HAITI AGROFORESTRY RESEARCH PROJECT

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OUTLINE OF TECHNIQUES FOR USE IN STUDYING AGROFORESTRY HEDGEROWS AND ALLEY CROPPING SYSTEMS IN HAITI

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SUMMARY

Research methods for obtaining tree, crop, and soil data from Haitian hedgerow agroforestry systems are presented. Most of the procedures were developed during on-farm survey research conducted by Haiti Agroforestry Research Project (HARP) scientists. They have been used successfully in researcher-managed trials on demonstration sites and for farmer-managed dispersed experiments. Data need to be collected in an homogenous fashion so that they can easily be compared. Indeed, problems encountered in comparing existing results from different research projects in various regions are due in part to differences in research methods. The procedures described in this paper can assist in standardizing research methods used in hedgerow and alley cropping systems. A reliable research data base on Haitian agroforestry hedgerow and alley cropping systems can then be achieved which, along with the techniques, will also be useful in other countries

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INTRODUCTION

Soil erosion in Haiti has been a major concern for many years. Trees are commonly planted with crops on steep slopes in Haiti. The impact of such agroforestry practices on soil conservation and crop production needs to be assessed in Haiti since field observations indicate that, in certain circumstances they are not efficient in conserving soil. Evidence of considerable soil loss from tilled fields has been observed in Haiti.

Farmers are generally aware of seriousness of soil conservation problems that they face and are willing to take necessary steps to control soil loss and land degradation. Indeed, barriers of crop and other plant residues are traditionally used to build ramp pay barricades. This indicates that Haitian farmers understand the need to conserve soil and water.

USAID's Agroforestry Outreach Project (AOP) grantees, Cooperative for American Relief Everywhere (CARE) and Pan American Development Foundation (PADF), have expanded their agroforestry programs to include the use of hedgerows in their effort to improve soil and water conservation practices. Haitian farmers have been encouraged to use hedgerows on garden sites and appear to be incorporating this innovation in their cropping systems. They understand the basic principles for using hedgerows but sound recommendations need to be developed to further improve hedgerow practices in meeting the farmers needs and objectives.

Stone terraces, grassed terraces, and other barriers have been used for many years to stop the down-hill movement of soil. These practices often have been related to specific development projects and were stopped when the projects were terminated, indicating that they may not fit well into Haitian farming system needs.

In order to evaluate the efficiency of soil conservation interventions, data need to be collected in an homogenous fashion allowing for meaningful comparisons. Indeed, problems encountered in comparing existing results from different research projects in various regions are due in part to differences in data collecting methods.

Most AOP hedgerows are made using Leucaena leucocephala apparently because it has proven to be most efficient in similar project in other parts of the world. However, other tree species and several species of grass used by farmers have shown promising results and are being tested by HARP to assess their efficiency and performances as hedgerow species.

Haitian farmers will adopt hedgerows into their farming systems if they consider them to be beneficial, i.e., they find their overall farm income is improved or stabilized at an acceptable level. As farmers evaluate hedgerows it is important they be instructed in proper establishment and management practices. Recommendations should be based primarily on results of research conducted in Haiti.

The methods presented in this paper can be used to collect the required research data from controlled experiments (Research managed trials) and from on-farm measurements (Farmer managed trials). Even though the forms developed here are thought to be adequate, research workers will probably find it necessary to alter some procedures or the format of data sheets to include data columns for recording additional information. These procedures will serve in the follow-on project as the basis for developing the protocols and data collecting sheets.

METHODS FOR TAKING RESEARCH DATA ON HEDGEROWS

The following major subjects are discussed:

1. General information from the farmers about their hedgerows,
2. The general description of each hedgerow on the farm,
3. Data relating to "crop trees" (those trees left, or planted, in the hedgerow to be harvested for wood products),
4. Soil and tree data from sample plots in hedgerows,
5. Collecting biomass data, and
6. Methods for sampling soil and crop yields.

Confusion in hedgerow terminology is common, especially when describing location on a slope relative to a hedgerow using the terms uphill from or above a hedgerow vs. behind a hedgerow, and downhill from or below a hedgerow vs. in front of a hedgerow. For this reason in this document the terms "behind" and "in front" are not used and their use should be discouraged.

GENERAL INFORMATION (HARP-OFR-2, page 1)

General information about the farm or site being measured is recorded on the form given on page 4.

Lines A.- I.: These lines are self-explanatory. Codes are assigned in the office.

Line J.-K.: Tree fallow is land retired from cropping and allowed to grow shrubs and trees naturally, but where animals may graze. A grass/pasture is where only grass and weeds are allowed to grow on land used primarily for grazing animals. The number of years land was in either of the above is the number of years the field has been so utilized prior to planting of the hedgerow.

