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HAITI

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EXPERIMENTAL AND SURVEY DESIGN AND ANALYSIS NEEDS FOR FARMING AND INFORMATION SYSTEMS COMPONENTS OF ADS-II PROJECT, HAITI

Report #10

EXPERIMENTAL AND SURVEY DESIGN AND ANALYSIS NEEDS FOR FARMING AND INFORMATION SYSTEMS COMPONENTS OF ADS-II PROJECT, HAITI

(Based on January 6 - 26, 1985
consulting trip of Doug Neeley)

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I INTRODUCTION

This report is based on a three week short term consultancy to Haiti. The purpose of the consultancy was 1) to review and evaluate the designs and the data collection and analysis procedures being used on the farmers' field trials and to provide workshops on experimental design, data analysis and use of the HP-41CX programmable calculator in support of the farming systems component of the ADS-II project; and 2) to work with a U. S. Bureau of Census team and ADS-II staff in determining the best strategy for implementing the information system component of the project.

The consultancy period was too short and the number of permanent farming systems' staff was too small to justify holding formal workshops. Instead, I did the following: 1) during the first week of my consultancy, I visited farmers' field trials and discussed experimental management, design and analysis problems with the ADS-II agronomy technical consultants and their permanent counterpart coordinators (Dr. Joseph Pierre and Mr. Jaques Surrell at Jacmel and Dr. Amal Chatterjee and Mr. Gardy Fleurentin at Les Cayes); 2) during part of the second week of my consultancy, I outlined problems and agronomists' concerns and modified a program for the HP-41CX calculator to analyze the harvested trials; and 3) during most of the third week of my consultancy, I participated in technical meetings to plan experiments for the coming season and returned to Jacmel and Les Cayes to give agronomists training on the HP-41CX program and to assist in the analysis of data that had already been collected in Jacmel.

Most of the second week and part of the third week of my consultancy was directed toward assessing survey needs for the information systems component of the project. The second week included joint meetings involving U. S. Bureau of Census consultants (Mr. Miguel Cuevas who specializes in questionnaire design and Mr. David Megill who specializes in sample design), ADS-II staff (Dr. Richard Swanson, Mr. Lionel Richard, Mr. Ernest Dupont, and Mr. Georges Werleigh), and myself. These meetings included internal meetings, a meeting with His Excellency, Minister of Agriculture Frantz Flambert and his staff, a meeting with the Secretary General of the Institut Haitien de Statistique et d'Informatique which is responsble for the census in Haiti, and informal meetings with U.S.A.I.D. mission staff. Part of my third week's activities involved visits to farm households in the Department Sur-Est in order to assess potential problems that may be encountered in field surveys directed toward assessing crop production and production area.

The following are observations and recommendations based on my visit. The two components of the ADS-II project, farming systems and information systems are addressed in Sections II. and III., respectively.

II. FARMING STYSTEMS

The second growing season of 1984 (roughly July,'84-January,'85) was the first season that farmers' field trials were conducted in Jacmel and Les Cayes under the ADS-II project. Agronomists encountered various manpower and field management problems during this first season, and these problems probably constituted the single greatest constraint to the quality of farmers' field experiments. There were also some experimental design problems encountered, and the provision of timely data summaries to assist in the planning of the coming season's trials proved to be a constraint (one which I hope will be partially alleviated by the use of the HP-41CX program).

This report identifies problems in various areas. Let me say from the outset, that I was greatly impressed by the fact that in a single season, trials have been conducted on farmers' fields, and that these trials have identified technologies that are appropriate to existing conditions and that farmers are ready to adopt. In spite of the constraints identified below, the coordinators and technical consultants clearly were successful in implementing the first phase of the farming systems component of ADS-II. This is an extremely important step that is rarely achieved in the first season of a farming systems research effort.

I will discuss the constraints under three major sections: Management; Field Plot Techniques and Experimental Design; Data Analysis. Most of the problems identified and potential

solutions suggested are based on discussions with the technical consultants and coordinators who were very open and cooperative. I should mention that problems associated with harvesting were observed at Les Cayes. Most trials had already been harvested at Jacmel before I arrived, and I did not have the opportunity to observe the harvest of any trials there. A fourth major section deals with the proposed experimental trials for the coming season.

A. Management

Short-term agronomists had been assigned to the farming systems program to assist in the implementation of the farmers' field trials. These were people who had finished their formal course requirements and were working on six-month practica. According to one of the technical consultants, the motivation of most of these agronomists was low. They tended to leave the farming system sites for a week-end in Port-au-Prince before the work week was finished and return to the site after the work week had begun; therefore, their presence at the site was frequently three days per week, and their commitment to the project during those few days was questionable. (There have been exceptions to this general characterization of the short-term agronomists.)

The short-term agronomists apparently have had little or no training on field plot techniques as part of their formal education. According to one of the technical consultants, they did not know how to make a rectangular plot in the field.

There are also institutional problems associated with the assignment of agronomists. Their period of assignment seems to correspond to an academic year rather than the growing season. The result of this scheduling practice in ADS-II's first season was that the agronomists were assigned for a period that included the sowing of the crop but that ended prior to the crop's harvest. Although additional agronomists were to have been assigned after the first group left, this had not taken place in a timely manner. There were no replacement agronomists present at the site during the harvest period. (In fact, no replacements had been assigned at the time of my departure, only two or three weeks prior to the sowing of the next season's trials.) This, of course, is a tremendous constraint to the management of the experiment.

Given these problems, the ADS-II project has had to rely heavily on monitors for management of the trials. The monitors are, for the most part, literate farmers. Their original responsibilities were to assist in the management of the trial, but in the absence of the short-term agronomists, their role became more supervisory in nature. While the motivation of the monitors is generally quite high, they lack training in experimental management; yet they have had to supervise field crews comprised of farmers who also lacked experience in working on experimental trials. In Les Cayes, I was able to witness the first harvests of sorghum and sweet potato trials; I'll list some of the serious problems that I observed.

Sorghum harvest: After visiting other trials, I was taken to a Sorghum varietal trial that was to be harvested. By the time I arrived, the monitors had already started the harvest activities. The monitors apparently had no concept of the purpose of replication and had bulked the harvest of all the replications together for each variety. They did not have the bags for harvest material, labels, scales for field weighing or tape measures in the field at the beginning the harvest. The bags, scales and tape measures were brought to the field in the car in which I was chauffeured; the bags had been procured earlier that morning from the market. There were no labels for the harvested material; instead, the plot identification information (in this case variety name, since the the replication could no longer be identified) was written on the bag with a marker pencil. However, the bag apparently had been waxed, and the label proved to be very difficult to write or read. Plot information was also written onto a scrap of paper which was placed into the bag along with the harvested ears. Field weights were taken; however there were no record sheets, the weights being recorded on a piece of yellow pad paper that had no trial information and that had not been prepared ahead of time. In short, the basic material required for experimental harvesting were neither prepared ahead of time nor available at all in many cases.

