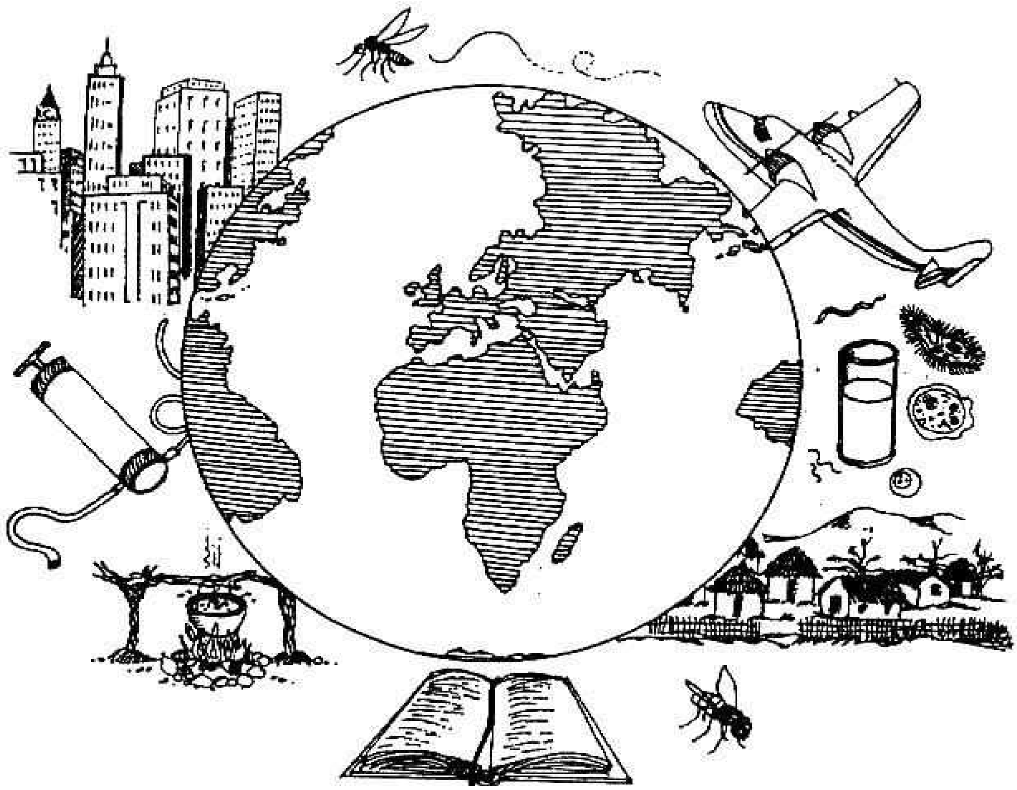
Sloping Agricultural Land Technology (SALT – 1)

Sustainable Agriculture



Training Pac

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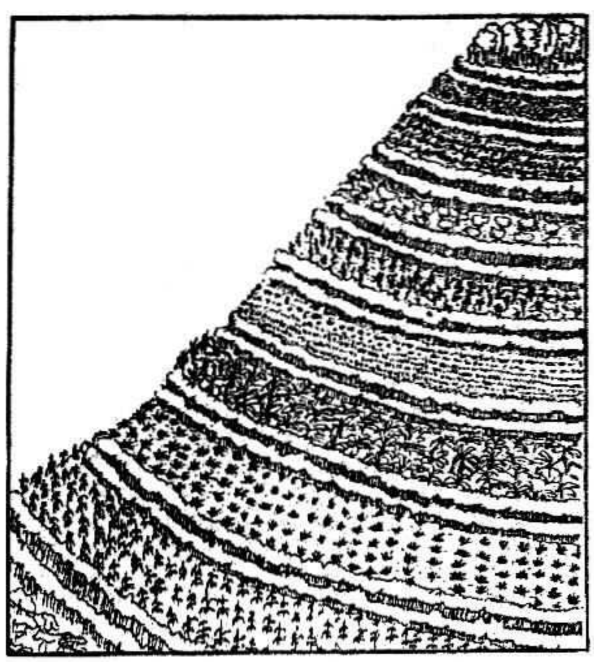


HOW TO FARM YOUR HILLY LAND WITHOUT LOSING YOUR SOIL

INTRODUCTION

1) About 70 years ago the Philippines was almost totally covered with forest resources distributed throughout the Archipelago. These resources provided income, employment, food, medicine, building materials, and water as well as healthy environment. Today, of the 30 million hectares that constitute the Philippines, there are only 1.2 million hectares of virgin forest (according to the Department of Environment and Natural Resources.) The country's remaining classified forest lands are placed at 14.96 million hectares, of which 5.72 million hectares are already categorized as badly eroded. The remaining 9.24 million hectares are unfortunately in various stages of degradation.

SOIL EROSION: A GREAT PROBLEM

2) One of the great problems man will encounter when forest trees are cut without replanting is soil erosion. The erosion of the topsoil. The erosion of the topsoil – that thin upper crust on the earth's surface on which man plants his food crops – is an extremely serious problems in the Philippines.

IMPORTANCE OF TOPSOIL

3) Soil is the result of gradual weathering of plants, rocks and minerals. Soil formation is a very slow process that takes place at the rate of 5.5 centimeters per century. Topsoil is rich and fertile because of its organic matter content. Plants and animals die, decay, disintegrate, and are incorporated in the soil, making the soil fertile and capable of supporting the growth of food crops.

FUNCTION OF TOPSOIL IN AGRICULTURE

4) Topsoil stores plant nutrients, air and moisture. It is a virtual factory of intense biological activity; innumerable fungi and bacteria in topsoil break down organic matter and make the soil richer. Topsoil, therefore, is essential to productive agriculture.

The nutrients in topsoil are crucial to crop production. They are the food of plants. So if the topsoil is lost, you cannot get a good harvest from your land unless you use expensive commercial fertilizer. The best thing you can do, therefore, is to protect your hilly land from soil erosion. Bear in mind that poor soil makes a farmer poor.

APPLY "SALT" IN YOUR HILLY LAND

5) There are several traditional ways of controlling soil erosion, such as reforestation, terracing, multiple cropping, contouring and cover cropping. The Asian Rural Life Development Program has developed an erosion control technique that is both easier and less expensive to implement than the traditional methods. This technology is known as SALT Sloping Land Agricultural Technology.

WHAT IS "SALT"?

6) SALT is a package technology on soil conservation and food production, integrating different soil conservation measures in just one setting . Basically, SALT is a method of growing field and permanent crops in 3-meter to 5-meter wide bands between contoured rows of nitrogen fixing trees. Are thickly planted in double rows to make hedgerows. When a hedge is 1.5 to 2 meters tall, it is cut down to about 40 centimeters and cuttings (tops) are placed in alleyways to serve as organic fertilizers.