HAITI AGROFORESTRY RESEARCH PROJECT

HEDGEROW DATA SHEET

CODE #

A. Name of farmer_____ _ _

B. Department_____ _

C. Commune_____ _

D. Section_____ _

E. Locality_____ _ _

F. Field Number_____ _

G. Date ___day ___month ___year _ _ _ _ _ _

H. Date hedgerows planted ___day ___month ___year _ _ _ _ _ _

I. Date(s) hedgerows reseeded ___day ___month ___year _ _ _ _ _ _

J. Utilization of land prior to planting hedgerows
1=tree fallow, 2=grass/pasture, 3=crops _

K. Number of years in "J" above prior to planting hedgerows _ _

L. Hedgerows seeded on: 1=bench terrace 2=flat furrow 3=other _

M. Depth seed were covered with soil when planted (cm) _ _

N. Crops planted at or near time hedgerows were seeded:
1=corn, 2=sorghum, 3=manioc, 4=pigeonpea, 5=sweetpotato,
6=beans/cowpea, 7=peanuts,8=other vegetables, 9=none _,_,_,_,_,_

O. Crops planted second season after seeding hedgerows: _,_,_,_,_,_

P. Number of times hedgegrows have been cut pruned _ _

Q. Months hedgerows are usually pruned (circle)
J, F, M, A, M, J, J, A, S, O, N, D _,_,_,_

R. Use of cut material: 1=animal feed, 2=mulch, 3=put
on top of h.r.,4=ranp pay above h.r., 5=fuel wood,
6=charcoal, 7=green manure,8=other_____ _,_,_,_,_,_

S. Does the order in R. also meet the order of your needs YES NO

COMMENTS:

Line L.: Most hedgerows are made by planting seeds on contour rows costructed so that a furrow is formed to reduce the erosive action of runoff after heavy rains. Flat planting is sometimes used and is done using a machete or other tool to open a small furrow which is closed after seeds are sown, leaving the soil surface as it was before seeding (Figure 1). In both methods ramp pay is often used to protect the seeded plants and prevent their washing away.

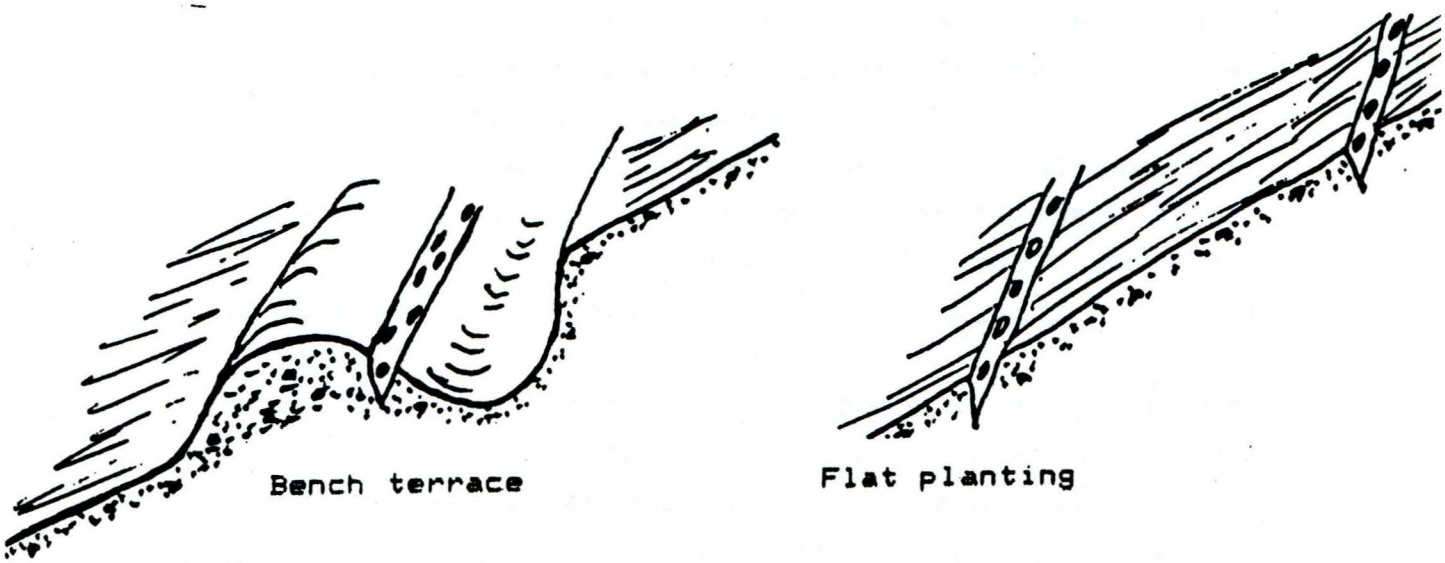

Figure 1. Two types of hedgerow seedbeds used in Haiti.

Line M.: The farmer is asked to show how much soil was placed over the seed after they were sown. The surveyor estimates in centimeters what is indicated by the farmer.