(The plots of this trials and most others that I saw in Les Cayes were not labeled as to the treatment or number of replication. In a different sorghum trial it was difficult to

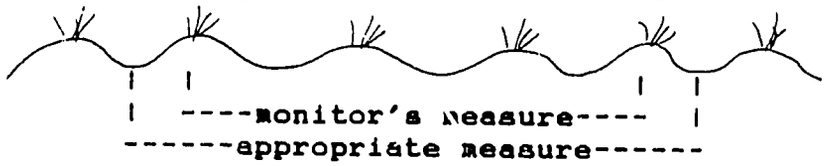
determine where some of the experimental plots ended and where the farmer's field began because labels and stakes were missing and the farmer had planted her/his crop of sorghum right next to some of the experimental plots. Such staking out and labeling of plots had apparently been done earlier, but the labels had been removed by passers-by. The problem of missing plot labels did not seem to exist in the trials that I observed at Jacmel; however many of the labels at Jacmel were not legible because either the ink had been washed off by rain or bleached by the sun.)

Monitors were weighing bags of sorghum ears while farmers were in the field harvesting other plots; consequently the harvesting was going unsupervized. The plots were not being thoroughly gleaned; there were several ears of filled grain on plots that had already been harvested. Further, one farmer would go through all the plots and would push over the stalks of sorghum, and another farmer would be harvesting the ears of the felled stalks; the result was that felled stalks of sorghum from plots of one replication would overlap those of another, making it difficult for the farmer harvesting the ears to identify which plot the ears belonged to.

Dry weight assessment of sorghum were to be obtained later after the farmers threshed and dried the ears. Since the project has no threshing or drying facilities and since the farmers are

apparently reluctant to give up the experimental produce for fear that the produce would not be returned, the drying and threshing is performed by the cooperative farmers at their residences. It would seem that this operation creates an additional opportunity for the mixing of grain from different plots; particularly since there can be no effective monitoring of the drying and threshing process.

Sweet potato harvest: I saw a sweet potato field harvested. Serious problems were noted there as well. This particular trial involved different varieties, and since the seed material was limited for many varieties, the plots were of different sizes. At the time of harvest, the decision was made to make assessments on the entire plot (excluding border hills adjacent to areas not planted to sweet potato). This decision meant that the harvest area of each plot had to be staked out and measured separately. The monitors, not experienced in field plot techniques, did not have the concept of measuring areas for harvest area assessment. They proceeded to measure from the middle of the outer rows of the hills to be included in the harvest area instead of measuring from half way between the row to be included in a given harvest area and the adjacent row falling outside the harvest area.



As soon as a plot was harvested, the monitors would bag a plot and take it for weighing. As was the case in sorghum harvesting, the farmers would proceede to the next plot and begin

harvesting while the monitors were weighing the previous plot's tubers. Therefore, again, the harvest effort was not being supervised. In a few cases, I observed the farmers harvesting the whole row, including hills outside the designated harvested area. Further, there were several farmers harvesting a single plot. When a farmer finished a row, s/he would frequently go to assist another farmer on another row. I noticed that several hills had not been harvested within the harvest area; this may have been the result of more than one farmer harvesting the same row, and the starting point of one farmer on the row may not have been known to the other.

With this overview of problems encountered in the field, I will put forward some recommendations on experimental management. It should be borne in mind that these recommendations are based on a very limited exposure on my part to the field operations and trials. I visited only a small portion of the trials, and I observed field operations only at Les Cayes, and those operations only involved harvesting.

1. Personnel Management:

Training. There should be training at all levels - for the short-term agronomists, monitors, and farmer field crews.

Since the short-term agronomists have had little or no field experience, no assumptions should be made about their experience in field plot techniques. They should be instructed ahead of time. To guide the short-term agronomists in the supervision of activities, the technical consultant and/or coordinator should

accompany the short-term agronomists in the field throughout periods of plot layout, sowing/transplanting, input application, and harvest for the first few trials of each experiment.

The same should be the case for monitors, especially if they are to take over the field supervisory role in the event that the motivational constraints of the short-term agronomists cannot be overcome. While the monitors will be familiar with the farm environment in which the trials are conducted, they will have no concept of experimental concepts. They should receive basic training that not only includes field plot procedures, but that also includes fundamental concepts as to the nature of a plot, a treatment, a replication and the random assignment of treatments to plots (concepts to which the short-term agronomists will have been exposed in their formal courses).

Prior to each trial's activity (plot layout, sowing, applications of inputs, harvest), the farmers performing these activities should be carefully instructed on the procedures that they should follow. Even if the experimental goals include the duplication of farmers' levels of inputs for all but the tested technological components, the application of those components may not be familiar to the farmer; and even if it is familiar to the farmer, the application of those components on research-managed small plots will not be familiar.

Short-term Agronomists. There is little that can be accomplished unless there are some institutional changes made. ADS-II must be permitted to use a carrot and stick approach in

dealing with the motivational problem. ADS-II staff should be permitted to penalize short-term agronomists who do not work full time in the field. This could involve a reduction in wages by an amount proportional to the time absent from the job. If a short-termer does not demonstrate a commitment to the project, then ADS-II should be able to terminate her/his services. The faculty and ministry should cooperate in such decisions. If a termination from the project in Les Cayes or Jacmel simply results in the short-termer being reassigned to Damien, the disciplinary effort will appear to be more of a reward than a punishment. High motivation should be rewarded. I understand that moneys for these short-term personnel are to be paid by the ministry and that additional funds from ADS-II are to be used to augment their salary. (My understanding is also that this has not been done and that ADS-II is covering those salaries and not the ministry.) Perhaps ADS-II's contribution could be used as a meritorious payment for those short-term agronomists who demonstrate a strong commitment to the project effort.

Short-termers should also have their period of assignment correspond to the cropping season, not to the academic year. Having the same personnel work with a trial from the lay-out through harvest and preliminary analysis will not only be beneficial to the research effort but would make the short-term personnel's practica much more meaningful. It would even be more beneficial if the short-termers could be assigned for a whole crop year (two growing seasons), enabling them to gain experience on whole systems of farming. If assignment on a cropping season

basis is not administratively possible, then there should be a timely assignment of new short-termers to replace those who completed their services to the project. Ideally, such a reassignment should result in an overlap of the old and new assignments. In no case, should the reassignment timetable leave the project without short-termers for major periods in trial activities as is now the case.

Monitors and monitored activities. Whenever farmer field crews are engaged in field activities, they should be monitored. If the monitors have to leave the field for any reason, then the field activities should be stopped until the monitors return. In the example in which monitors were weighing plot harvests while the field crew continued harvesting in other plots, different procedures should have been followed. If it is necessary to get a field weight immediately after harvesting the plot, then the plot should be harvested, the produce from that plot weighed and the monitors returned to the field before the harvesting of the next plot is initiated. Alternatively, field weights can be taken for all plots after all the plots have been harvested.

