired labor.

TABLE 17: TOTAL FARMER LABOR HOURS PER WEEK (FARM & OFF-FARM), FARMERS SURVEYED, WEEKLY DATA SURVEY

WEEKLY LABOR HOURS	ADOPTER		NON-ADOPTER		TOTAL	
	NO	%	NO	%	NO	%
1. < 11 Hrs/wk.	7	17.5	7	17.1	14	17.3
2. 11-20 Hrs/wk.	21	52.5	17	41.5	38	46.9
3. 21-30 Hrs/wk	8	20.0	10	24.4	18	22.2
4. > 30 Hrs/wk	4	10.0	7	17.1	11	13.6
TOTAL	40	100.0	41	100.0	81	100.0

Total family labor includes the farmer's labor in addition to the contribution from the spouse and the children. Labor also can be hired as needed. The summaries for average family labor and hired labor are presented in Tables 18 and 19, respectively. The family labor shown here from the Weekly Data Survey does

not include hours of household labor for activities such as maintenance of the house, collection of firewood or other non-farm activities. The hired labor shown in Table 19 is the amount of labor hired during the survey period for all farm activities. The hired labor is primarily used during the harvesting period and to some extent for plowing and land preparation.

TABLE 18: FAMILY LABOR PER WEEK FOR FARM WORK, FARMERS SURVEYED, WEEKLY DATA SURVEY

WEEKLY LABOR HOURS	ADOPTER		NON-ADOPTER		TOTAL	
	NO	%	NO	%	NO	%
1. < 11 Hrs/wk.	6	15.0	12	29.3	18	22.2
2. 11-20 Hrs/wk.	16	40.0	15	36.6	31	38.3
3. 21-30 Hrs/wk	8	20.0	8	19.5	16	19.8
4. > 30 Hrs/wk	10	25.0	6	14.6	16	19.8
TOTAL	40	100.0	41	100.0	81	100.0

TABLE 19: HIRED LABOR PER WEEK, FARMERS SURVEYED, WEEKLY DATA SURVEY

WEEKLY LABOR HOURS	ADOPTER		NON-ADOPTER		TOTAL	
	NO	%	NO	%	NO	%
1. None	4	10.0	4	9.8	8	9.9
2. 0.1-5 Hrs/wk	20	50.0	26	63.4	46	56.8
3. 6-10 Hrs/wk	4	10.0	4	9.8	8	9.9
4. 11-15 Hrs/wk	6	15.0	5	12.2	11	13.6
5. 16-20 Hrs/wk	2	5.0	.	.	2	2.5
6. > 20 hRS/WK	4	10.0	2	4.9	6	7.4
TOTAL	40	100.0	41	100.0	81	100.0

ADOPTION OF THE SLOPING AGRICULTURAL LAND TECHNOLOGY

This section is devoted to analyzing the responses of adopters to issues related to their implementation and maintenance of SALT; and the nonacceptance and the potential for adopting the salt by the non-adopters. The data from the Technology Assessment Survey was used here. Finally, a probit model will be presented to examine the impact of different variables on the adoption of SALT.

SALT and Adopters

Most of the impetus to SALT in the study area has come with the implementation of the FSDP-EV in 1983. The FSDP-EV sites, particularly at Villaba, have served as a training and demonstration model to farmers in the area. Recently the Department of Agriculture (DA) has also established its training site in Tabango. The SIRSDP conducts SALT training at its sites around San Isidro. Sixty-six percent of the farmers surveyed had indicated their awareness of contour/hedgerow farming (i.e. SALT). The training and demonstration activities of FSDP-EV, SIRSDP and the DA have been primarily responsible for increasing the farmer awareness of the consequences of soil erosion, and the need for employing control measures such as SALT.

Establishment of SALT

Table 20 shows the years in which SALT was established at different sites. Only four adopters out of the total of 78 reported adopting SALT prior to 1983. As mentioned earlier, it was in 1983 when the organized efforts to introduce SALT on the island of Leyte were undertaken by the FSDP-EV. Eighty percent of the adopters at FSDP-Villaba established SALT in 1983. SALT at the SIRSDP site was introduced mostly in 1985 and 1986. Eighty-nine percent of the adopters at the DA sites introduced SALT during 1984-1986. The DA sites are scattered over a wider area in Northern Leyte.

Eighty-seven percent of the adopters had selected *Leucaena* as their principal legume for the hedgerows. Only 13 percent chose Madre de Cacao instead of *Leucaena* for hedgerows. Psyllid infestation of *Leucaena* was the principal reason given for selecting Madre de Cacao over *Leucaena*.

TABLE 20: YEAR WHEN SALT WAS ESTABLISHED, ADOPTERS BY SOURCE OF SALT, TECHNOLOGY ASSESSMENT SURVEY

SALT ESTABLISHED (YEAR)	SOURCE OF SALT									
	DA		FSDP-EV-BONTOC		FSDP-EV-VILLABA		SIRSDP		TOTAL	
	NO	%	NO	%	NO	%	NO	%	NO	%
1973	1	3.6	.	.	.	.	.	.	1	1.3
1982	.	.	2	16.7	.	.	1	3.6	3	3.8
1983	.	.	2	16.7	8	80.0	.	.	10	12.8
1984	11	39.3	.	.	.	.	.	.	11	14.1
1985	7	25.0	5	41.7	1	10.0	8	28.6	21	26.9
1986	7	25.0	3	25.0	1	10.0	17	60.7	28	35.9
1987	2	7.1	.	.	.	.	1	3.6	3	3.8
1988	.	.	.	.	.	.	1	3.6	1	1.3
TOTAL	28	100.0	12	100.0	10	100.0	28	100.0	78	100.0

It can be seen from Table 21 that about 94 percent of the adopters had received an offer of assistance to implement SALT and 78 percent of the non-adopters did not. It is significant to note that six percent of the adopters did not receive an offer of assistance while 22 percent of the non-adopters did. Seed was reported to be the principal assistance received by 81 percent of the adopters. Cash and fertilizer assistance was reported by 14 percent and four percent of the adopters, respectively. Some adopters had received more than one type of assistance. Cash assistance was given at the DA sites while seed assistance was given at the remaining sites. Technical assistance to construct the contour lines and plant the hedgerows was available to all farmers who wanted to adopt SALT.