Line N.-O.: The important consideration here is the competition or protection encountered by the newly-established hedgerows. Since cropping cycles follow bi-modal rainfall patterns, crops are recorded for the next two cropping seasons after seeding hedgerows. For 'N' record crops that were planted either just before or immediately after hedgerows were seeded. Record crops grown the second season on line 'O'.

Line P.: The farmer is asked for the number of times the hedgerows have been pruned. The researcher will also observe the stems of the hedgerow trees to see how many pruning stubs or scars are found. These counts may not agree with what the farmer says, since on older hedgerows recent prunings may have been below earlier pruning levels. If the farmer confirms this, the number of prunings he says were made each year is multiplied by the number of years hedgerows have been pruned, and this number is recorded. When more prunings are observed than the farmer says, the observed number should be recorded.

Line Q.: The months in which the farmer prunes hedgerows in a typical year are circled. This helps confirm the information in Line 'P' and indicates when hedgerows are pruned relative to the developmental stages of crops planted in the garden.

Line R.: Succulent tips and leaves are commonly used as animal feed. Mulch is the pruned material spread over the garden or around plants. Sometimes farmers place pruned material on top of the hedgerow in an attempt to prevent rapid regrowth they fear will compete with crops before they have time to prune again. More commonly, the recommendation for placing this material above the hedgerow (ramp pay) to aid in soil and water conservation is followed. Large stems may be left in the garden to dry before being used for fuel wood or charcoal. Some farmers turn the succulent material into the soil as green manure. All uses mentioned by the farmer should be recorded in order of the quantity of prunings used. For example, if a farmer used most of his prunings for animal feed and the rest divided 40% : 60% for fuel wood and ramp pay respectively, the surveyor would record 1,4,5,_,_. Other uses should be described and recorded.

Line S: The interviewer should also ask if the order of uses also reflects the order of needs.

DATA FROM INDIVIDUAL HEDGEROWS (HARP-OFR-2, page 2)

The second page HARP-OFR-2 has two sections (see page 8). The upper section is for recording data related to the whole length of each hedgerow; the lower section is for recording details on "crop trees" left or planted in the hedgerow which will be harvested for such things as poles or charcoal wood. All pages must have farmer's name or ID# and date work was done.

Hedgerow numbers (H.r. #) are assigned so that #1 is always at the top of the slope. Others are numbered in sequence below. Similarly, "bands" between hedgerows for crop measurements will be discussed later and will also be numbered in sequence beginning with #1 in the uppermost position.

The four-letter species code for the trees in the hedgerow is made using the first two letter of both Latin names. Thus, leucaena, Leucaena leucocephala, will be LELE. If there are two or more species in the hedgerow, each should be listed by species code and percentage of the hedgerow it represents. For example, a hedgerow with 70% leucaena and 30% kasya will be coded as LELE70/CASI30. Percentages are estimated; actual number of each species will be obtained on 1-meter plots discussed later.

Meters between hedgerows is the slope distance between the ends of a hedgerow and the ends of the hedgerow above, or in the case of the uppermost hedgerow (#1), to the top the garden and/or the top of the landform. (Horizontal distance = slope distance x cosine of slope (% x .45) and is calculated in the office.)

HAITI AGROFORESTRY RESEARCH PROJECT

HEDGEROW DATA

Name or ID# of farmer: _____ Date: _____

H.r. #	Sp. code	Length (m)	Percent damage			Length of breaches (list separately, cm)
			graz-ing	di-sease	in-sect	

H.r. #	Crop trees in h.r.				H.r. #	Crop trees in h.r.			
	Dist from 0.0m	Diameter 0.3m cm	Diameter 1.3m cm	Ht. m		Dist from 0.0m	Diameter 0.3m cm	Diameter 1.3m cm	Ht. m

COMMENTS:

Length in meters of hedgerows is the distance between the stems of the two end trees. With the zero end of a measuring tape held at one end of the hedgerow by the person recording the data, another walks along the hedgerow with the tape and measures the length of breaches, in centimeters, and distances to crop trees in meters starting from the zero end. For a curved hedgerow, the tape should be pulled tightly along the up-hill side allowing it to rest against the trees in the hedgerow. For straight hedgerows the tape is kept tightly pulled so it is parallel to the line of trees over its entire length (Figure 2).

Length of breaches are recorded individually. A breach is a region where trees are absent or have failed to hold back soil or water. It is usually a place where erosive water channels are noted. Spaces larger than the usual spacing between trees should be counted as breaches even when water channels are not seen because these are points where erosion will occur if the farmer is not vigilant with his ramp pay work. The causes for breaches to develop needs to be studied, but all breaches should be reseeded or planted with a grass as quickly as possible.