The field crews should be carefully instructed by the monitor prior to the initiation of any field activity. They should not engage in any activity unless they check with the monitor first. They should complete the activity on one plot under the supervision of the monitor before proceeding to the next plot.

In the case of harvest, the harvest area should be staked out and, if the border rows or hills are to be excluded, then the harvested area should be clearly delineated from the border area.

It may be a good idea to rogue plants from the border area prior to the harvest to avoid confusion. A given plot should be harvested and then carefully checked by the monitor to make sure that the harvesting was thorough before the crew begins the harvest of the next plot. In sorghum, the canes for one plot should be felled, the ears harvested, and the plot checked by the monitor before the canes of the next plot are felled. In sweet potato, if more than one harvester is working in the plot, then there should be no more than one harvester working on any given row. One harvester should have the responsibility of completely harvesting the row on which s/he is working.

2. Plot Management:

Record keeping and record sheets: I was very surprized to find that there were no prepared record sheets and that the field weight records were simply recorded on a piece of yellow paper. I was even more surprized when I learned that some of the coordinators and consultants saw no need for formal record sheets and felt that the use of a yellow pad was sufficient.

For every experiment, a format for field record keeping should be established and separate record sheets made for each trial in that experiment. The minmum content of each sheet should include 1) the name of the experiment, 2) the season, 3) a space for the name and/or location of the farm where the trial is being conducted, 4) a listing of the treatments, 5) space for the layout of the experiment (the layout will differ for each farm due to rerandomization and different replication and plot orientations for

each farm), 6) spaces for the dates of sowing/transplanting and harvest (multiple spaces may be required if crops are sown/transplanted on different dates in cases of relay intercropping or if the cropping pattern involves different crops and/or varieties which are harvested on different dates), and 7) blank lines for recording yield(s) (each line identified according to treatment number, replication number). There should also be space available for comments.

These record sheets should be kept in hard cover binders, and monitors and/or agronomists should have these record books with them any time they go into the field. These record books should be kept in plastic bags to protect them from rain. Any time that entries or comments are entered into the record book, they should be dated and initialed by the person making the entries.

The failure to have such formalized procedures, which are strongly advocated by both Drs. Chatterjee and Swanson, can only lead to sloppy record keeping and uncertainty as to the validity of experimental findings. A uniform system is absolutely essential whenever several monitors and/or agronomists are going to be involved in record keeping.

Demarcation of plots and harvest area: Plots need to be clearly staked out and labeled in the case of research managed plots. Before any plot-level activity is initiated (sowing, application of fertilizer and pesticides, harvesting, etc.), the labels should be checked and replaced if necessary. If the whole plot is not to be harvested or if a crop cut is to be taken, then

the harvest area should be staked out and lined off. Such demarcation of plots and/or harvest areas should be performed before the field crews enter the plots and begin the plot-level activities.

Labels, bags, etc. Labels, bags, inputs and any other material should be prepared before they are required. A given activity should not be initiated until all such material is ready. The bags into which the produce is to be placed should be ready and labeled and placed out in the plot before the harvest crews enter the field. An additional label, prepared ahead of time, should be placed in the bag. Before the plot's harvest is placed into the bag, its exterior and interior labels should be checked against the plot's label and the layout sheet.

3. Other management areas:

Activities in the absence of supervision. It was mentioned that the drying and threshing of seed is the responsibilty of the farmers. I assume that monitors check back to see when the drying and threshing has been completed so that they can take dry weight yield measures. Activities that are outside of the monitors' control are of particular concern. Consultants and coordinators should set up and write out guidelines for these activities, and these guidelines should be discussed with agronomists and/or monitors. Once agreed upon, these guidelines should be explained clearly to the cooperating farmers. The importance of keeping the produce separate for each plot and for keeping the produce in the correct bag with its respective label should be emphasized.

If there is any doubt at all about a farmer's ability to understand the importance of these activities or her/his willingness or ability to take the necessary special precautions to assure that mixing does not occur, either other threashing/drying arrangements must be made or a different cooperator should be sought.

Volunteers or off-types in the field. Off-types were seen in rice and sorghum trials. Decisions must be made on how to handle these at harvest time. In plots involving the farmers' levels of methodology, such off-types may result from genetic variability in the local material or farmers' management of their own material or land. The consultants and coordinators must decide what they are going to do with off-types (rogue them prior to harvest or include them in the harvest if it is felt that volunteers are representative of farm conditions and should be included). If off-types are included in yield assessment they may lead to bias in evaluating the true potential of a new technology and may add another variable that will reduce the precision of the trials.

Unequal harvest areas. Some varietal trials, because of limited seed for some varieties, involved differing plot sizes among the varieties. Although those plots were used primarily for multiplying seed for the next season's trials, decisions as to which varietites to use in the next season were based, in part, on the varietal performance in those multiplication plots. I recommend that the same size of harvest area be used for each

plot and that the positioning of the harvest area be established ahead of time to make decision making as objective as possible.

B. Experimental Design.

Variation on farmers' field trials are expected to be much greater than on research station trials. Further, based on manpower and personnel management problems during ADS-II's first season, it is clear that the experiments must be kept simple, in terms of both the complexity of the treatments (multi-factor experiments should be avoided) and the number of treatments to be studied. There is agreement among most of the ADS-II staff on this point, and the experiments planned for next year reflect this agreement.

Various design problems and concerns stemming from the first season's experiments are discussed below:

1. Rerandomization of treatment assignment at each farm.

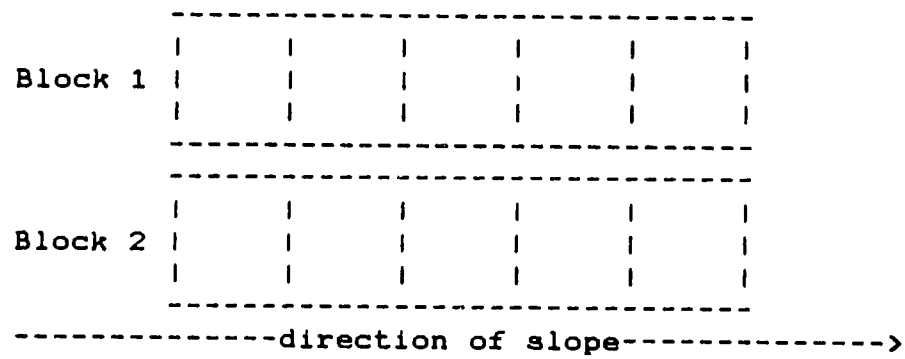
The same randomization was followed at each farm for any given experiment conducted at Jachel. This may have resulted from a written description of the experiment that was circulated prior to the laying out of the experiment. A sample layout was included in the description, and this sample layout was duplicated on every trial. The only way to guarantee that there will be no systematic variation correlated with treatments over farms is to randomize treatment allocation to the plots separately for each farm.