SALT: AN AGROFORESTRY SCHEME

7) SALT is a diversified farming system which can be considered agroforestry since rows of permanent shrubs like coffee, cacao, citrus and other fruit trees are dispersed throughout the farm plot. The strips not occupied by permanent crops, however, are planted alternately to cereals (corn, upland rice, sorghum, etc.) or other crops (sweet potato, melon, pineapple, castor bean, etc.) and legumes (soybean, mung bean, peanut, etc.). This cyclical cropping provides the farmer some harvest throughout the year. SALT also includes planting of trees for timber and firewood on surrounding boundaries. Examples of trees species for "boundary forestry in SALT are mahoganies, casuarinas, sesbanias, cashew nuts, pili nuts, etc.

HISTORY OF

8) SALT was developed on a marginal site in Kinuskusan, Bansalan, Davao del Sur. In 1971, the Asian Rural Life Development Program started to employ contour terraces in our sloping areas. Dialogues with local upland farmers acquainted the center with farm problems and needs which gave us the impetus to work out a relevant and appropriate upland system.

From testing different intercropping schemes and observing ipil-ipil based farming systems in Hawaii and at the Center, the SALT was finally verified and completed in 1978. While it was still in the developing stage, the following guidelines were considered essential. The system must: adequately control soil erosion, help restore soil structure and fertility, be efficient in food crop production, be applicable to at least 50 percent of hillside farms, be easily duplicated by upland farmers with the use of local resources and preferably without loans, be culturally acceptable, have the small farmer as the focus and food production as the top priority, be workable in relatively short time, require minimal labor, and be economically feasible.

In 1978 a hectare of land was selected as a test site at the Asian Rural Life Development Program. It was typical of the surrounding farms: slope steeper than 15 degrees, had been farmed for five years or more, and had soils similar to those of most farms in the area. Contour lines were established carefully with the aid of the A-frame and planting of hedgerows and permanent crops was begun.

ADVANTAGES OF SALT

9) The advantages of SALT are that it is a simple, applicable, low-cost, and timely method of farming upland. It is a technology developed for farmers with few tools, little capital, and little learning in agriculture. Contour lines are run by using an A-frame transit that any farmer can learn to make and use. A farmer can grow varieties of crops he is familiar with and old farming patterns can be utilized in the SALT system.

VARIOUS FORMS OF SALT

10) There are several forms of SALT, and a farmer may wish to use a SALT system in several variations. Small Agro-Livestock Land Technology (SALT 2) and Sustainable Agroforest Land Technology (SALT 3) are two variations of SALT that have been developed at the Asian Rural Life Development Program.

SALT 2 (Small Agro-Livestock Land Technology) is a goat-based agroforesty with a land use of 40% for agriculture 20% for forestry and 40% for livestock. As in a conventional SALT project, hedgerows of different nitrogen-fixing trees and shrubs are established on the contour lines. The manure from the animals is utilized as fertilizer both for agricultural crops and the forage crops.

SALT 3 (Sustainable Agroforest Land Technology) is a cropping system in which a farmer can incorporate food production, fruit production, and forest trees that can be marketed. The farmer first develops conventional SALT project to produce food for his family and possibly food for livestock. On another area of land he can plant forest fruits such as rambutan, durian, and lanzones between the contour lines. The plants in the hedgerows will be cut and piled around the fruit trees for fertilizer and soil conservation purposes. A small forest of about one hectare will be will be developed in which trees of different species may be grown for firewood and charcoal for short-range production. Other species that would produce wood and building materials maybe grown for medium and long-range production.

In some areas where the soil is too steep for row crops, contour lines maybe established two or three meters apart and planted with flemingia or some other hedgerow species, and in between the hedgerows coffee, cacao, calamansi or other permanent crops could be planted.

The Ten Steps of
Sloping Agricultural Land Technology

Step One : Make An A-Frame

MAKING THE A-FRAME

11) In SALT, the first instrument you need is an A-frame. this is a simple and yet effective tool which looks like the letter A...thus it's name.

ONLY LOW-COST MATERIALS ARE NEEDED

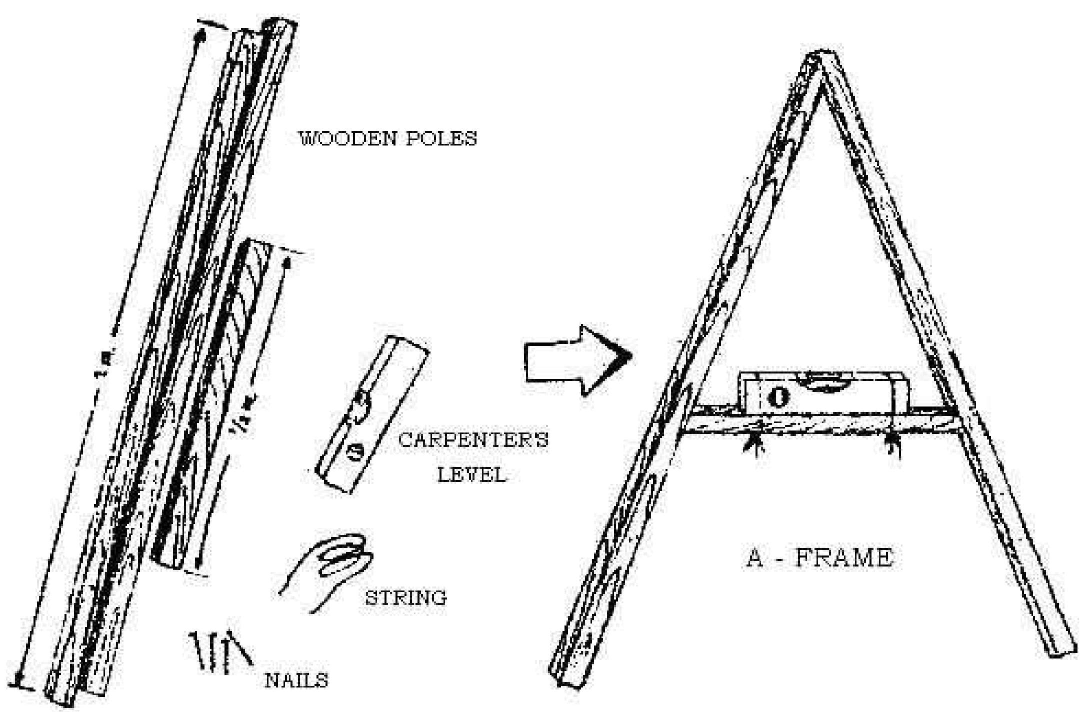
12) The A-frame is so simple that you can make your own using materials generally found in your farm. To make the A-frame, three sturdy wooden or bamboo poles, a saw or bolo, and ordinary carpenter's level, and string or rope are needed. Cut two pieces of wood at least one meter long to serve as the crossbar of the frame.

ASSEMBLE THE A-FRAME

13) Tie together the upper ends of the longer poles. Let the lower ends of the legs stand on level ground. Spread the legs about one meter apart to form a perfect angle. Braze horizontally the shorter pole to become a crossbar between the two legs. Tie the carpenter's level on top of the crossbar.

USE OF THE A-FRAME

14) Use the A-frame to find the contour lines of the land. Soil erosion can be prevented by plowing and planting following the contour lines. The contour lines is a level line from one end of the field to the other and is found around the hill or mountain.