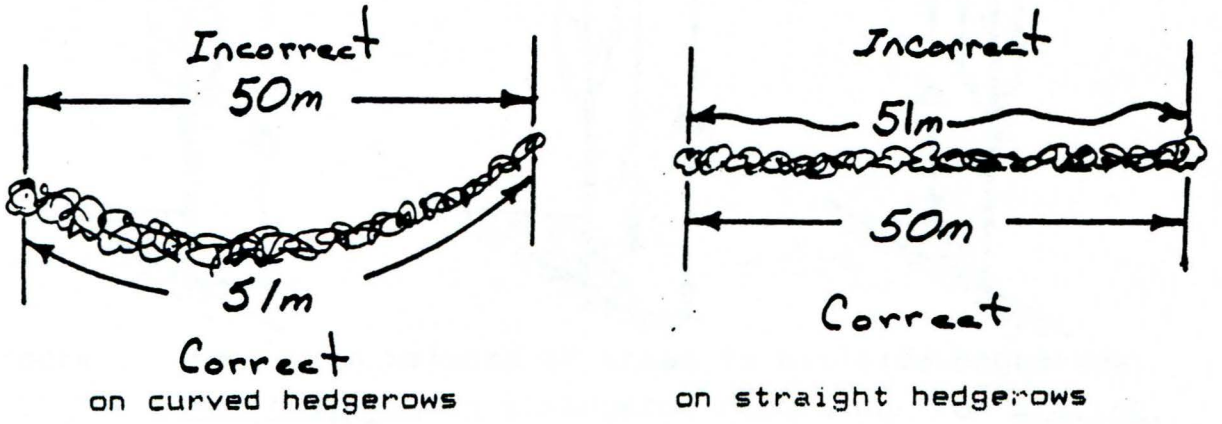

Figure 2. Correct and incorrect measuring of hedgerow length.

When recording measurements of crop trees, care must be taken to insure that the hedgerow number used is the same as the hedgerow being measured. After the distance from 0.0 is recorded for a crop tree in the hedgerow, diameters at 0.3 m and at 1.3 m above ground level are measured with a tree caliper or diameter tape. For noticeably elliptic tree stems, the recorded diameter should be the average of the greatest diameter and the diameter at right angles to this.

The height of the crop tree may be taken with a small telescoping fiberglass tree measuring pole. For small trees, a 3 - 4 m rigid measuring pole or fold-up rule may be faster. The pole is placed next to the tree with its lower end at the root collar level (RCL). The RCL is defined as the point on the tree equal to the ground line at the time the tree was seeded or planted. The pole must not be resting on either accumulated soil or places where soil has been eroded. Either remove the excess soil or raise the pole to set its base at RCL.
When measuring hedgerow tree heights, the same principles apply (Figure 3).

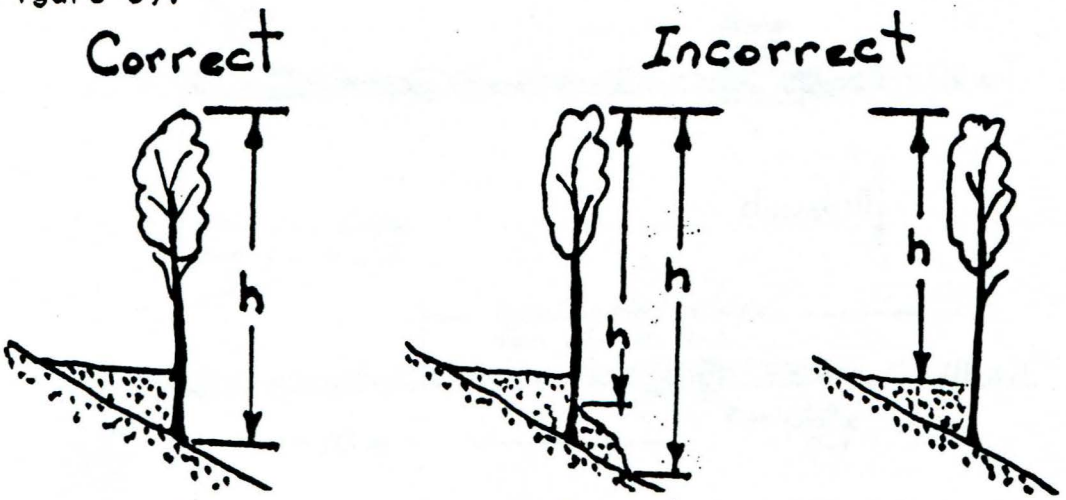

Figure 3. Measuring heights of trees in hillside hedgerows.

The percent damage in a hedgerow resulting from grazing, disease, or insects usually will be a subjective estimate. However, if the damage is such that the affected area can be measured, the data should be recorded as the fraction:

Percent damage = length damaged / length of hedgerow.
If the damage can be described, more precisely it should be noted in the space for COMMENTS.

DATA FROM 1 METER SAMPLE PLOTS IN HEDGEROW

To characterize a hedgerow garden, based on methods commonly used in forestry, a 10% sample will be used. This requires a 1-meter plot from each 10 meters of hedgerow. To allow for sound statistical analyses data must be from plots located randomly. This is done as follows. The first sample plot is located 1 to 4 meters from a point one meter from the beginning of a hedgerow. The center of the first sample plot is determined by randomly picking a distance (in meters) as one of four objects (beans etc.) marked 1 to 4. Measuring from the center of this first plot, a one meter sample plot is measured every 10 m (see Figure 4). The residual end sections of the hedgerow are treated as buffer zones and are not sampled.