Another kind of problem that can arise if treatments are not rerandomized can be illustrated with the following example: There

may be a chance that Treatment 1 on one plot may effect the yield on adjacent plots (e.g., shading effect if Treatment 1 involves a tall variety, fertilizer or pesticide drift if Treatment 1 involves high level of chemical inputs). Of course, the elimination of border areas may partially correct for the affect of the adjacent plot, but perhaps not completely. Now if failure to rerandomize results in Treatment 3 always being adjacent to Treatment 1, then the performance that is attributed to Treatment 3 may be, in fact, partially attributable to the application of Treatment 1 in the adjacent plots. Rerandomization guarantees that this effect would be associated with Treatment 3 only at random.

2. Block and Plot Orientation.

There is no reason that the same blocking pattern should be used at each farm site. I saw farms at Jacmel where the blocks seemed to run parallel to the direction of the slope.

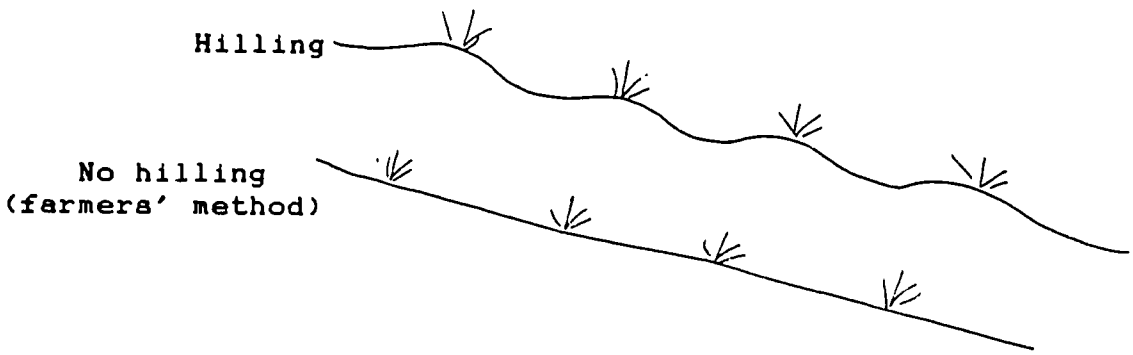


To maximize the precision of the trials, blocks should be managed so as to have the least variation among plots within the same block and the greatest variation between blocks. In the above example it would have probably been better to run blocks perpendicular to the slope. Since conditions are bound to differ from one farm to another,

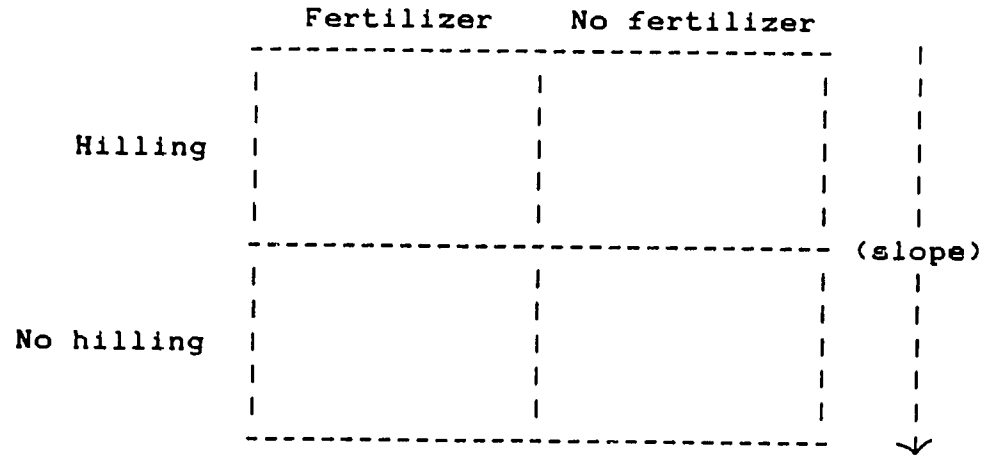
the same block and plot orientation would not be appropriate for each farm. The condition of each farm's field should be considered before the experiment is laid out in that field.

3. Need for comparable plots for each treatment and need for plot size and shape to reflect objectives of the experiment.

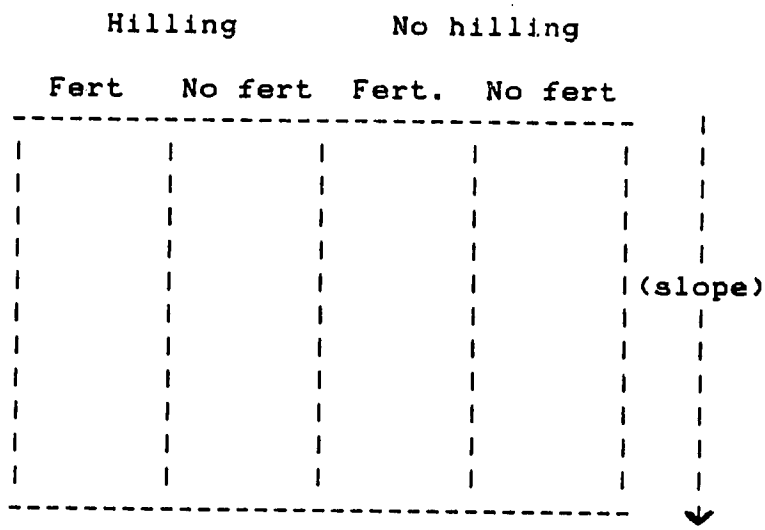
I will focus on one experiment conducted in the first season to make my point, even though the experiment is apparently not going to be conducted in the coming season. The experiment involved hilling row crops on slopes with weeds at the time of weeding to reduce runoff and the washing away of fertilizer.



The experiment involved two factors (Hilling vs. No hilling and Fertilizer versus No fertilizer). The experimental layout was a strip-plot with the following general layout.



It is not meaningful to compare hilling of plots located at the top of the slope to no hilling of plots at the bottom of the slope (or vise versa); the plots are not comparable. Even with rerandomization over farms, the results would be too variable to lead to meaningful conclusions. A preferable layout would have been a layout (perhaps a split plot) with long plots traversing the slope



Here the plots are comparable; i.e. similar except for treatment.

Apparently, the plots used for this experiment, besides being oriented poorly, were also too small for meaningful comparisons, and the gradient of the slope was too small for meaningful results. Designs, plot sizes and farms must be selected to meet the objectives of the experiment; and this frequently requires special thought and attention.