Step Two: Locate Contour Lines

FINDING THE CONTOUR LINES

15) Cut all grasses or remove any obstructions so that you can easily move and mark lines. Two people will make the work much easier and faster. One will operate the A-frame while the other marks the contour lines with stakes.

HOW TO START

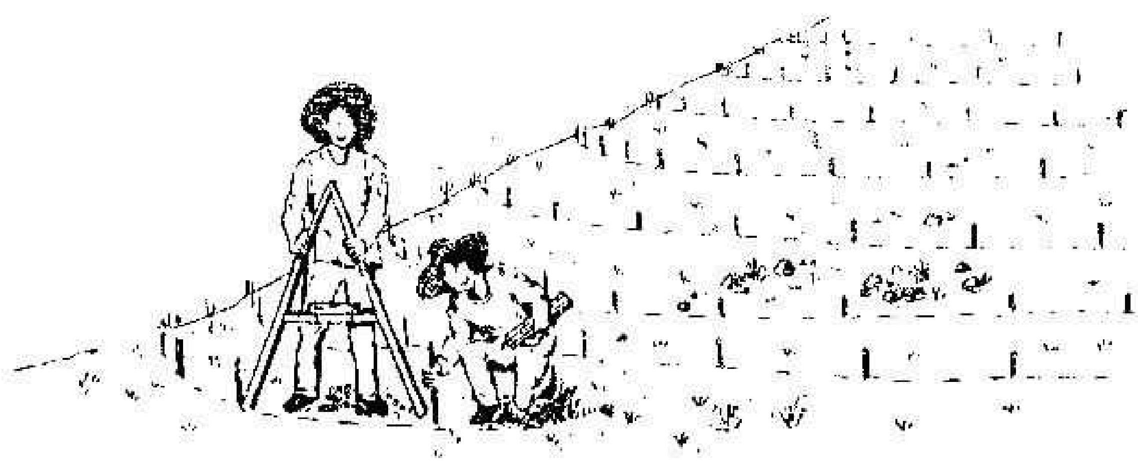
16) Make a study of the area for which contour lines are to be determined. Begin marking contour lines near the highest point. Let the A-frame stand on the ground. Without moving the rear leg, lift the front leg. Then put the front leg down on the ground that is on the same level with the rear leg.

A CONTOUR LINE IS A LEVEL LINE

17) The two legs of the A-frame are on the same level when the air space in the carpenter's level stops in the middle. When this happens, it means that you have found the contour line which is a level line between the two legs of the A-frame. Mark with a stake the spot where the rear leg stands.

LENGTH OF THE CONTOUR LINES

18) Move the A-frame forward by placing the rear leg on the spot where the front leg stood before. Adjust the front leg again as in item #16 until it levels with the rear leg. For every two to three meters of contour line you find, mark it with a stake. Follow this procedure until you reach the entire length of the contour line which is the other side of the mountain or hill.



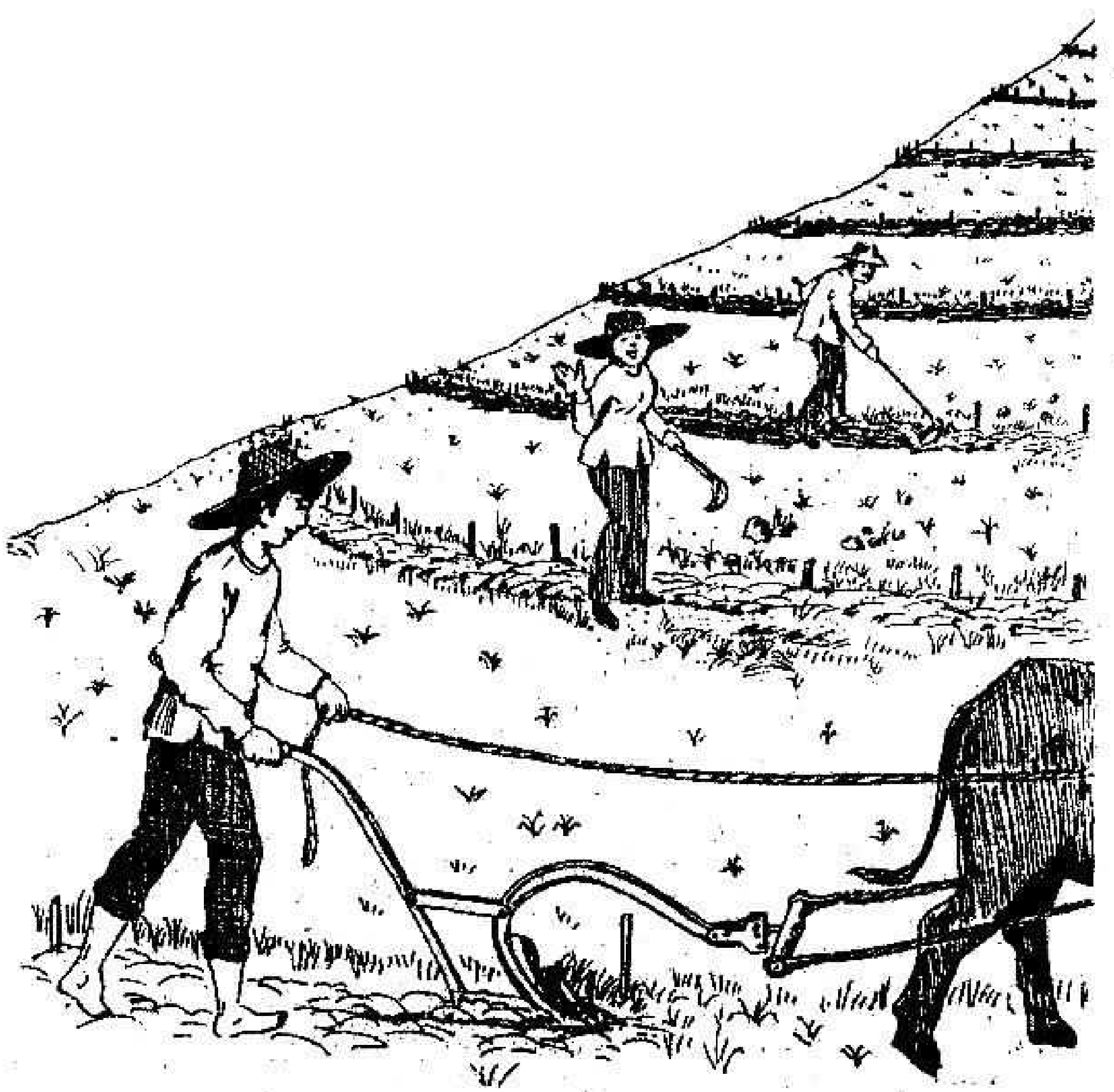
DISTANCE BETWEEN CONTOUR LINES

19) Try to locate as many contour lines as possible. The contour lines should be spaced from four to six meters apart.

Step Three: Prepare the Contour Lines

CULTIVATING THE CONTOUR LINES

20) After you have found the contour lines, prepare them by plowing and harrowing until ready for planting. The width of the area to be prepared should be one meter. The stakes will serve as your guide during plowing.