Area Under SALT

Initial farm area brought under SALT is shown in Table 22. Almost 60 percent of the adopters had used less than one-half hectare to introduce SALT. Of the remaining farmers, 28 percent had between 0.50 to 1.00 hectares and about 13 percent had more than one hectares initially under SALT. A total of 22 farmers have reported an expansion in their area under SALT since its implementation. The distribution of the after-expansion area under SALT is shown in Table 23. As

TABLE 21: RECEIVED AN OFFER OF ASSISTANCE TO IMPLEMENT SALT, ALL FARMERS SURVEYED BY SOURCE OF SALT, TECHNOLOGY ASSESSMENT SURVEY

ADOPTION TYPE	OFFER?	SOURCE OF SALT									
		DA		FSDP-EV-BONTOC		FSDP-EV-VILLABA		SIRSDP		TOTAL	
		NO	%	NO	%	NO	%	NO	%	NO	%
ADOPTER	NO	.	.	2	16.7	.	.	3	10.7	5	6.4
	YES	28	100.0	10	83.3	10	100.0	25	89.3	73	93.6
	SUB TOTAL	28	100.0	12	100.0	10	100.0	28	100.0	78	100.0
NON-ADOPTER	NO	27	96.4	7	58.3	10	100.0	15	57.7	59	77.6
	YES	1	3.6	5	41.7	.	.	11	42.3	17	22.4
	SUB TOTAL	28	100.0	12	100.0	10	100.0	26	100.0	76	100.0
ROW TOTAL	NO	27	48.2	9	37.5	10	50.0	18	33.3	64	41.6
	YES	29	51.8	15	62.5	10	50.0	36	66.7	90	58.4
	SUB TOTAL	56	100.0	24	100.0	20	100.0	54	100.0	154	100.0

TABLE 22: INITIAL AREA UNDER SALT, ADOPTERS BY SOURCE OF SALT, TECHNOLOGY ASSESSMENT SURVEY

INITIAL AREA IN SALT (HECTARES)	SOURCE OF SALT									
	DA		FSDP-EV-BONTOC		FSDP-EV-VILLABA		SIRSDP		TOTAL	
	NO	%	NO	%	NO	%	NO	%	NO	%
1. 0.25 OR LESS HCT.	10	35.7	5	41.7	4	40.0	7	25.0	26	33.3
2. 0.20-0.50 HCT.	7	25.0	4	33.3	1	10.0	8	28.6	20	25.6
3. 0.51-0.75 HCT.	1	3.6	.	.	1	10.0	5	17.9	7	9.0
4. 0.76-1.00 HCT.	6	21.4	1	8.3	3	30.0	5	17.9	15	19.2
5. 1.10-2.00 HCT.	2	7.1	2	16.7	.	.	2	7.1	6	7.7
6. > 2.00 HCT.	2	7.1	.	.	1	10.0	1	3.6	4	5.1
TOTAL	28	100.0	12	100.0	10	100.0	28	100.0	78	100.0

a result of the expansion, the proportion of farmers with more than one hectares in SALT increased from about 13 percent to about 36 percent. On an average, the area under SALT increased from 0.58 hectares to 1.28 hectares because of the expansion.

TABLE 23: CURRENT AREA UNDER SALT (AFTER EXPANSION), ADOPTERS BY SOURCE OF SALT, TECHNOLOGY ASSESSMENT SURVEY

CURRENT AREA IN SALT (HECTARES)	SOURCE OF SALT									
	DA		FSDP-EV-BONTOC		FSDP-EV-VILLABA		SIRSDP		TOTAL	
	NO	%	NO	%	NO	%	NO	%	NO	%
1. 0.25 OR LESS HCT.	7	25.0	4	33.3	4	40.0	7	25.0	22	28.2
2. 0.20-0.50 HCT.	6	21.4	2	16.7	1	10.0	8	28.6	17	21.8
3. 0.51-0.75 HCT.	1	3.6	1	8.3	1	10.0	4	14.3	7	9.0
4. 0.76-1.00 HCT.	2	7.1	1	8.3	.	.	1	3.6	4	5.1
5. 1.10-2.00 HCT.	7	25.0	2	16.7	4	40.0	7	25.0	20	25.6
6. > 2.00 HCT.	5	17.9	2	16.7	.	.	1	3.6	8	10.3
TOTAL	28	100.0	12	100.0	10	100.0	28	100.0	78	100.0

The reasons why the adopters are not using SALT on their remaining land are shown in Table 24. Lack of seed/planting material was the most prominent reason cited by 36 percent of the adopters followed by the unsuitability of land for SALT by 28 percent. Lack of any additional land (14 percent) and lack of labor (5 percent) were indicated as other reasons for not expanding SALT to remaining farmland.

TABLE 24: REASONS WHY ADOPTERS DO NOT USE SALT ON REMAINING LAND, BY SOURCE OF SALT, TECHNOLOGY ASSESSMENT SURVEY

REASONS FOR NOT USING SALT ON REMAINING LAND	SOURCE OF SALT									
	DA		FSDP-EV-BONTOC		FSDP-EV-VILLABA		SIRSDP		TOTAL	
	NO	%	NO	%	NO	%	NO	%	NO	%
1. LAND NOT SUITABLE	9	32.1	4	33.3	3	30.0	6	21.4	22	28.2
2. LACK OF SEED/PLANTING MATERIAL	12	42.9	2	16.7	3	30.0	11	39.3	28	35.9
3. NO MORE LAND	1	3.6	2	16.7	3	30.0	5	17.9	11	14.1
4. DO NOT HAVE LABOR	4	14.3	.	.	1	10.0	2	7.1	7	9.0
5. LANDLORD DOES NOT ALLOW	1	3.6	1	8.3	.	.	1	3.6	3	3.8
5. OTHER REASONS	1	3.6	3	25.0	.	.	3	10.7	7	9.0
TOTAL	28	100.0	12	100.0	10	100.0	28	100.0	78	100.0

Implementation and Maintenance Problems

One of the objectives of this study was to learn about various problems faced by the adopters. Thus, SALT adopters were asked about the problems they encountered while implementing SALT and their responses are presented in Table 25. Most of the farmers (67 percent) reported having no problems in implementing SALT. Other prominent problems indicated by the remaining farmers include: lack of seeds/planting material (14 percent), lack of money (6 percent) and difficulty in plowing contour lines (5 percent). Lack of *Leucaena* seeds has been identified by the FSDP-EV as a major constraint towards a more rapid diffusion of SALT. For the FSDP-EV site at Villaba, Cornick and others (1986) report, "Farmers begged, bought, and bartered Ipil-Ipil seed, but were unable to satisfy the demand. Neither was the project able to provide sufficient seed to enable all farmers who wanted to plant to do so."