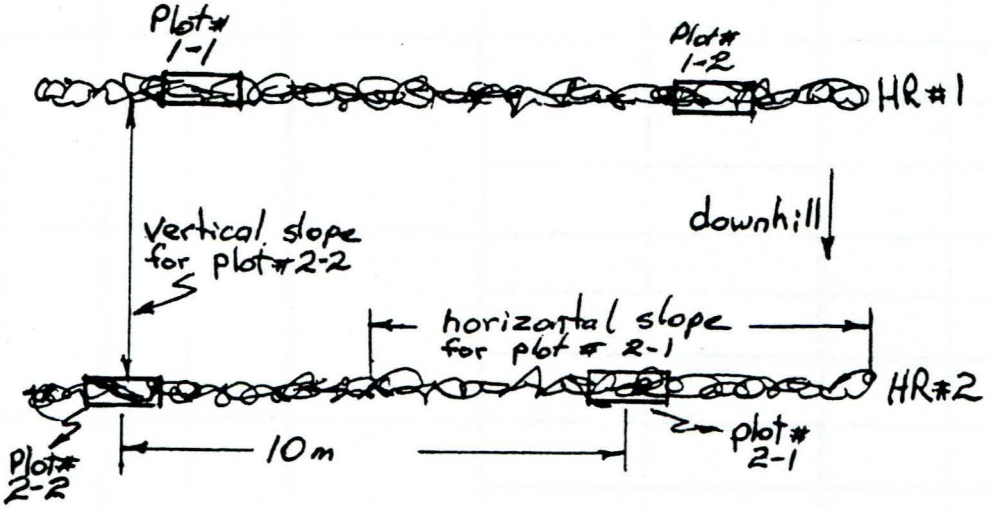

Figure 4. Locating and measuring 1-meter plot variables.

Data from 1-meter plots is recorded on the HARP-OFR- 2, Pages 3 and 4 (see pages 12 and 16). Hedgerow numbers are assigned as previously described and plot numbers are assigned in sequence along the hedgerow. Figure 4 illustrates an example of plot numbering. Always make a map of garden showing the locations of the hedgerows and plots.

HAITI AGROFORESTRY RESEARCH PROJECT
HEDGEROW DATA SHEET

DATA FROM 1 METER PLOTS CENTERED EVERY 10 METERS IN HEDGEROWS

Name or ID of farmer____ Date____________

H.r. #	Plot #	Plot slope hor/ver (%)		Length of breaches	Average pruning height	Average h.r. height	Soil accumulation		
		hor	ver				Slope (o)	Height (cm)	Width (cm)

COMMENTS:

Plot slopes (%) are obtained as follows. Horizontal slope is measured with a clinometer by sighting parallel to the ground from one end of a 10-meter section to the other. Vertical slope (S) is determined while standing at the center of the 1-meter plot and sighting parallel to the ground and perpendicular (90 degrees) to the hedgerow towards a point just below the hedgerow above, or, for hedgerow #1, to the edge of the garden. To avoid taking a wrong measurement, do not stand on accumulated soil either above or below the hedgerow. The slope distance between the hedgerows along the vertical slope is recorded, see Figure 4.

Three average pruning heights are measured, one at either end and one in the middle of the 1-meter plot. The estimated height at which trees have been pruned may be measured using a meter stick. Old pruning scars are used to determine pruning height. The average hedgerow height is measured at these same points in the plot. Tree height is measured by holding branches immediately below the pruning cut on several trees vertically.

Volumes of soil accumulated above hedgerows are of primary interest and can be calculated in several ways. With two additional field measurements taken in the one meter plot at the same three locations mentioned above, the following method will be used. (see Figure 5).

1. h = height of the accumulated soil and is obtained by measuring the distance from the RCL to the point on the trees to where soil has accumulated. To find the upper point for measuring h place a meter stick on the surface of the accumulated soil and extend it through the hedgerow. Any soil accumulated below the hedgerow above the RCL must be removed before measuring h.

2. S' = slope in degrees of the surface of the accumulated soil and is measured by placing a clinometer, pointed downhill, on the surface of the meter stick while it extends through the hedgerow while measuring height of accumulated soil and reading the scale in the side window.