Step Four: Plant Seeds of Nitrogen Fixing Trees

PLANTING SEEDS OF NITROGEN FIXING TREES

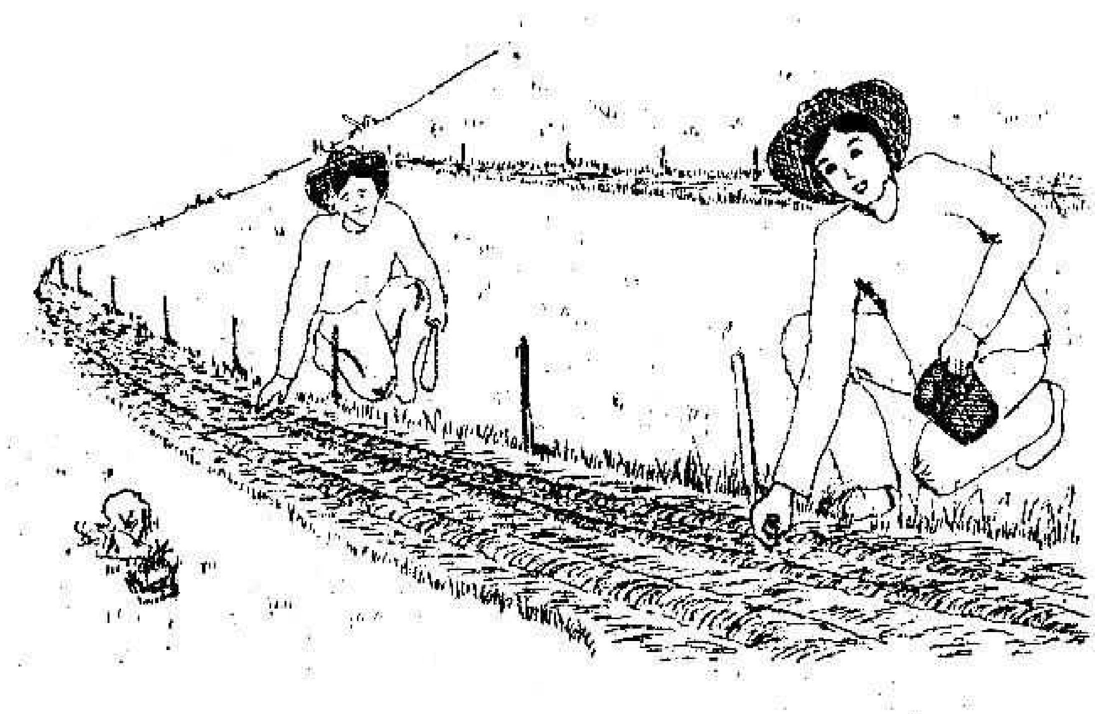
21) On each prepared contour line make two (2) furrows at a distance of one half meter apart. Plant at least two to three seeds per hill at a distance of one fourth inch between hills. Cover the seeds firmly with soil. (Ipil-ipil seeds should be soaked overnight in water before planting.)

IMPORTANCE OF NITROGEN FIXING TREES

22) The ability of nitrogen fixing trees to grow on poor soils and in areas with long dry seasons makes them good plants for restoring forest cover to watersheds, slopes and other lands that have been denuded of trees. Through natural leaf drop they enrich and fertilize the soil. In addition, they compete vigorously with coarse grasses, a common feature of many degraded areas that have been deforested or depleted by excessive agriculture.

EXAMPLES OF NITROGEN FIXING TREES

23) Ipil-ipil (Leucaena leucocephala) is the best example of nitrogen fixing trees for hedgerow on the SALT farm. Other examples of nitrogen fixing trees are Flemingia congesta, Acacia villosa, Gliricidia sepium (locally known as the madre de cacao or kakawate), Leucaena diversifolia (the so-called acid-tolerant ipil-ipil), and the Desmodium family (gyroides, distortum and discolor).



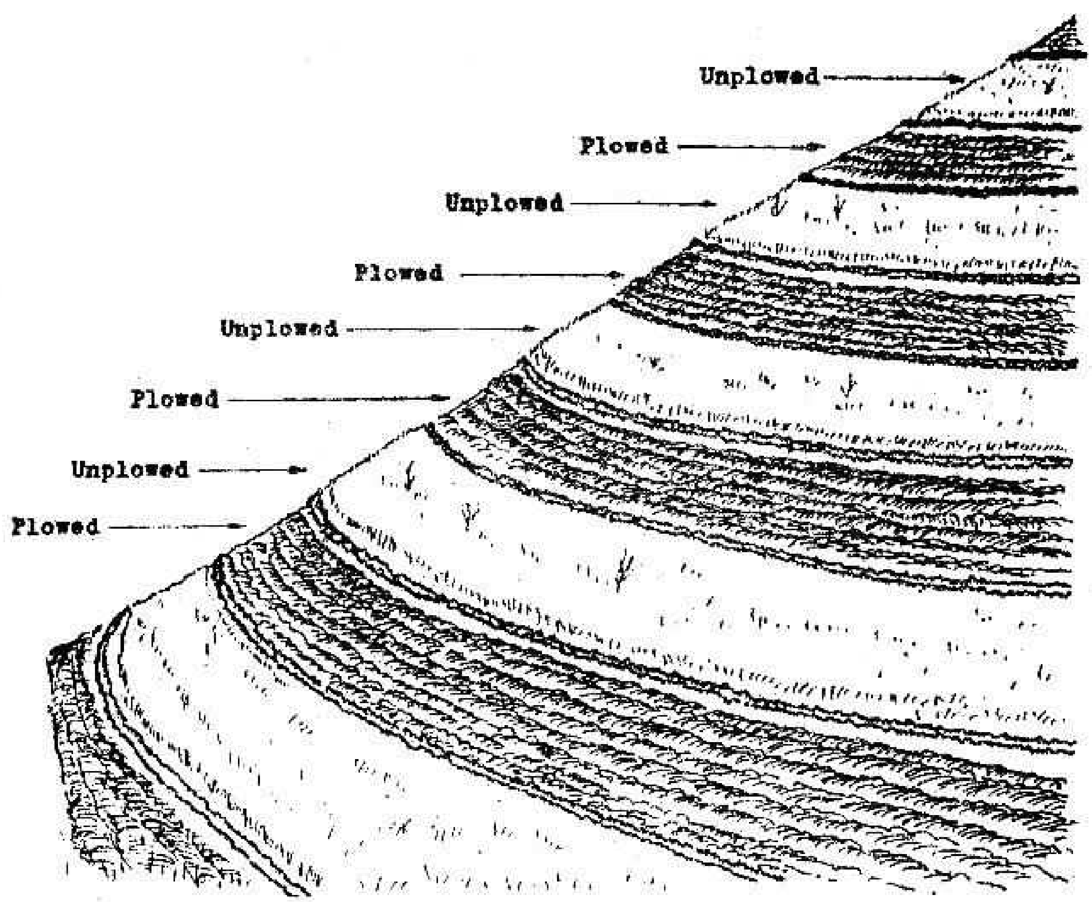
Step Five: Cultivate Alternate Strips

WHAT IS A STRIP?