TABLE 25: DIFFUCLTIES FACED BY ADOPTERS IN IMPLEMENTING SALT, BY SOURCE OF SALT, TECHNOLOGY ASSESSMENT SURVEY

PROBLEMS IN IMPLEMENTING SALT	SOURCE OF SALT									
	DA		FSDP-EV-BONTOC		FSDP-EV-VILLABA		SIRSDP		TOTAL	
	NO	%	NO	%	NO	%	NO	%	NO	%
1. NO PROBLEMS	18	64.3	4	33.3	10	100.0	21	75.0	53	67.9
2. LACK OF PLANTING MATERIAL	6	21.4	4	33.3	.	.	1	3.6	11	14.1
3. LACK OF MONEY	2	7.1	2	16.7	.	.	1	3.6	5	6.4
4. DIFFICULT TO PLOW CONTOUR LINES	1	3.6	1	8.3	.	.	2	7.1	4	5.1
5. OTHER REASONS	1	3.6	1	8.3	.	.	3	10.7	5	6.4
TOTAL	28	100.0	12	100.0	10	100.0	28	100.0	78	100.0

Problems faced by the adopters in maintaining the hedgerows are shown in Table 26. Thirty-nine percent of the adopters indicated no problems in maintenance of hedgerows. Other prominent maintenance problems mentioned by the adopters include psyllid infestation (20 percent) of the *Leucaena* hedgerows, time consuming technology (13 percent), carabaos feed/damage hedgerows (5

TABLE 26: DIFFUCLTIES FACED BY ADOPTERS IN MAINTENANCE OF SALT, BY SOURCE OF SALT, ADOPTERS, TECHNOLOGY ASSESSMENT SURVEY

PROBLEMS IN MAINTAINING SALT	SOURCE OF SALT									
	DA		FSDP-EV-BONTOC		FSDP-EV-VILLABA		SIRSDP		TOTAL	
	NO	%	NO	%	NO	%	NO	%	NO	%
1. NO PROBLEMS	13	46.4	1	8.3	6	60.0	10	35.7	30	38.5
2. PSYLLID INFESTATION	1	3.6	3	25.0	3	30.0	9	32.1	16	20.5
3. TIME CONSUMING	5	17.9	2	16.7	1	10.0	2	7.1	10	12.8
4. CARABAO FEED/DAMAGE HEDGEROWS	.	.	.	.	.	.	4	14.3	4	5.1
5. DIFFICULT TO WEED HEDGEROWS	2	7.1	1	8.3	.	.	1	3.6	4	5.1
6. OTHER REASONS	7	25.0	5	41.7	.	.	2	7.1	14	17.9
TOTAL	28	100.0	12	100.0	10	100.0	28	100.0	78	100.0

percent) and difficulty of weeding hedgerows (5 percent). During 1985-86 there was a serious attack of psyllid on the *Leucaena* throughout the Philippines. (Escalada, 1987; Gapas, 1987). Consequently, psyllid infestation was mentioned by the adopters as the most significant problem in maintaining the hedgerows.

Evaluation of SALT by Adopters

The SALT has received an overwhelming approval by the adopters. Most of the adopters (92 percent) were satisfied with their decision to adopt SALT. The adopters cited erosion control, potential increase in soil fertility and the ability to sell *Leucaena* leaves for cash as the major factors for their satisfaction with SALT. About half (51 percent) of the adopters reported using *Leucaena* leaves to feed their livestock and 21 percent reported cash sales. The amount of leaves sold ranged from 5 to 300 kilos with an average being 68 kilos during the one-year period prior to the survey.

Concerning soil erosion control, about 66 percent of the adopters did not use any additional measures other than SALT. The remaining 34 percent of the adopters planted grass, built stone blocking, installed staking or placed wood blocking as the major means of soil erosion control. These soil erosion control measures were used by the adopters on the upland parcels where SALT has not yet been implemented.

When asked if they would have adopted the technology even if they had received no assistance, 57 percent of the adopters said no, 26 percent said yes, and the remaining 17 percent were not sure. It should be noted that in spite of their general satisfaction with SALT, a majority of the adopters indicated that they would not have adopted the technology had they not received assistance from the SALT promoting groups or agencies. In terms of recommending SALT to other farmers, 91 percent of the adopters indicated that they would recommend this technology to others while six percent indicated that they would not. This latter group of adopters were not yet convinced about the benefits of SALT. It should be reiterated here that 41 percent of the adopters had introduced SALT since 1986. Their hedgerows were not well established at the time of this survey. Thus, these adopters had not experienced the full benefits of contour/hedgerow farming.

SALT and Non-adopters

The non-adopter farmers included in the survey were selected in the vicinity of SALT adopters. What factors prevented these farmers from accepting the new technology was one of the important concerns of this study. The farmers' reasons not adopting SALT are shown in Table 27. Sixteen farmers (or 27 percent) of the farmers indicated that they were not familiar with SALT at all. The most prominent reason as cited by 42 percent of non-adopters for not employing SALT was that the seeds were not available. Difficulty of working with the hedgerows (15 percent) and the time consuming nature of SALT (12 percent) were other notable reasons for non-adoption.

It was observed that 64 percent of the non-adopters did not use any soil erosion control measures and 36 percent did. Table 28 shows the reasons of non-adopters for not following soil erosion control practices. Thirty-six percent of the 47 non-adopters not controlling soil erosion indicated that they did not know how to control soil erosion. Other major reasons for not employing soil erosion controls were: land not steep/no erosion problem (17 percent), one cannot really stop erosion (13 percent), and not enough time or money (15 percent).