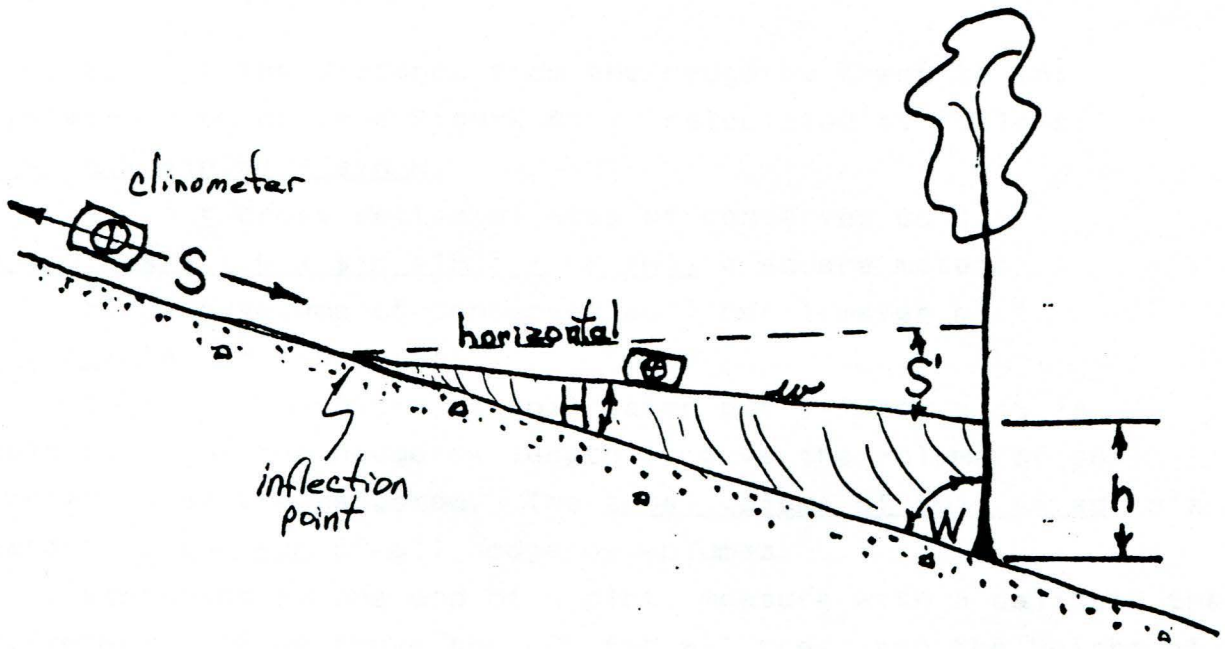

Figure 5. Widths, heights, slopes, and calculated variables used to find volume of soil saved in 1-meter plots on hillside hedgerows in Haiti.

Two areas of accumulated soil, one just below the hedgerow and the other in the filled furrow above could be considered in calculating volumes of saved soil. The soil below is subject to erosion from cascading water and/or by anthropic erosion during cultivation (or research efforts!). This soil is expected to move down the slope to the next zone of soil accumulation. Soil in the filled furrow is replacing that removed during hedgerow establishment and is not considered as "conserved" soil.

The following formulas are used to calculate the <u>volume of soil conserved.</u>

1. W = the angle (deg) formed between the hedgerow trees and the vertical slope of the plot. <u>W = 90° - S°</u> where S = S% x 0.45. If slopes are taken in degrees, this conversion is not needed.

2. H = the angle (deg) formed between the surface of the conserved soil and the plot vertical slope. <u>H = S° - S'°</u> where S' is the average of the three accumulated soil slopes.

3. w = the distance from the hedgerow trees to the inflection point (see Figure 5) is calculated as follows:
$w = (h \times \sin W) / \sin H.$

4. A = cross sectional area of conserved soil.
$A = 0.5 \times w \times h \times \sin (180° - (W + H))$ = square meters

5. V = volume of conserved soil per 1-meter plot.
$V = A \times 1m$ = cubic meters

The average volume of soil saved per 1-meter plot is multiplied by the hedgerow length to give the volume of soil conserved by the hedgerow. The total volume of soil saved in a garden is the sum of all hedgerow volumes.

Beginning at one end of a plot, measure with a calipers the diameter at 10 cm above the RCL for all trees and the height of the first and every fifth tree in a each diameter class. Use the DIAMETER CLASSES AND HEIGHTS data sheet here (see page 16). Diameter classes are assigned in the field. Depending on the distribution of the diameters, increments in diameters classes will vary. For example for a plot having many small trees, diameter classes in 1 millimeter increments are used. If a plot has mostly small trees with few large trees, diameters and heights for these large trees will be recorded without assigning diameter classes in the lower half of the page. Heights are measured as described previously. Biomass samples taken at this time will be used in regression analyses of height and diameter on oven-dry weight (see BIOMASS DATA SHEET page 18).

HAITI AGROFORESTRY RESEARCH PORJECT
HEDGEROW DATA

Name or ID of farmer_____ Date_____

Hedgerow #_____ Subplot #_____

Diameter classes (mm)												

Height of first and every fifth tree in above diameter class (cm)												

Diameter classes (mm)												

Height of first and every fifth tree in above diameter class (cm)												

HEDGEROW BIOMASS DATA

In sampling hedgerows for biomass production, data are recorded on the BIOMASS DATA SHEET (HARP-OFR-3). Crop trees are not destructively sampled to determine their biomass, but their stem volume will be calculated from data recorded and will be used to estimate biomass according to procedures described in the Forestry Handbook (edited by Karl F. Wenger, John Wiley & Sons). For trees, the stem, or bole, volume makes up 55-60% of the total biomass; the crown, 15 - 25%; and the stump and roots 17 - 23%.