24) The space of land between the thick rows of nitrogen fixing trees where the crops are planted is called a strip.

CULTIVATING ALTERNATE STRIPS

25) If you wish to prepare the soil for planting before the nitrogen fixing trees are fully grown, do it alternately, on strips 2, 4, 6, 8 and so on. Alternate cultivation will prevent soil erosion because the unplowed strips will hold the soil in place. When the nitrogen fixing trees are fully grown, you can proceed with cultivation on every strip.



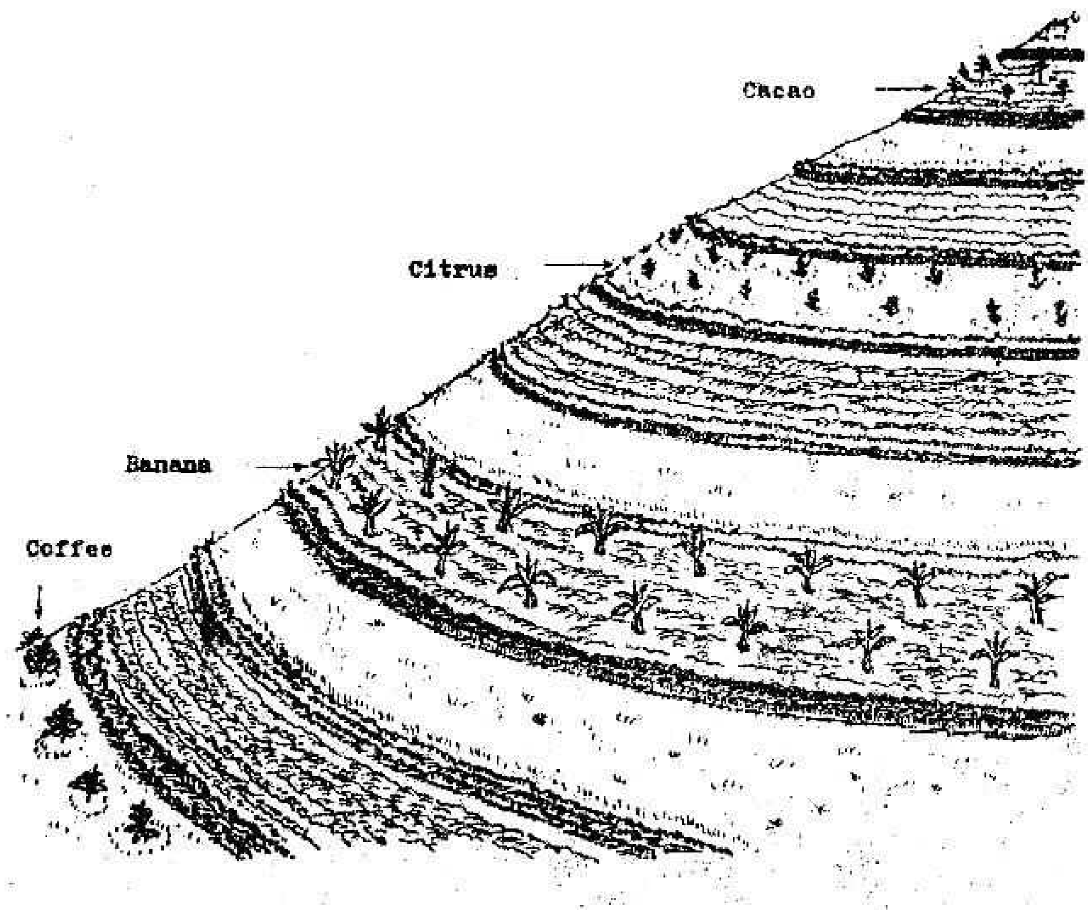
Step Six: Plant Permanent Crops

PLANTING OF PERMANENT CROPS

26) Permanent crops may be planted at the same time the seeds of nitrogen fixing trees are sown. Only the spots for planting are cleared and dug; later, only ring weeding is employed until the nitrogen fixing trees are large enough to hold the soil so full cultivation can begin.

EXAMPLES OF PERMANENT CROPS

27) Coffee, banana, citrus, cacao, and others of the same height are good examples of permanent crops. Tall crops are planted at the bottom of the hill while the short ones are planted at the top.