4. Choice of treatments.

The treatments chosen for an experiment should be closely linked to the objectives of the experiment. A fertilizer experiment, conducted in Jacmel, involved the following treatments:

Treatment	Level
1	No fertilizer
2	20-10-20 (N-P_2O_5-K); 200 kg/ha
3	Urea; 80 kg/ha
4	11-43-00 (N-P_2O_5-K); 200 kg/ha
5	0-0-60 (N-P_2O_5-K); 200 kg/ha

The comparability of the treatments is open to question. The difference in the N-P compositions among treatments apparently reflects the fertilizer mixtures available on the market. However, the N-P compositions should be comparable if meaningful comparisons are to be made. For example, it would not be possible to ascertain whether differences in Treatments 2 and 4 were attributable K or to differering ratios or amounts of N and P_2O_5 or both. Comparisons between Treatments 3 and 4 may not reflect the presence of P but rather the molecular form of N. Unless truly comparable forms of fertilizers can be formulated, fertilizer experiments of this kind are not meaningful and probably should not be conducted on farmers' field trials. (If the experimental objectives were to test fertilizers that were on the market, and the objectives were not to test specific nutrient levels and ratios, then this should have been made clear in a written description of the experiment, and the amount of fertilizer should have been justified for each treatment.)

5. Measuring instruments.

Most of the scales that I saw appeared to be accurate only to the nearest tenth of a kilogram, if they were that accurate. This low degree of accuracy may contribute somewhat to the high variability noted on the analysis of some of Jacmel's field trials (discussed later). It might be advisable to get more precise instruments for assessing dry grain weights from small crop cuts.

6. Number of farms versus number of blocks per farm.

The major intent of research managed plots on farmers' fields is to test, in a controlled manner, the appropriateness of developed technologies. The broader the range of applicable farm conditions, the more valid the tests will be. Therefore, the preference is for the experiment to be conducted on as many farms as possible. The fewer replications there are per farm, the more time there will be available to conduct trials at more farms. It may even be advisable to have trials that are not replicated within farms. However, I do recommend replication within at least some farms for research managed trials. In the absence of replication within farms, there will be no objective way to statistically test whether the are any interactions between farms and treatments (i.e., determine whether some treatments are better on some farms but not others). Nonetheless, replications within farms should be kept at a minimum. Most of the coordinators and technical assistants agree on this point; and, whereas there were some experiments involving three replications per farm in IADS-II's first season, the number per farm will be held down to two next season.

Because of the manpower constraints in the first season, the number of farm trials will also be reduced to ensure that the experiments can be adequately managed in the next season.

C. Data analysis.

Analysis capabilities for multi-farm experiments did not exist for the two farming system sites. The statistical software available on the projects' Radio Shack computers did not permit combined analyses over farms. To be meet the shorter term analysis needs of the project, WINROCK procured two HP-41CX programmable calculators which I took with me on my trip to Haiti. I modified an appropriate program which I developed two years ago for the TI-59 programmable calculator (no longer in production). The modifications permited the program 1) to run on the HP's, 2) to summarize the first season's data over sites, and 3) to meet some specific data requirements of the project. The program was field tested on data from some of the trials at Jacmel. (Data were not yet available from Les Cayes trials.)

Field evaluation and farmer assessments of field trials had earlier indicated that performances of two varieties of bean (Salagnac 86, a red bean variety, and Tamazulapa, a black bean variety) exceeded that of the local red bean variety grown by farmers. Analysis of the data from fourteen farmers' field trials confirmed this finding despite the high coefficient of variation (approximately 25%). The yielding capacity of the improved varieties exceeding that of the local by approximately 50%. The analysis also indicated no significant or substantial farm x variety interaction, indicating superior performance of the improved varieties over all farms in the test sites. (Tamazulapa seems to be preferred by farmers in Les Cayes over their local variety; however data were not available analysis.)

Field evaluation and farmer assessments of field trials had also indicated that an improved maize variety, Les Anglais, outperformed the local chicken corn variety in Jacmel. However, the analysis of the maize varietal trials indicated no significant nor substantial differences among the varietal performances, nor were there any farm x varietal interactions indicated; however I am not absolutely certain that the trial analyzed included the Les Anglais variety.

The availability of the HP-41CX calculators with appropriate software should enable a speedier analysis of data and thereby lead to better decision making as to the trials that should be conducted in the next season.

Once field record sheets have been developed, data entry into the calculators (or computers, if they are used for trial analyses) should be made directly from the record sheets. Recopying of data for data entry only increases the chances of errors being made.

(Other calculator equipment was procured and/or ordered. In addition to the batteries in the calculators, a rechargable battery pack was left at each station; unfortunately, the battery chargers had not yet been delivered. One printer was purchased and left at Jacmel. The decision to leave the printer at Jacmel was based on the fact that Jacmel had much of its data ready for analysis. The reasons that only one printer was purchased are that the printers are expensive and that their printing quality is quite poor. If the availability of a printer for Les Cayes is deemed necessary, then one should be procured at

a later date. Two magnetic card readers were also ordered but had not arrived. After the project receives the readers, I will furnish the program on a magnetic card. The program currently resides in program memory from which it could inadvertantly be erased. A draft of documentation for running the program was left in Haiti. Once a final version is written, I will send a copy to ADS-II and to WINROCK International, Arkansas.)

D. Designs for next seasons' planned experiments.

Tentative plans were made for the major research managed trials on farmers' fields in the next season based on farmers' reactions to experiments conducted in the previous season. In both Les Cayes and Jacmel, the decision was made to keep the experiments as simple as possible based on the manpower and management constraints encountered in the first season's experiments.

The major effort in Les Cayes will involve a simple two factor experiment involving Tamazulapa and a the local black bean variety, each grown under two management conditions - the farmers' level of management and an improved management package. The bean trials will be grown on ten farms (five in Berault and five in Maniche) in association with maize and on fifteen farms (five in Berault and ten in Maniche) in pure stand. To facilitate management, I suggested that these trials be laid out as split-plot designs with management levels assigned to main plots and varieties assigned to subplots. There should be two replications per farm.

A two-treatment subset of the above trial will comprise superimposed trials extended to additional farms. These trials will include Tamazulapa and the farmer's variety. The trial will be under the complete management of the farmer. I suggested that the coordinator or technical consultant specify which part of the field should be planted to a given variety (assignment being at random and the portions of field selected to give comparable plots); otherwise the farmer may allocate the varieties to the field in a way that s/he thinks will maximize return. The problem with the farmer making such an allocation is that any varietal differences would be confounded with the farmers' allocation decisions.

Pure stand varietal trials on maize, rice and peanuts will also be conducted at Les Cayes. The details of those experiments had not been worked out in detail during my visit. Decisions as to which varieties to include in rice trials were to be based, in part, on farmers' opinions of varietal seed multiplication plots in the first season. (A farmers' field day was held on January 24, and the farmers seemed to like International Rice Research Institute's selected lines IR 13146, IR 10147 and possibly IR 4819. Dr. Chaterjee was also considering including IR 42 in the trial. The local variety, Madame Gugus would be included as a control check.)