It should be pointed out again that about 71 percent of the non-adopters reported receiving no offer of assistance while the remaining 19 percent did. The

TABLE 27: REASONS FOR NOT ADOPTING SALT, NON-ADOPTERS, TECHNOLOGY ASSESSMENT SURVEY

REASONS FOR NOT ADOPTING SALT	SALT SITE								TOTAL	
	DA		FSDP-EV-BONTOC		FSDP-EV-VILLABA		SIRSDP			
	NO	%	NO	%	NO	%	NO	%	NO	%
1. SEEDS NOT AVAILABLE	8	40.0	1	8.3	2	100.0	14	53.8	25	41.7
2. TIME CONSUMING	2	10.0	2	16.7	.	.	3	11.5	7	11.7
3. HEDGEROWS HARD TO PLOW/SHADE CROP	4	20.0	2	16.7	.	.	3	11.5	9	15.0
4. NOT INTERESTED	.	.	2	16.7	.	.	2	7.7	4	6.7
5. NO MONEY	2	10.0	1	8.3	.	.	1	3.8	4	6.7
6. LANDLORD DOES NOT PERMIT	1	5.0	1	8.3	.	.	1	3.8	3	5.0
7. OTHER REASONS	3	15.0	3	25.0	.	.	2	7.7	8	13.3
TOTAL	20	100.0	12	100.0	2	100.0	26	100.0	60	100.0

TABLE 28: REASONS FOR NOT FOLLOWING EROSION CONTROL MEASURES, NON-ADOPTERS, BY SOURCE OF SALT, TECHNOLOGY ASSESSMENT SURVEY

REASONS FOR NO EROSION CONTROL	SALT AREA								TOTAL	
	DA		FSDP-EV-BONTOC		FSDP-EV-VILLABA		SIRSDP			
	NO	%	NO	%	NO	%	NO	%	NO	%
1. DO NOT KNOW EROSION CONTROL TECHNIQUE	4	23.5	.	.	4	40.0	9	75.0	17	36.2
2. NOT MUCH EROSION/LAND NOT STEEP	3	17.6	2	25.0	3	30.0	.	.	8	17.0
3. ONE CAN NOT REALLY STOP EROSION	3	17.6	.	.	1	10.0	2	16.7	6	12.8
4. NO TIME/MONEY	4	23.5	2	25.0	1	10.0	.	.	7	14.9
5. OTHER REASONS	3	17.6	4	50.0	1	10.0	1	8.3	9	19.1
TOTAL	17	100.0	8	100.0	10	100.0	12	100.0	47	100.0

non-adopters were asked for their conditions or prerequisites for adopting SALT. Their responses are reported in Table 29. Assistance in providing seeds is the predominant response (36 percent) followed by the assistance for free seed/labor (13 percent) or an offer of technical assistance (9 percent). Combining these groups, it can be stated that about 58 percent of the farmers indicate willingness

TABLE 29: CONDITIONS OF NON-ADOPTERS TO ADOPT SALT, BY SOURCE OF SALT
TECHNOLOGY ASSESSMENT SURVEY

CONDITIONS FOR ADOPTING SALT	SOURCE OF SALT									
	DA		FSDP-EV-BONTOC		FSDP-EV-VILLAGA		SIRSDP		TOTAL	
	NO	%	NO	%	NO	%	NO	%	NO	%
1. IF SEEDS AVAILABLE	7	25.0	1	8.3	3	30.0	16	61.5	27	35.5
2. IF FREE SEEDS/LABOR AVAILABLE	4	14.3	2	16.7	2	20.0	2	7.7	10	13.2
3. NONE	1	3.6	2	16.7	.	.	5	19.2	8	10.5
4. IF TECHNICAL ASSISTANCE AVAILABLE	4	14.3	1	8.3	2	20.0	.	.	7	9.2
5. IF SALT IS REALLY GOOD	1	3.6	2	16.7	1	10.0	1	3.8	5	6.6
6. OTHER REASONS	11	39.3	4	33.3	2	20.0	2	7.7	19	25.0
TOTAL	28	100.0	12	100.0	10	100.0	26	100.0	76	100.0

to adopt SALT if they are provided with some kind of assistance. About seven percent of the non-adopters want to see if SALT is really a good technology before they would accept it. Except for this group, all other reasons given by non-adopters indicate that they are favorably disposed towards SALT. None of the farmers surveyed had specific negative attitudes towards SALT. A systematic plan of training, technical assistance and making seeds available could induce a significant portion of upland farmers to adopt SALT.

SALT and ALL Farmers Surveyed

All the farmers surveyed, adopters and non-adopters alike, were almost unanimous in their concern for soil erosion problems and the need to remedy the situation. About 88 percent of the farmers surveyed indicated that SALT is a beneficial technology while 10 percent were not sure about it. Only three percent of the farmers did not believe that SALT was a beneficial technology. All of the farmers in the survey were asked to indicate their impressions as to why some of the farmers chose to adopt SALT while others do not. Controlling the soil erosion and improving soil fertility were cited as the most significant factors for adopting this technology.

All the farmers surveyed were asked to indicate their impressions as to why some of the farmers have not adopted SALT. These responses are presented in Table 30. Difficulties of working around the hedgerows and shading of crops by the hedgerows was the primary reason reported by 33 farmers or 21 percent of the total. Other major reasons were: They do not know the dangers of soil erosion (11 percent), They are lazy (9 percent), and planting materials/seeds not available (8 percent).

TABLE 30: VIEWS OF FARMERS SURVEYED ON WHY SOME FARMERS DO NOT ADOPT SALT, ALL FARMERS SURVEYED, TECHNOLOGY ASSESSMENT SURVEY

WHY FARMERS DO NOT ADOPT SALT	ADOPTER		NON-ADOPTERS		TOTAL	
	NO	%	NO	%	NO	%
01. DO NOT KNOW	3	3.8	10	13.2	13	8.4
02. HEDGEROWS HARD TO PLOW/SHADE CROP	20	25.6	13	17.1	33	21.4
03. DO NOT KNOW DANGERS OF EROSION	12	15.4	5	6.6	17	11.0
04. LAZY	6	7.7	8	10.5	14	9.1
05. NO PLANTING MATERIAL	5	6.4	8	10.5	13	8.4
06. REQUIRES EXTRA LABOR	5	6.4	2	2.6	7	4.5
07. DO NOT RECEIVE ASSISTANCE	1	1.3	5	6.6	6	3.9
08. NOT INTERESTED	4	5.1	2	2.6	6	3.9
09. DO NOT OWN LAND	4	5.1	2	2.6	6	3.9
10. OTHER REASONS	18	23.1	21	27.6	39	25.3
TOTAL	78	100.0	76	100.0	154	100.0

Farmers were asked to indicate their perception of specific problems with SALT as a technology and their responses are recorded in Table 31. About 28 percent of the farmers indicated that there were no problems with SALT as a technology. Other major problems with SALT as indicated by the farmers surveyed were: Labor intensive/time consuming technology (14 percent), difficulty of working around the hedgerows (22 percent), psyllid infestation (12 percent), and shading of crops by the hedgerows (10 percent).