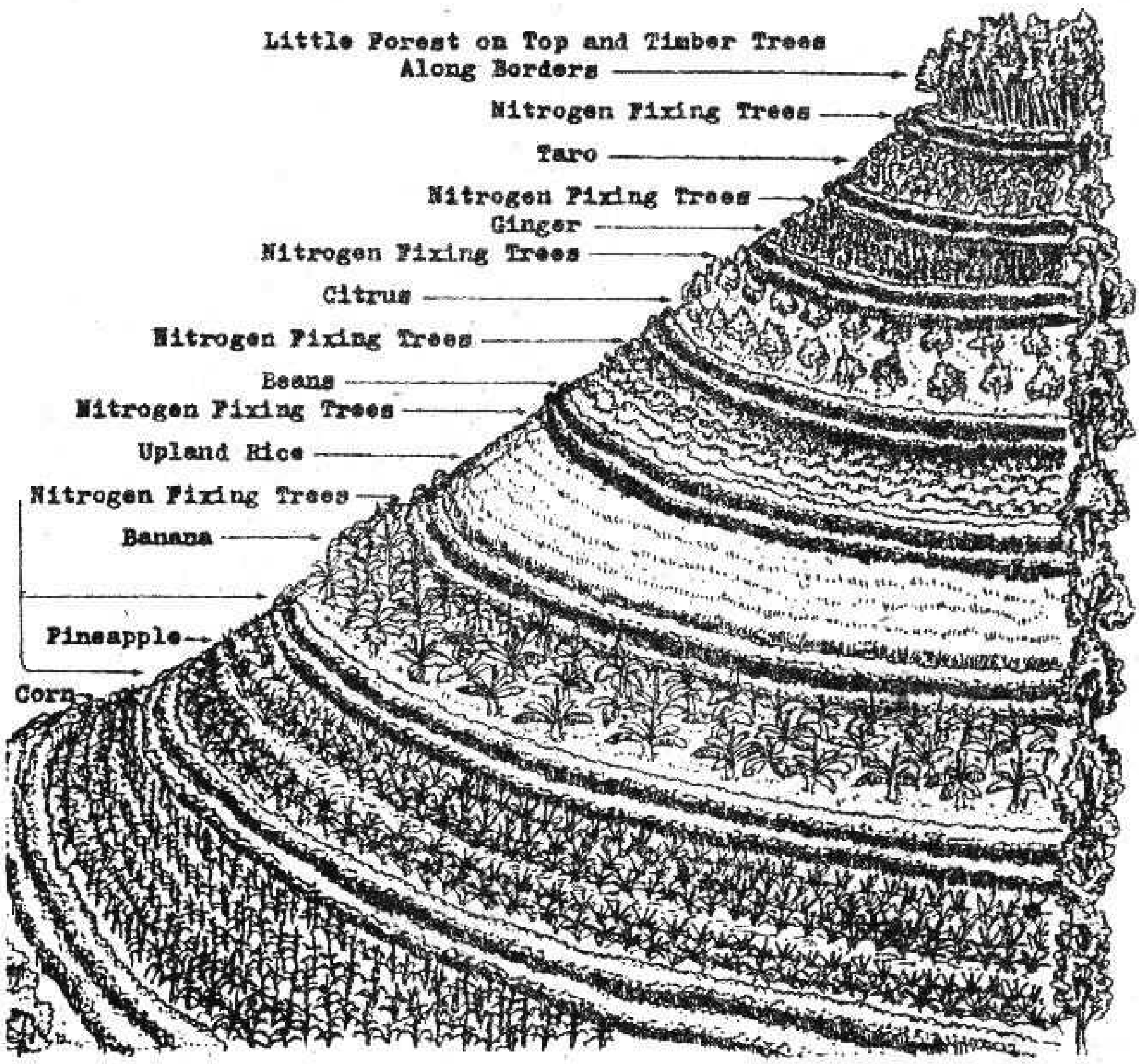
Step Seven: Plant Short - Term Crops

PLANTING OF SHORT - TERM CROPS

28) You can plant short and medium - term income producing crops between strips of permanent crops as a source of food and regular income while waiting for the permanent crops to bear fruit.

SUGGESTED SHORT – TERM CROPS

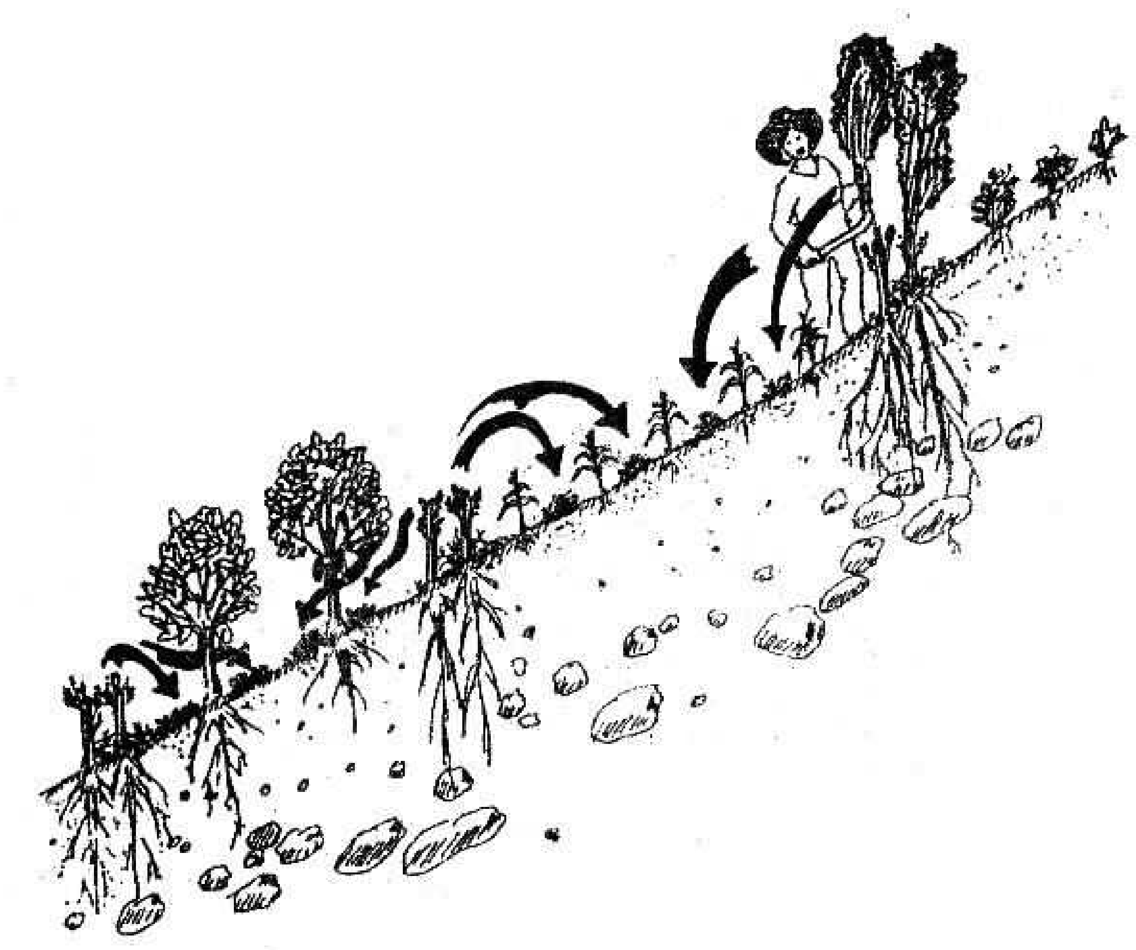
29) Suggested short and medium – term crops are pineapple, ginger, gabi, castor bean, camote, peanut, mung bean, melon, sorghum, corn, upland rice, etc. To avoid shading, short plants are planted away from tall plants.



Step Eight: Trim Nitrogen Fixing Trees

TRIMMING OF NITROGEN FIXING TREES

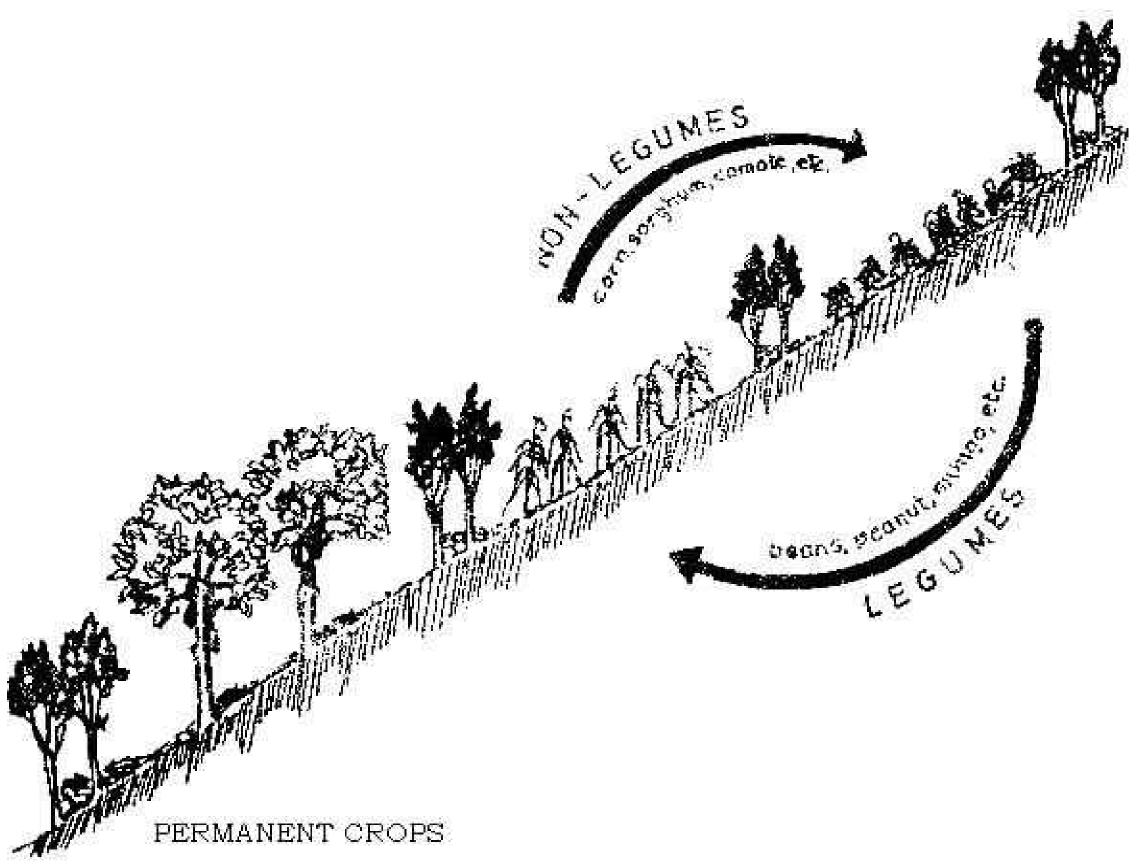
30) About once a month the continuously g rowing nitrogen fixing trees are cut down at a height of one to one and a half meters from the ground. Cut leaves and twigs are always piled at the base of the crops. They serve as an excellent organic fertilizer for both the permanent and short – term crops. In this way only a minimal amount of commercial fertilizer (about ¼ of the total fertilizer requirements) is necessary.