Hedgerow biomass cut from the 1-meter plot is to be separated into two groups: (1) stems and large branches consist of material that would normally be used for firewood; (2) leaves and small branches consist of succulent material suitable for feeding to animals. The actual pruning height needs to be recorded on this biomass data sheet in the "Remarks column". Use a #2 pencil or a permanent marker to label paper water-resistant sacks (made with waterproof glue) for each group. For example, if the sample came from the plot in the third 10-meter section of the fourth hedgerow it should be labeled 4 - 3, along with the farmers name or ID # and the date samples were taken. It is not necessary to label the sacks as to the kind of sample (leaves or stems) they contain. A hanging balance previously tared (adjusted to zero while weighing an empty paper sack, or other container for holding biomass samples,) is used to measure the field weights to the nearest 0.1 kilogram. Balances should be calibrated monthly using a standard of known weight.

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BIOMASS DATA SHEET

CODE #

A. Name of farmer _____ _

B. Departmenmt _____ _

C. Commune _____ _

D. Section _____ _

E. Locality _____ _

F. Date samples taken ___day ___month ___year _ _ _ _ _ _

Sample ID (tree #, H.r. #, plot #)	Species code	Field weights (g)		Oven-dry weights (g)		Remarks
		Stems + large branches	Leaves + small branches	Stems + large branches	Leaves + small branches	

COMMENTS:

There is large variation in moisture content in field weights of fresh material, thus research results are standardized by determining oven-dry weights. Break large stems into pieces about 10 cm in length, and if diameter is greater than 2 cm split these pieces length-wise to allow for more rapid drying. Samples will be dried in a forced-draft oven at 105° C until bags attain a constant weight. If samples can not be oven-dried the day they are taken, they should be left in open paper sacks in full sunlight. Rain can not to be allowed to wet the samples. The leaves and small branches should be kept loose in the sacks to allow for proper air circulation. Care must be taken to prevent the succulent material from decaying. Total hedgerow biomass harvested from a garden is equal to the sum of the average production for each hedgerow.

METHODS FOR SAMPLING SOIL AND CROP YIELDS.

Conservation of soil and water are the primary reasons for using hedgerows in hillside farming systems, but their effects on crop yield and soil fertility need to be determined so management practices can be developed to maximize overall farm income. For example, when choosing a tree species to use in a hedgerow there may be no differences between species in their ability to stop soil erosion while significant differences exist in their effects on crops and soil fertility. The following sampling procedures are recommended for studying hedgerow effects on soils and crops.

SAMPLING FOR CROP YIELDS.

Between the hedgerows where measurements are taken, three bands are defined as follows:

a. A = the band adjacent to and above a hedgerow,
b. B = the band adjacent to and below a hedgerow, and
c. M = the band in the middle between two hedgerows.

A, M and B represent a gradient between each hedgerow. In each of these bands at least three circular sample plots are taken for crop yield measurements. Bands A and B are those where the hedgerow is expected to have an effect on crop yields. Their width is not to exceed 3 meters and the radius of the sample plot is thus not to exceed 1.0 meters. In band M the radius of the sample plot can be 1-2 meters. If the distance between two hedgerows is less than six meters, only two bands can be defined. In cases where the distance between hedgerows is less than 4 meters only one "single" (S) band is defined. Figure 6 illustrates a few examples.

Location of sample plots is defined in a similar fashion as for the 1 m hedgerow sample plots discussed earlier. In each band, the first sample plot is located 1 to 6 meters from a point one meter inside the field from edge of the field. This distance is determined by randomly picking one of six objects (beans, die, etc.) marked 1 to 6. From the center of this first plot, other sample plots are defined every 10 m (see Figure 6). When the band length does not allow three samples at this distance, reduce the distance between plots to allow taking three samples. The residual end sections of the bands are treated as buffer zones and are not sampled.