TABLE 31: PROBLEMS WITH SALT AS PERCEIVED BY THE FARMERS, ALL FARMERS SURVEYED, TECHNOLOGY ASSESSMENT SURVEY

PROBLEMS WITH SALT	ADOPTER		NON-ADOPTERS		TOTAL	
	NO	%	NO	%	NO	%
1. NO PROBLEMS	24	30.8	19	25.3	43	28.1
2. TIME CONSUMING/REQUIRES MORE LABOR	11	14.1	11	14.7	22	14.4
3. PSYLLID INFESTATION	17	21.8	2	2.7	19	12.4
4. HEDGEROWS HARD TO WORK WITH	14	17.9	21	26.7	35	22.2
5. HEDGEROWS SHADE CROPS	6	7.7	9	12.0	15	9.8
6. NOT SURE	1	1.3	4	5.3	5	3.3
7. SCARCITY OF SEEDS/PALNTING MATERIAL	1	1.3	5	6.7	6	3.9
8. OTHER FACTORS	4	5.1	5	6.7	9	5.9
TOTAL	78	100.0	76	100.0	154	100.0

The Probit Model

One of the components of this study was to examine the impact of several variables on the probability that an upland farmer will adopt SALT. The acceptance (or rejection) of a given technology entails a binary decision. Outcomes of these decisions are recorded as "yes-no", "for-against", "accept-reject" and so on. For statistical analysis such variables are represented in a binary fashion (0, 1). Other examples of this nature include buying a house, choice of a given occupation, voting, and many others. The outcomes of such events are purely probabilistic. The primary analytical concern here is explaining and predicting the outcomes as they are influenced by other factors. The linear probability models are not very useful here because their predictions may actually lie beyond the range (0, 1). The qualitative response models are ideal techniques to examine these relationships. Specific techniques that are most commonly used are probit, logit, and tobit. A number of references of the theoretical and empirical aspects of such models are available. (Amemiya, 1981; Pindyck and Rubinfeld, 1981).

To assure that the predictions of a qualitative response model are within the binary range, it is necessary to have the values of independent variables (which may take any value) transformed so that their probability remains within (0, 1)

range. The transformation needs to be such that it should be possible to measure the impact of the independent variables on the outcome of the dependent variable. The cumulative probability function is most suitable to achieve such transformation. The logit model uses the cumulative logistic probability function and the probit model uses the cumulative normal probability distribution (Pindyck and Rubinfeld, 1981). The logit and probit models give basically the same results. A normal curve in the probit model becomes asymptotic relatively quickly compared to the logistic curve. The selection between these two techniques is merely a matter of computational convenience.

The model chosen for this analysis was probit. The probability (likelihood) of the adoption of SALT is assumed to depend on whether or not a given farmer was offered assistance to implement SALT, the farmer's tenure arrangement, the farmer's age, the number of years of formal schooling, the number of work-age children living on farm, and the total household cash income in the previous year.

The Model

The specification of the probit model and the definitions of variables are shown below:

$$\text{ADOPT} = \beta_0\text{ONE} + \beta_1\text{ASSIST} + \beta_2\text{OWNLAND} + \beta_3\text{SHARECRP} + \beta_4\text{CLT} + \beta_5\text{AGE} + \beta_6\text{SCHOOL} + \beta_7\text{LAND} + \beta_8\text{CHILDREN} + \beta_9\text{INCOME}$$

Where,

ADOPT	= 1 if farmer adopts SALT, 0 otherwise
ONE	= Constant, or Y-intercept
ASSIST	= 1, if farmer was offered assistance to introduce SALT, 0 otherwise
OWNLAND	= 1, if the tenure of major parcel is OWNERSHIP, 0 otherwise
SHARECRP	= 1, if the tenure of major parcel was SHARECROPPING , 0, otherwise
CLT	= 1, if the tenure of major parcel is CLT, 0 otherwise
OTHERTN*	= 1, if the tenure different than previous three, 0 otherwise
AGE	= Age of the head of the household (in years)
SCHOOL	= Years of schooling for the head of the household
LAND	= Total farmland (hectares)
CHILDREN	= Number of work-age (>8 years) children living on farm
INCOME	= Household cash income in previous year (in pesos)

* Variable excluded to avoid the dummy variable trap. Impact of this variable can be observed from the statistics for the intercept.

The above variables were included in the probit analysis because of their potential impact on SALT adoption. An offer of technical and/or material assistance (ASSIST) represents an incentive for farmers to adopt SALT. The tenure arrangement (OWNLAND, SHARECRP, CLT, OTHERTN) is generally recognized as an important consideration for adoption of a new technology among the subsistence farmers. A farmer who owns the land would have more incentive to adopt SALT to conserve the soil and enhance its productivity. On the other hand, a tenant may not be allowed by his landlord to implement a long-term technology such as SALT. Since the age and education (AGE, SCHOOL) of the head of the household may influence the outlook of farmers, these variables were also included in the model. SALT is essentially a labor oriented technology. Therefore, the number of work-age children (CHILDREN) were included as a source of family labor. Finally, the size of farm (LAND) and the level of cash income (INCOME) in the previous year were selected to assess the impact of these variables on the adoption of SALT.

Assumption

As mentioned previously, the sample in the Technology Assessment Survey consisted of 78 SALT adopters and 76 nearby farmers who were non-adopters. This was done deliberately to learn more about the adopters. To remove this sampling bias, it was necessary to scale the data. The true population of non-adopters should be those specific farmers (not all the farmers) within the study area who had upland farms, and were in some way exposed to SALT but decided against adopting it. There was no practical way to assess this. Thus, on the basis of the definition of the sample frame of non-adopters, it was assumed that the true proportion of adopters and non-adopters was 20:80 and was scaled accordingly.