Step Nine: <u>Practice Crop Rotation</u>

ROTATE YOUR NON-PERMANENT CROPS

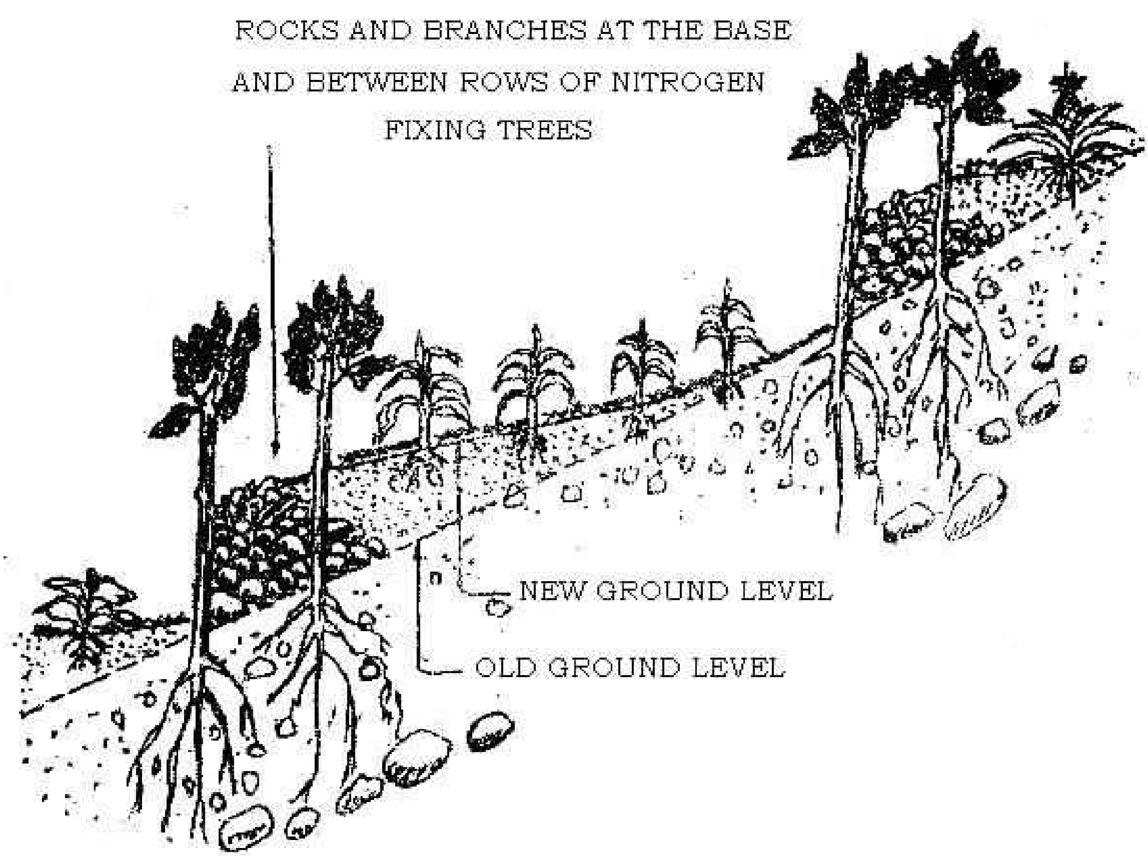
31) A good way of rotating is to plant grains (corn, upland rice, sorghum, etc.), tubers (camote, cassava, gabi, etc.) and other crops (pineapple, castor bean, etc.) on strips where legumes (mung bean, bush sitao, peanut, etc.) were planted previously and vice versa. This practice will help maintain the fertility and good condition of your soil. Other management practices in crop growing like weeding and pest and insect control should be done regularly.



Step Ten: Build Green Terraces

MAINTAIN YOUR GREEN TERRACES

32) Apart from providing you with adequate food and sufficient income, another more important benefit of using SALT is the control of soil erosion. This is done by the double thick rows of nitrogen fixing trees and the natural terraces being formed along the contour lines of the hill. As you go on farming the sloping land, keep gathering and piling up straw, stalks, twigs, branches, leaves, rocks, and stones at the base of the rows of nitrogen fixing trees. By doing this regularly as the years go by, you can build strong, permanent, naturally green and beautiful terraces which will reliably anchor your precious soil in its right place.



GOOD QUALITIES OF SALT FARMING

33) As a proven system of upland farming, SALT has certain good qualities over both the traditional techniques of slash and burn and conventional terrace farming.

One, the SALT system protects the soil from erosion.

Two, it helps restore soil fertility and structure.

Three, it is efficient in food crop production.

Four, it is applicable to at least 50% of hillside farms.

Five, it can be duplicated readily by hillside farmers.

Six, it is culturally acceptable because the farming techniques are in harmony with Filipino beliefs and traditional practices.

Seven, it has the small family as the focus and food production as the top priority. Fruit trees, forest, and other crops are secondary priority.

Eight, it is workable in a relatively short time.

Nine, it is economically feasible.

Ten, it is ecologically sound.

Eleven, the SALT farm can easily revert back to forest land if left unfarmed.

Twelve, it fits into the framework of the government's rainfed resources development strategy for the upland.