Jacmel is planning to conduct a bean/maize varietal intercrop trial. The treatments would be as follows:

Treatment	Combination
1	improved maize, improved bean
2	improved maize, local bean
3	local maize, improved bean
4	local maize, local bean

The improved maize variety would be Les Anglais. The improved bean variety would be Salagnac 86 on some of the farms and Tamazulapa on others. The recommended design is a randomized complete block with two replications per farm.

Two-treatment superimposed trials also will be extended to additional farmers in Jacmel. The treatments will involve either one of the improved bean varieties and the farmers' variety, both bean varieties being grown in association with the local variety of maize. Again, the coordinator or technical consultant should specify which part of the field should be planted to a given variety.

Given the high variability of the farmers' field experiments so far analyzed in Jacmel, no research managed trial should be conducted on less than ten farms (or twenty replications = ten farms x two blocks/farm). Superimposed trials under complete farmers' management are expected to be even more variable and since they will not be replicated within the farm, there should be at least twenty or thirty farms per superimposed trials.

III. SURVEY DESIGN AND IMPLEMENTATION

There are conficting opinions as to what the focus of the survey component of ADS-II should be. Part of this conflict probably stems from the desire on the part of the Minister of Agriculture to implement a national survey for the purpose of assessing land-use patterns and areas in production for major crop commodities. The Minister also has some specific ideas as to the type of technology that should be used to make the assessment. He supports the development of a major land-use classification system based, in part, on remote sensing technologies (LANDSAT imagery) and the implementation of aerial photographs to develop area-frames. I presume the interest in these technologies stem from a proposal put forward by Ger Schultink of Michigan State University (CRIES's Preliminary Work Plan, June, 1984). The area-frame aspect (not dealt with in detail in the CRIES proposal) would utilize aerial photographs to assist in the identification of area segments. Area in production would then be assessed from sampled segments. The Minister of Agriculture also wishes the survey to be implemented on a national basis from the beginning and does not wish to begin with a departmental or regional level pilot survey (ref. Aide Memoire de la Reunion du Janvier 1985 en Rapport Avec l'Orientation du Volet Economie Rurale et Statistiques Agricoles du Project ADS-II). The Minister's objective is the estimation of national production for planning purposes and is <u>not</u> the assessment of the farm-level decision-making that determines crop production strategies.

The Minister's focus is clearly not the focus set forward in the Unversity of Arkansas's and WINROCK International's Technical Proposal which is the basis of the ADS-II contract. The proposal clearly states that "Usually, when reference is made to 'information for decision-making', most people think of national public policy decisions, but, in this project, the area-profile data collection and processing will be done to first serve the decision-making needs of farmers, then those of the community and regional extension and research, and finally those of national policy decision-makers."

Earlier, when an ADS-II project was first being considered, there was some consideration given to the type of survey that the ministry now wishes ADS-II to conduct (see Annex G-2 of Project Paper, Haiti, ADS-II; Project #521-0092 LAC/DR:78-11 entitled Agricultural Statistics and Information Systems in Haiti written by Raymond Bosecker of U.S.D.A.); however, even at that time, the implementation of that survey would have been based on a pilot effort in one or two sites. No consideration was given to implementing a survey on a national basis from the onset.

ADS-II evolved into a project with a farming systems component and an information systems component; however the two components were not in any way intended to be distinct from each other. Survey information regarding factors influencing farmers' decision-making clearly benefits the farming systems research and extension efforts, and adoption of technologies tested and extended through the farming systems component can be

monitored and evaluated using recurrent survey information. Both components were clearly intended to complement each other. The type of survey proposed by the Minister would not, in its current form, complement the farming systems' component.

While understandably, there may be a strong desire on the part of many of the staff at the USAID mission and on the part of the University of Arkansas and WINROCK International to accommodate the desires of the Minister, the first questions that must be asked are 1) whether the focus of the current Minister's proposed survey is consistant with the focus of the ADS-II project and 2) if not, whether the project should be amended to accommodate the focus of the Minister's proposal.

I believe that the answers two both questions are the same: "No". The focus of ADS-II's information systems is clearly different that of the Minister, and if ADS-II's project were to be amended to accomodate the current Ministers' desires, then the two ADS-II components (farming systems and information systems) would be completely distinct and unmanagable within a single project. Another concern is the stability of the Ministry. I understand that the expected tenure of a Minister of Agriculture is less than a year. Would the ADS-II project be amended with each new Minister who would likely have a different agenda than her/his predecessor?

I do not wish to be misunderstood. I do not not think that the proposed survey objective of the Minister is wrong. I simply believe that ADS-II should not be the entity to implement such a

survey. ADS-II, if it is to be successful, must have a clear consistant focus throughout the life of the project, and the information system described in the present ADS-II technical proposal is essentual to the evaluation of technological development and extension needs in farming systems.

However, I do believe that it would be a disaster for <u>any</u> project to implement <u>any</u> survey on a national basis without first conducting a pilot survey. No matter what survey technology is developed, it must be tested on a small scale before it is finally implemented nationally. Further, there are serious manpower constraints in Haiti. Special training would be required to implement any survey. Based on the experience of ADS-II, it would not be possible to identify and train enough motivated people on a national basis without identifying the manpower and training constraints in one or two pilot areas.

Dr. John Lewis of the USAID mission to Haiti asked me whether it would be possible to develop the Minister's proposed survey on a national level and then to have regional projects implement the national survey within their respective regions. First, this question begs the real question. Is the focus of the survey consistant with the foci of all the regional projects that might do the implementation? If the answer is "no" for ADS-II (and it is "no"), it will likely be "no" for most other projects as well. Second, a national survey will still require a pilot. Third, two essential components to any survey is the ability to effectivley administer and supervise the survey from the beginning

to the end and to guarantee the quality of data gathering, editing and summarization. Quality guarantees cannot be assured if there are different projects implementing the survey in different regions.

Although I am opposed to implementing the survey that the Minister wishes to conduct through ADS-II, I would like to make some comments on the the different tools suggested with specific reference to his goals. I would then like to discuss the requirements for the ADS-II project's information needs. These are two distinct topics.

A. Survey Technologies to Meet the Minister's Goals

I am not in a postion to make any comments on remote sensing technologies and their potential use to create land-use strata within which sampling-frames can be constructed. And I doubt that any of the consultants (Miguel Cuevas and David Megill of the U.S. Bureau of the Census and Roland Albert of U.S.D.A.), who were requested to address the ADS-II survey needs, have expertise in this area. However, I would like to make some comments on the two major kinds of frames that have been suggested - area-frames and houshold-frames.