Method of Estimation

The probit model was estimated using the computer software package LIMDEP (Limited Dependent Variable). To find the maximum likelihood values for the coefficients, LIMDEP uses Newton's method in which the variance matrix is estimated with the second derivatives of the log-likelihood (Greene, 1986).

The Results

The overall statistics which measure the predictive power of the probit model are shown in Table 32. It required 6 iterations for the model to converge

TABLE 32: SUMMARY STATISTICS, THE PROBIT MODEL OF SALT ADOPTION DECISION

Item	Value
Number of Iterations	6
Log likelihood	-47.036
Restricted (slopes=0) Log-L	-106.730
Likelihood Ratio Index (LRI)[a]	0.559
Likelihood Ratio Test[b]	119.390
Significance Level	0.3E-13
Correctly predicted (121/154), or	78.6%

[a] LRI = 1 - (Log likelihood of function/log likelihood when β = 0)
[b] Test of H_0: β = 0, Chi-square test (9 df).

and estimate the parameters. The Likelihood Ratio Index (LRI) is comparable to the R^2 in linear models and is used to measures the goodness of fit for the model on the scale of 0 to 1. A value closer to one indicates a relatively stronger fit. LRI of 0.56 in this model indicates a moderate goodness of fit. Another measure of the predictive power of a model is the proportion of correctly predicted outcomes. The probit model correctly predicted almost 79 percent of the farmers as adopters or non-adopters of SALT. The results of the likelihood ratio test were also highly significant indicating that the variation explained by the model was real and not random. Thus, this model does a reasonably good job explaining the decision of SALT adoption as influenced by the selected independent variables.

Coefficients and related statistics for the individual variables in the probit model are shown in Table 33. The 'Change in Probability' indicates the changes in probability of adopting SALT with one unit of change in the independent

TABLE 33: PARAMETER ESTIMATES AND RELATED STATISTICS FOR VARIABLES IN THE PROBIT MODEL.

Variable	Coefficient	Std.Error	Change In @ Probability	T-Value	Sig.level
ONE	-1.56401	0.8793	-.268	-1.779	(.07529)
ASSIST	2.08734	0.3517	.358	5.935	(.00000)
OWNLAND	0.56862	0.8418	.098	0.675	(.49938)
SHARECRP	0.05271	0.6819	.009	0.077	(.93838)
CLT	0.22074	0.6495	.038	0.340	(.73398)
AGE	-0.01938	0.0139	.003	-1.392	(.16378)
SCHOOL	0.00550	0.0680	.001	0.081	(.93552)
LAND	0.00142	0.0967	.000	0.015	(.98828)
CHILDREN	0.02862	0.1201	.005	0.238	(.81169)
INCOME	0.00003	0.4E-04	.000	0.793	(.42781)

@ Computed at sample means, $z_i = x_i\beta = 1.30$, Thus, $p(z) = 0.1714$.

variable. The change in probability is calculated by multiplying the probit coefficients of the variables with a factor of proportionality, the standard normal density function. Calculated at the sample means, the factor of proportionality was 0.1714.

The results in Table 32 suggest that the key variable influencing the adoption of SALT is ASSIST or the offer of assistance to farmers to implement the SALT. It has an extremely high level of significance with a t value of 5.94. Also,

an offer of assistance increases the probability of adoption by 35.8 percent. Since the upland farmers have the required labor, any assistance with providing the seeds and technical help appears to be highly conducive to their adoption of SALT. All the farmers surveyed have considered this type of assistance as a significant factor for adoption of SALT.

All the variables related to tenure (OWNLAND, SHARECRP AND CLT) arrangement are insignificant. A landlord is usually reluctant to permit the tenant or the sharecropper to implement a technology of long-term or permanent nature on his land. A negative sign for the sharecropping variable confirms this to some extent. On the other hand OWNLAND and CLT have a positive sign and thus shows a direct relationship with adoption decision. The change in probability from these variables is also negligible. Since all these variables were not significant, it is not possible to make conclusive statements about their contribution to the decision about the adoption of technology. Remaining variables - AGE of the head of the household, years of SCHOOL, hectares of LAND, number of work-age CHILDREN, and the household cash income in the previous year - are also not significant in terms of their contribution to the variation in the dependent variable.

CONCLUSIONS AND RECOMMENDATIONS

The Sloping Agricultural Land Technology (SALT) involves planting contours across the slopes in the uplands with hedgerows of fast growing legumes. These hedgerows help flatten contours and reduce soil erosion. Likewise, soil fertility is also enhanced through the fixation of atmospheric nitrogen and from the addition of organic matter from the clippings of the hedgerows. This study was undertaken with an overall objective to assess the factors influencing the adoption of SALT and to evaluate its economic viability.

An organized attempt to introduce SALT on the island of Leyte in the Philippines started with the Farming Systems Development Project - Eastern Visayas (FSDP-EV) in 1983. Since that time, other organized efforts have been initiated to introduce this technology. They include: (1) San Isidro Rural Systems Development Project (SIRSDP), a joint project of the Land Bank of the Philippines and the Center for Social Research in Small Farm Development (CSR) at VISCA, (2) The Department of Agriculture (DA), and (3) The Bontoc Credit Cooperative Incorporated (BCCI), a credit union set up by the Catholic Relief Services. This study included SALT sites of these organizations along with two sites of FSDP-EV.

Three types of survey were taken to gather data for this study. First, the Contour/hedgerow Budget Survey was administered to 36 SALT adopters for budget data on construction and maintenance of SALT. Second, the Technical Assessment Survey was administered to 78 SALT adopters and 76 non-adopters to gather basic socio-economic data for these farmers and their experiences and views concerning SALT. Third, the Weekly Data Survey involved weekly visits to 43 adopters and 41 non-adopters to gather farm input-output data for a period of about six months.