NATIONALIZATION OF THE SALT SYSTEM

34) The following groups have received training and have established SALT projects in their respective areas: Ecosystem Research and Development Bureau (ERDB), U.S. Peace Corps, British Volunteers, Department of Agriculture, Department of Agrarian Reform (DAR), Federation of Free Farmers (FFF), Rainfed Resources Development Project (RRDP), Farmers Training Center for Rural Development (FTC-RD), Philippine Coconut Authority (PCA), New Tribes Mission, REACH Foundation, Inc., Center for Rural Technology (CRT), Christian Reformed World Mission (CRWM), Negros Forest and Ecological Foundation, Inc., Save the Children Foundation, Department of Education, Culture, and Sports (DECS). Visayas State College of Agriculture (VISCA), Meralco Foundation, Inc., Shell Foundation, Inc., Overseas Missionary Fellowship (OMF), and Farming Systems Development Corporation (FSDC).

INTER-NATIONALIZATION OF THE SALT SYSTEM

35) Many countries and international organizations are now aware of SALT. The United States Agency for International Development (USAID), I nternational Development Research Center (IDRC), Food and Agriculture Organizations of the United Nations (UN-FAO), Nitrogen Fixing Tree Association (NFTA). Winrock International,WorldBank, World Neighbors, Environment and Policy Institute Center (EAP) of the East - West Center. Southeast Asian Regional for Graduate Study and Research in Agriculture (SEARCA), International Institute of tropical Agriculture (IITA), International Rice Research Institute (IRRI), and the International Institute of Rural Reconstruction (IIRR) know about this technology.

FOREIGN VISITORS

36) Upland development researchers and scientist from Nepal, Indonesia, India, Sri Lanka, Japan, China, Korea, Bangladesh, New Guinea, Nigeria, Mozambique, Ethiopia, the Solomon Islands, Malaysia, Liberia, Ghana, Thailand, Taiwan, Great Britain, United States, and Australia, among others, have visited the hillside demonstration area in Bansalan, Davao del Sur for possible adoption of the technology for their countries.

CONCLUSION

37) The Asian Rural Life Development Center recognizes that SALT is not a perfect farming system. There is not and never will be one system for all farmers. SALT is not a miracle nor a panacea. To establish a one hectare S ALT farm requires much hard work and discipline. There is no easy way. It takes three to ten years to deplete the soil of nutrients and to lose the topsoil; no system can bring depleted, eroded soil back into production In a few short years. Soil loss leads to low yields and poverty, but land can be restored to a reasonable level of productivity by using SALT.

Do you have any questions or suggestions? Let us know. See us personally at the Asian Rural Life Development Center in Kinuskusan, Bansalan, Davao del Sur or write to us at P.O. Box 80322, 8000 Davao City, Philippines. We will be happy to receive your letter.

Some Facts and Figures On

SALT (Sloping Agriculture Land Technology) Farm

1. Location: Kinuskusan, Bansalan, Davao del Sur
2. Area: 1 hectare
3. Slope: 25%
4. Climate: Type D (with about 100-125 inches rainfall per year)
5. Soil: Miral Clay Loam
6. pH: 5.5; low N: low P: Medium K
7. Total length of Ipil-ipil hedgerows = 1,804 linear meters
8. Ipil-ipil yield of 1 linear meter = 1 kilo green leaves
9. Ipil-ipil yield per harvest per hectare = 1,804 kilos of green leaves
10. 1 kilo of green ipil-ipil leaves =325 grams of dry leaves
11. 3 kilos of green leaves = approximately 1 kilo of dry leaves
12. 1,804 kilos of green leaves = approximately 601 kilos of dry leaves
13. Leaf and stem yield per harvest per hectare = 3,608 kilos
14. 100 kilos of dry ipil-ipil leaves = 4.3 kilos of N: 2.0 kilos of P: 1.5 kilos of K
15. 10 harvests per year of ipil-ipil =
    a. 36,080 kilos of green leaves and stems
    b. 18,040 kilos of green leaves
    c. 6,013 kilos of dry leaves
16. One year harvest of ipil-ipil =
    a. 258.5 kilos of N or about 11 bags of Urea
    b. 120.2 kilos of P about 12 bags of 0-20-0 (Solophos)
    c. 90.1 kilos of K or about 3 bags of 0-0-60 (Muriate of Potash)
17. Corn yield per hectare:
    a. Without fertilizer = 1.5 tons
    b. With ipil-ipil only = 3.3 tons
    c. With commercial fertilizer = 4.3 tons (100-50-0)
18. Per P=1.00 investment SALT will give you a net return about:
    a. P= 0.05 or 5% during the first year
    b. P= 1.04 or 104% during the second year
    c. P= 1.31 or 131% during the third year
    d. P= 2.07 or 207% during the fourth year
    e. P= 4.15 or 415% during the fifth year

APPENDIX A. Cost and return analysis of the SALT Demonstration Plot. 1980-1989 (in Pesos 1 hectare)

Year	Gross Income	Total Expense*	Net Income	Net Income/Mo.
1980	5,693.20	1,117.50	4,575.70	381.31**
1981	3,005.45	583.25	2,472.20	206.02**
1982	9,007.30	1,833.10	7,174.20	597.85**
1983	6,471.33	1,228.55	5,242.78	436.90***
1984	25,287.36	1,741.75	12,545.61	1,045.47****
1985	15,559.62	1,858.34	13,701.28	1,141.77
1986	13,294.88	1,710.07	11,584.81	965.40****
1987	17,257.75	3,062.13	14,195.62	1,182.97******
1988	13,869.82	2,764.55	11,105.27	925.44
1989	18,795.73	2,814.85	15,980.88	1,331.74
1990	17,310.63	1,982.90	15,327.73	1,277.31***

* Seeds, insecticides, fertilizer. No labor expense is included because the farmer uses his own labor.
** Permanent crops were not yet producing .
*** Droughts occurred in Mindanao in 1983 and 1990.
**** Permanent crops commenced producing.
***** Psyllid infestation of ipil-ipil was at highest level.
****** No ipil-ipil available, used commercial fertilizers <u>Leucaena</u> hedgerows were replaced by <u>Flemingia congesta</u>

APPENDIX B. Comparison of SALT model with a local farming system (1 hectare).

Item	SALT Model	Local Farm
Labor (1 year) 100% of work hours	50% of work hours	
Corn yields (2 crops per year)	2000 kg per crop*	500 kg per crop**
Soil loss Slight	Severe	

Only leaves from ipil-ipil in hedgerows were used as fertilizer.
The local farmer used neither commercial fertilizer nor ipil-ipil.

APPENDIX C. Effect of nitrogen sources on corn production (DMR-2 variety) over 8 croppings, ½ hectare.

Treatment	Corn Yield (Tons/Ha.)
No fertilizer	1.3
Ipil-ipil leaves from hedgerows	2.7
Commercial fertilizer* + ipil-ipil	3.7
Ipil-ipil = commercial fertilizer	2.6
Commercial fertilizer only	3.7
LSD % 5 level	0.7

* Commercial fertilizer applied = 100 kg N; 50 kg P/ha.

APPENDIX D. Average yields (six croppings) of two corn varieties In a SALT experiment treated with ipil-ipil as fertilizer

Variety	Yield (tons/ha)
Tinigib	1.99
DMR-2	2.18
Mean	2.09
LSD (0.05)	0.58

SOURCES OF INFORMATION

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