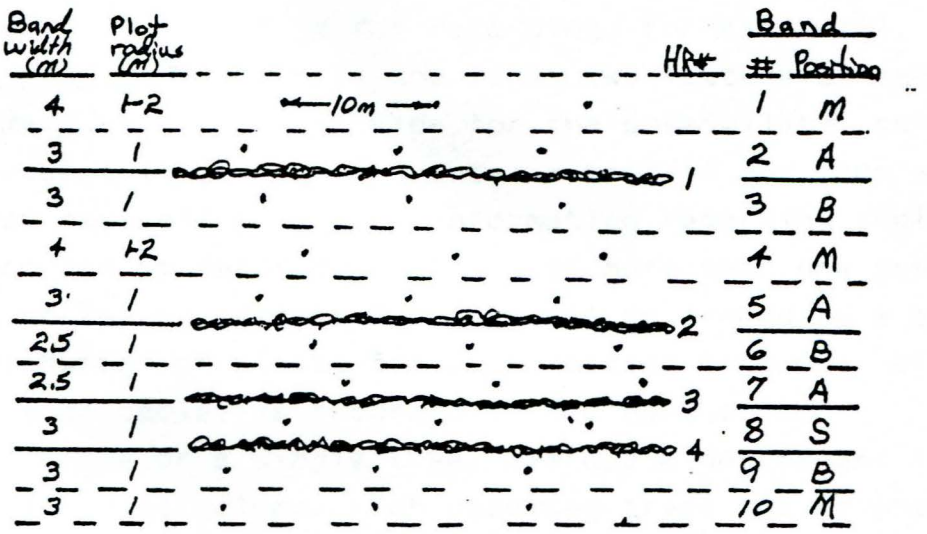

Figure 6. Example for laying out gradient bands and plot centers.

The variables measured on the data sheets for crop yields will vary depending on the crops measured. In each sample plot a complete inventory of what is found is needed. This inventory will include species names, counts, sizes (diameters and heights as needed). Specifically for agricultural crops, the count will include the number of hills, the number of plants in each as well as the count of ears, heads, pods, etc. Counts are separated into harvested and aborted units. Damages from insects and diseases are also recorded.

The following information about the cropping system and variables measured should be recorded. See plant count and measurement form, page 23.

1. IDENTIFICATION: Location, commune, section, locality and farmer's name as well as date garden is measured.
2. Band numbers are assigned from top to bottom of the garden. Flexibility exists to use the same form in more sophisticated experiments where we may have randomized blocs. In these cases we record bloc numbers instead of bands. Bloc and plot sizes are then also recorded. In the case of hedgerows, plot numbers are recorded as Rep # and their diameter recorded.

For each replication in each of the bands measured:

3. The first column is for recording, for each hill, the Crop or Tree code which is the first two letters of each Latin name. We have to provide for the possibility, quite frequent indeed, to encounter a tree in our sample plot. In that case all pertinent information regarding that tree is recorded as described later. If more than one species is found in the same hill, they will be linked by a bracket.
4. The number of plants for each species or number of coppices, if applicable, is recorded in the next column.
5. For crops or a single tree, average plant height is recorded in the next column. For coppiced trees the height of the three largest coppice stems are recorded.

PLANT COUNT AND MEASUREMENTS. DATE: YR: MONTH: DAY:

LOCATION: IDENT:

Commune Section Localite Farmer's name:

BLOC #: of (Blocs are numbered from top to bottom of slope).

Bloc sizes (if field is devided into blocs),

PLOT SIZE: Length (m): Width (m): Diameter (m):

COD	CROP TREE	#PLNT /HILL #COPI	PLNT HGT (m)	DIAMETER BASE (mm)	DBH mm	EAR COUNT ADOR	HARV	CF WC (g
REP #1								
REP #1								
REP #1								
REP #1								
REP #1								

6. The next two columns for recording basal diameter (0.1m for stems without basal swell and 0.3 m otherwise) and DBH of trees, pigeonpeas, manioc, cotton, etc.
7. The next two columns are for recording the number of ears, both aborted and harvested.
8. The last column is for recording the total field weight of the sample harvested.

Always make a map of garden showing the locations of the hedgerows and plots.

SOIL SAMPLES.

Soil samples are taken to evaluate soil fertility as well as soil physical characteristics related to hedgerows.

Soil samples are taken at the center of each circular plot after crop measurements are taken. A composite soil sample for each band of gradient plots is obtained by mixing approximately 50 grams of soil from the top 15 cm from each of the three plots. If the plot centers of band A fall outside the zone of accumulated soil, a separate composite sample of accumulated soil is taken. A soil auger, shovel, machete, etc. can be used for this. Write the hedgerow or band number, farmer's name or ID#, and the date samples were taken on a soil sample bag or box, or on a piece of waterproof paper or a waterproof tag. Use a #2 pencil or a permanent marker. Place the paper or tag inside the polyethylene bag containing the soil. Information written on the outside of plain poly bags, even with "permanent" markers, is sometimes rubbed off; a tag attached outside may be torn off and lost.

SOIL MOISTURE AND BULK DENSITY.

Volumetric samples are taken at the same sampling points as described above to compare soil moisture and bulk density between bands.

A list will be made of all soil samples and their origins. Soil samples should be dried to a constant weight at 40 C in the forced-draft oven. Obtain the total weight of each soil sample and the weight of the gravel that fail to pass through a 2 mm sieve. Percentage of gravel is then calculated. Soil is sent to the Auburn University Soil Testing Lab for further analyses. Chemical analyses include organic matter, pH, phosphorus, potassium, magnesium, and calcium and the mechanical analysis includes particle size distribution.