1. Area-frames:

To establish area-frames, aerial photographs are overlain to form a mosaic of the total area within each stratum. These areas are then partitioned by permanent or semi-permanent physical boundaries. Ideally, these boundaries should correspond to the desired size of the sample segment; however this kind of boundary

resolution is not always possible from aerial photographs. If an area within the physical boudaries is too large, that area is divided by the desired segment size to determine the number of segments that would fall within the physical boundaries. (For example, if a discernable boundary contained 5.1 square kilometers and the desired segment size were 1 square kilometer, then that boundaried area would contain five segments.) This procedure is followed for the whole stratum, and the result is an effective listing of all the segments in the stratum (the listing of all the units is the frame). Once the total number of segments and their location in the stratum have been determined, sampling takes place. Units are sampled within the stratum. If the sampled units fall within aerial boundaries containing more than one segment, then a ground crew establishes physical boundaries within the aerially determined boundaries to separate the segments, and then one of these segments is randomly sampled.

The above may sound a little too technical to include in this report; however, I have a feeling that some people might believe that an aerial photograph would be divided into a grid, then grid segments would be sampled from the photograph. The process is not that simple. Physical boundaries are required to distinguish among units. Therefore these units will not be the exact specified size (e.g., 1 square kilometer).

<u>If the major objective of the survey is to estimate the area of production for each major crop</u>, it will not be possble to do so from the photograph. The photograph will not provide the

resolution necessary to distinguish among the various intercropping patterns present. This can only be done by physically going into the sampled segment and actually measuring the area under the different crop associations. As will be seen, segment sizes of 1 square kilometer will prove to be far too large to permit such an assessment. Specifically, the problems that I forsee are as follows:

a. If a one square kilometer sampled segment is to fall into an area that is completely under crop production, and if we assume that the average size of a continuous parcel managed by a farmer is approximately 0.25 has. (a reasonable assumption), then one square kilometer would be expected to contain 400 parcels. For every one of those parcels, the enumerator would need 1) to determine who manages the parcel, 2) to find that person (who, in many cases, may be located an one hour or more walk from the parcel), 3) to obtain that person's permission to measure the parcel, and then 4) to return, 5) to identify each major cropping association in the parcel, and, then, 6) to measure the area of each of those associations. This would have to be done for each of the parcels in the sampled segment. Clearly, a one square kilometer area is too large an area to be managed effectively. (In fact, Bosecker, unfortunately, recommended 2 square kilometer segments.)

b. If area in production is the desired measure, another problem that will need to be addressed is how to aggregate the areas in intercropped associations by crop. Attempts to simply

add the areas could result in an extreme over-approximations of total crop area. For example, the areas grown in maize-bean associations could be added into both the area under maize production and the area under bean production. Those two crop areas, if simply added to assess the total area under both crops, would greatly exceed the actual area because of the double enumeration. Further, the value of the commodity in a given association should be taken into account. It is unlikely that maize has the same productivety in pure stand that it does when intercropped with beans, with sweet potato, with beans and yam, etc.

Given these problems, actual production per commodity may then be a more meaningful measure than area of production. However, production information may also be difficult to assess in a complicated farming systems environment if it were based on objective measures of assessment at the parcel-level (e.g., crop cuts in a complex intercropping environment). Yield assessment would probably be better dealt with at the level of a household interview dealing with the whole farm's production of each commodity; household interviews in the context of area-frame sampling will be discussed later under the section dealing with open, closed and weighted segments.

However, if the major objective of the area-frame were to make gross assessments of land-use patterns; e.g., how much land was under tree cover, under pasture, under cultivation, etc., then most of the problems discussed above do not exist. The enumerator can take a copy of the photograph into the field, delineate within the sampled segment of the photograph the major

land-uses based on ground observation. The area devoted to these major uses could then be determined by tracing out the delineated areas using a planometer.

Open, closed and weighted segments. If some of the variables being measured require household-level interviews (estimates of number of different kinds of livestock in a particular land-use strata would require such interviews), then all households falling within the sampled area-frame segment could be interviewed, whether or not the household had parcels in the segment; this is referred to as an open segment. Sample estimates could readily be expanded to the whole area of the strata using this procedure. (I use livestock as an example because the Minister stated that he wanted this information in addition to areas in crop production.)

Another method would be to use a closed segment approach. Households managing parcels in the sampled segment are interviewed. If the questions apply to only those parcels falling within the segment, then sample estimates can again be easily expanded to the total area of the land-use strata.

However, if the questions are directed to the entire household-level of production in the closed segment (as would be the case for inquiring about the number of livestock), then each interviewed household's response would have to be multiplied by the proportion of that household's area which falls into the sampled segment (weighted segment approach). This means that information must be be available on the total land area managed

by the household as well as the amount of that area falling into the sampled segment. Objective information of this nature would be very difficult to obtain. For each parcel in the segment, one would have to identify the farmer managing the parcel, to go to that farmer, to get the permission to measure the parcel areas in the segment, to measure those parcels, to ask the farmer to identify all managed parcels outside the segment, to locate those parcels and to measure them as well - all to determine the proportion of the household's area within the segment. (One might use the proportion of the total number of a farmer's parcels falling into the segment instead of the proportion of the farmer's total area falling into the segment. This would be easier to assess, but the estimates would be less precise.)

In the case of assessing livestock production, the open segment is the preferred form of area-frame assessment. It is the easiest to implement. The closed segment approach would exclude from the population any households that own livestock but that do not manage any parcels. And the closed segment estimates would have to weighted, making data gathering much more complicated.

In the case of yield assessments based on farm interview, the open segment approach would also be preferred over the closed and weighted segments. The closed segment approach would require the farmer to assess crop yields on an individual parcel basis. This would probably be difficult for the farmer to do; however, a farmer may be able to state, with a reasonable degree of accuracy, the total yield by major commodity for the whole farm.

The weighted segment approach would have the same constraints as discussed ealier. Using the open segment, interviews on yield per household should also include an assessment of the total land area managed by the members of the household so that the information can be more precisely expanded to stratum-level production. If yield and area information are to be based on household interviews; objective measures should alsc be developed to test the accuracy of the farmers' estimates.

2. Household-frame samples:

For the household-frame, the ultimate unit of sampling is the household. Usually two stages of sampling are involved. The first stage involves the sampling of some kind of defined grouping of households. All the groupings are listed, and samples are drawn from the listings. In the second stage of sampling, all households are listed within the sampled groupings, and from each of these lists, a sample of households is taken.

The frame for the first stage of sampling already exists. Enumeration areas are defined for the entire country by the Institut Hatien de Statistique et d'Informatique. These enumeration areas can be grouped into the land-use strata, and within each stratum, enumeration areas sampled. All households within each sampled enumeration area would have to be listed and from this list a sample of households selected.

For assessing area in production, the strategy would nearly be the reverse of that described under the area-frame

Area-Frame	Household-Frame
Select segment from area-frame	Select houshold from household-frame
For each parcel in segment identify farmer	For each sampled farmer identify parcel
Find farmer	Secure permission to make measurements
Secure permission to make measurements	Find Parcel
Return to segment	Make measurements
Make measurements	

The same problems would exist in dealing with intercrop information as existed with the area-frame.