Most of the demographic characteristics of the adopters and non-adopters were basically similar. The average age of the adopters was 42 years compared to 44 years for non-adopters. The average years of education was 4.6 for adopters and 3.3 for non-adopters. The average number of farm parcels operated by adopters and non-adopters were 3 and 2.5, respectively. The average farm size for adopters was 2.12 hectares compared to 1.80 hectares for non-adopters. In terms of tenure arrangement, sharecropping was relatively more prevalent among non-adopters (35 percent) than adopters (27 percent). CLT arrangement was fairly even among both groups. There were no basic differences in the ownership of farm tools and equipments, types of dwelling, and the possession of household items.

Most of the 78 adopters surveyed (93 percent) had received an offer of some kind of assistance to implement SALT. Seed assistance was reported by 81 percent of adopters followed by cash assistance by 14 percent. Initial area under SALT of less than 0.5 hectares, between 0.5 and 1.0 hectares, and more than 1.0 hectares were reported by 59 percent, 28 percent and 13 percent of the adopters, respectively. Twenty-two of the adopters reported expanding their SALT area in later years. Lack of seeds was cited as the primary reason for not expanding SALT to their remaining upland farm area. Most of the adopters reported having no trouble in implementing SALT. In terms of maintenance psyllid infestation of *Leucaena* hedgerows, labor requirements of SALT, and working with the hedgerows (i.e., weeding and plowing) were indicated as the primary problems. Major factors for the satisfaction of adopters with SALT were the potentials for erosion control, increase in soil fertility and the ability to sell *Leucaena* leaves for cash.

Of the 77 non-adopters, about 27 percent indicated that they were unfamiliar with SALT farming. The remaining non-adopters indicated unavailability of seeds, time consuming nature of SALT, and the difficulties of working with the hedgerows

as the major reasons for not adopting SALT. Sixty-four percent of the non-adopters did not follow any soil erosion control measures. Lack of knowledge of erosion control measures was their primary reason. Fifty-eight percent of non-adopters indicated their willingness to adopt SALT if seeds and technical assistance was made available. None of the farmers surveyed had any negative disposition towards SALT.

The per hectare cost of establishing SALT was estimated to be P368 (seeds P344 + materials P24) of direct cost and P179 for labor. Maintenance thereafter was estimated to be 8.6 man-days per hectare of labor per year. On the basis of weekly use and availability of labor from the Weekly Data Survey, it was concluded that this amount of labor easily available to both adopters and non-adopters. Specific benefits of SALT, i.e. prevention of soil erosion and increasing soil fertility, are long-term in nature. It was not possible to measure these benefits for the lack of necessary data. Changes in crop yields also could not be ascertained because of the lack of availability of baseline yield data, and the hedgerows were mostly young to make any impact at the time of the study.

Recommendations:

1. Implement an Organized Seed Production and Distribution Program. One of the problems most persistently mentioned by the adopters and non-adopters alike was the unavailability of *Leucaena* seeds. The government should consider a program for large-scale production of quality seeds and channels for its proper distribution to farmers.
2. Introduce Psyllid Resistent Varieties. All the farmers surveyed were particularly concerned about the psyllid damage to the *Leucaena* hedgerows a year earlier. Any seed program the government may undertake should take into account the introduction of psyllid resistent varieties. Considerable

work on the genetic improvement of *Leucaena* has been done at the University of Hawaii. (Brewbaker, 1983).

3. Explore Alternative Legumes/plants for Hedgerows. There are several potential legumes which can be used for hedgerows. A systematic evaluation of potential alternative plants or their combinations could present attractive options to farmers to suit their particular farming systems. Some work on the evaluation of alternative legumes is already underway in the Philippines, Hawaii and other places. (Brewbaker, Den Beldt, and MacDicken, 1982; Serrano, 1988).

4. Provide Material and Technical Assistance to Farmers to Encourage SALT. An offer of assistance was indicated as the primary motivation by the adopters to implement SALT. Fifty-seven percent of the adopters had indicated that they would not have adopted SALT if they had not received the assistance. Similarly, 58 percent of the non-adopters had shown willingness to adopt SALT if they were provided with seeds and technical assistance.

   Providing seeds and technical assistance to the farmers appears to be the key constraint towards the adoption of SALT on a wider scale. A feasibility of partial or full subsidy for seeds should be seriously considered by the government in its attempt to encourage SALT in the Philippines. Farmers would also need training and technical guidance in the use of A-frame to lay out the contours, plant and establish the hedgerows, and maintain them on long-term basis.

5. Extension Efforts Should be Expanded Towards Soil Erosion Control. Almost all the farmers surveyed were found to be aware of the problem of soil erosion. A sizable portion of non-adopters, however, did not know about the

measures to control soil erosion. Extension efforts should be directed towards enlightening the farmers about the consequences of continued soil erosion and the use of various soil erosion control measures, including SALT.

6. Initiate a Long-term Study of SALT. The potential benefits of SALT, i.e., erosion control and increase in soil fertility, are long-term in nature. Precise data on these benefits are not available. A long-term research to examine all the components of SALT should be undertaken under different agro-climatic conditions. With increasing significance of farming in the uplands, soil scientists are strongly recommending studies of this nature. (Lal, 1988). This type of study could make a great contribution to further development and dissemination of SALT in the Philippines.

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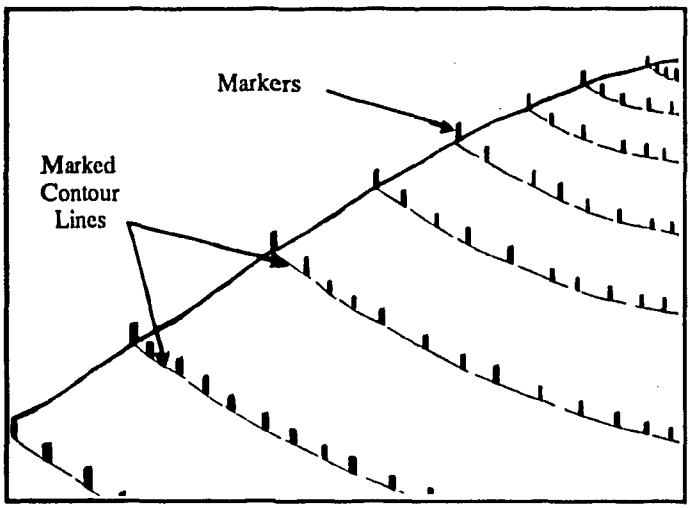
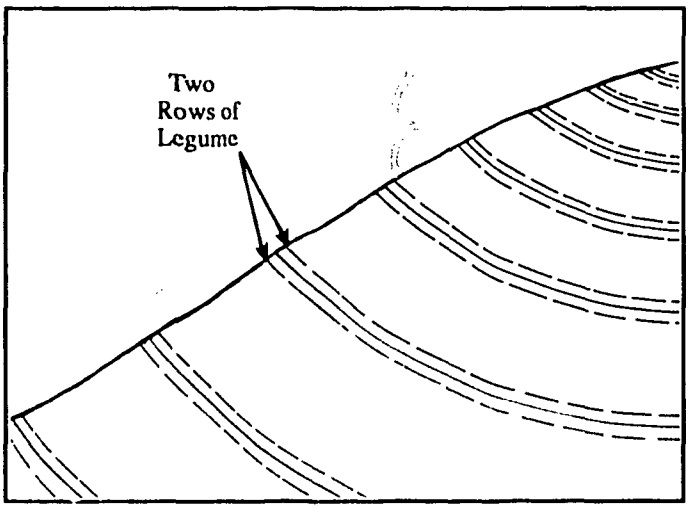
APPENDIX

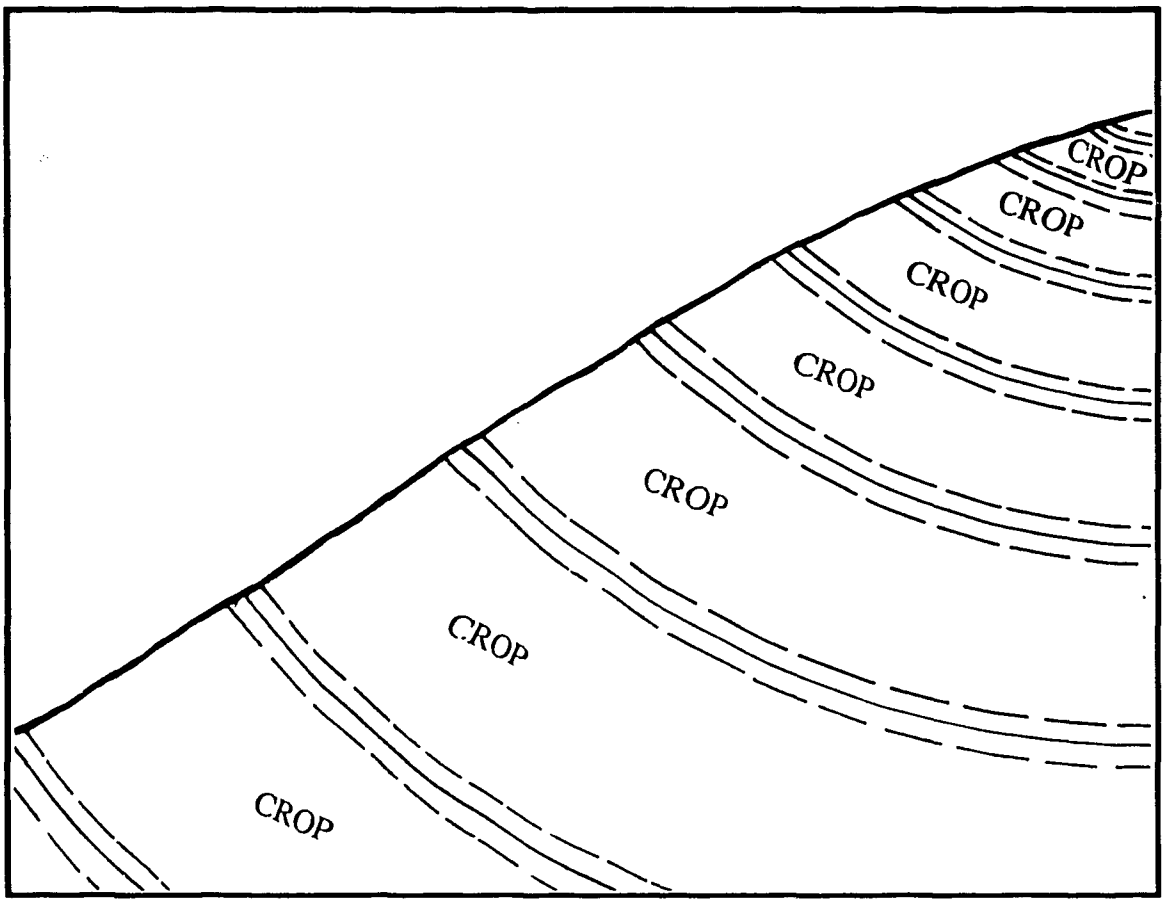
A DIAGRAMMATIC PRESENTATION OF SALT



A. Mark the contour lines using the A-Frame.



B. Prepare the land and plant two rows of legume on each contour to form a hedgerow.



C. Plant desired crop(s) between the hedgerows.

A BRIEF DESCRIPTION OF SALT

A brief description of the main elements involved in the establishment and maintenance of SALT contour/hedgerows is given below:

1. Land Preparation. Contour lines are marked across the slope using an A-frame. A one meter-wide contour line is plowed, harrowed and made ready for planting. The distance between the hedgerows is determined by the degree of the slope. With steeper slopes the distance between the hedgerows needs to be narrower.

2. Planting Hedgerows. Two furrows are prepared 50 cm apart on each contour and planted with 4-6 seeds of legume on each hill at 13 cm apart. Most commonly used legumes are: Ipil Ipil (*Leucaena Leucocephala*), Madre de Cacao (*Glericidia Sepium*), and *Flangis Congesta*. Sidedressing may be applied at the rate of 20 grams per linear feet of hedgerow. Ungerminated segments of the hedgerow are replanted to form continuous hedgerows.

3. Trimming. The trimming of the hedgerows is done about 5-6 months after planting. After that the trimming is done every 2-3 months depending upon the vegetative growth. A stump height of about 70 to 100 cm is considered to be desirable. Trimming leaves and twigs are incorporated into the soil for decomposing during cultivation or hilling up operation.

4. Planting Crops. Selection of the cropping pattern is determined according to the agro-climatic conditions of the area and the specific farming system preference of the farmer.

5. Maintenance. Segments of hedgerows destroyed by erosion or by any other reason are replanted and repaired on a regular basis.