If commodity yield per total farm area were to be used to assess production, then the household-frame may be the best approach; household-frames are usually more efficient for these puposes than area-frames. However, information on areas not managed by households (e.g., government-owned land, communally operated lands, etc.) could not usually be estimated using a household-frame. Therefore, the household-frame may be adequate for assessing crop production within the statum, but not for obtaining estimates involving other land-use patterns, e.g., pasture and forest land.

B. Survey Technologies to Meet Current ADS-II Goals

I am afraid that I did ADS-II something of a disservice during my trip. Much of my input was concerned with developing a survey that focuses on the kinds of questions that would meet the Minister of Agriculture's goals, not those of the current ADS-II project. I will try to redeem myself and address the needs of ADS-II.

Household-level information is what would be desired to obtain information relating to farm-level decision-making - the stated goal of the information system component of the ADS-II project. It is clear that the household-frame is the most efficient means of getting this information. This does not mean that such information could not be gathered by using household interviews associated with the open or closed segments in area frame sampling; however any survey focused on household information would be most efficiently collected using the household-frame approach.

The enumeration areas of the Institut Hatien de Statistique en d'Informatique could be stratified according to pre-determined factors. Elevation has been suggested as the basis for stratification - one stratum containing enumeration areas located less than 300 ft. elevation, another stratum containing the enumeration areas located above 300 ft. elevation. (ADS-II should not wait for the land-use classification on which the Ministry might base its stratification.) Again, within each stratum, enumeration areas would be sampled; and within each sampled enumeration area, all households would be listed; and from each listing, farms sampled.

Before discussing sample sizes, I am going to put forward a strategy that might be implemented if the ADS-II project were to be implemented in a new site beginning in the second growing season of 1985. This is not an academic excercise; at the end of the project period, ADS-II will be proposing a design for the whole

country. The strategy proposed below can be amended to meet the current needs at Jacmel and Les Cayes. The strategy treats the farming system and information system components of the ADS-II project in an integrated manner.

Survey strategy: Two months prior to the growing season, the first survey is conducted. The questionnaire should be narrowly focused, identifying 1) the cropping patterns that the household farm managers intend to use in the coming season, 2) the farm size, the number of irrigated and non-irrigated parcels, and any other farm charateristics that may influence decisions as to which cropping patterns are followed, and 3) perceived constraints to production that influence the farm managers' decision-making. If the project had already made some decisions as to which kinds of technologies are to be tested in farmers' field trials, then the first survey should also include questions as to whether the farm managers have ever heard of and/or used the technologies and as to the farm managers' opinions regarding those technologies.

Subsamples should be taken from the surveyed households for the farmers' field trials. Throughout the season, recurrent surveys should be conducted on this subsample and another subsample of farmers who do not have trials on their land. These on-going surveys would determine the kinds and timing of farmers' inputs and operations. Such recurrent surveys could also be used to monitor harvests and measure production.

After the trials are completed, a post-trial interview should be conducted to assess the farmers' reaction to the technologies that have been tested. In addition to farmers whose fields were used for the trials, it is a good idea to get the reactions of farmers who did not receive the trials in order to determine whether the reactions to the tested technologies differ depending on whether the trials were actually conducted on the farmers' fields or not. In order that these two sets of farmers be truly comparable, the post-trial questionnaires should be administered to all households receiving the pre-trial questionnaire. By comparing post- and pre-trial responses, it would then be possible to determine whether farmer perceptions have changed; and by comparing the changes for the farmers having trials and those not having trials, it would be possible to determine whether changed perceptions had been influenced by having trials on the interviewed farmers' fields. Such comparisons should would also be useful in determining how rapidly the information about ADS-II trials is being disseminated throughout the area; especially if the survey design were structured so that some of the sampled enumeration areas had no farm trials and others did.

Sampling plan: For each stratum within a department, I suggest sampling fifteen enumeration areas. Within each of these enumeration areas, sample a minumum of twenty households. One-third of these enumeration areas should not receive farmers' trials; they will serve as a control group. Even though no trials are to be conducted, the pre- and post-trial questionaires should be administered to all the sampled households in these "control" enumeration areas.

Within the other two-thirds of the sampled enumeration areas, pre-trial questionnaires should be administered. Based on the responses, it may be possible to stratify the sampled households by farm size, irrigation or other factors. Within these strata, a subsample can be taken to select farmers for trials and another subsample for farmers who won't receive trials but who will still be administered the recurrent survey on the kinds and timing of farmers' inputs and operations. It may be necessary to sample more than twenty farmers in these enumeration areas to guarantee a large enough subsample that would contain farmers who would be willing to cooperate in the trials and/or the recurrent input evaluation surveys.

Those sampled farmers who are not in the subsample should not be asked whether they would be willing to cooperate in the trials or the recurrent survey. This non-subsampled group would be the core of farmers who will be compared to farmers in the control enumeration areas. By asking farmers whether they will be willing to cooperate, a screening process has taken place that makes them unrepresentative and therefore not comparable to the control group.

The kinds of trials that can be conducted in the sampled enumeration areas will depend on the responses to the pre-trial questionnaires, but I would suggest not involving more than about five farms in research managed trials per enumeration area.

Superimposed trials should not be conducted in any of sampled enumeration areas until the project is reasonably certain that the technologies are appropriate, perhaps in the next season

or the same season of the next year. Do not conduct any superimposed trials in the sampled control enumeration areas; the sampled farmers in the control area can be used to monitor the rate of farm to farm transfer of the technologies.

Questionnaire development and administration. The development of the questionnaires will require an interdisciplinary effort involving input from agronomists, social scientists, economists and people experienced in the area of questionnaire design. (Perhaps the U. S. Bureau of Census can provide this expertise. My guess is they would like to design and implement the whole survey. However, this would not be in the interest of the project. This survey must be in the hands of agricultural technologists specialized in agronomy and the social sciences. The U. S. Bureau of Census may suggest that the Institut Hatien de Statistique en d'Informatique be responsible for the survey. That institution's services may effectively be used in the drawing of the sample, and in assisting in the design of the questionnaires, and in the analysis of the data; however, the adminstration of the questionnaire should be in the hands of the project staff since it is to be done in conjunction with the farming systems component. The Institut employed professionals, such as high school teachers, as enumerators for its nation-wide survey; it would probably better for ADS-II to hire and train educated farmers who would better understand the contents of the questionnaire and would recognize the cropping patterns in the field.)

I do have some general comments on questionnaire design based on my rather cursory scanning of the questionnaires that have already been used in the farming system sites. These questionnaires seemed to be structured around the computer software being used on the project's Radio Shack micro-computers. The result was that a single field sheet was used for several interviews, one interview corresponding to one row on the field sheet, one question corresponding to a single column on the code sheet. Consequently, the record sheets did not have the question written out in full, and the alternative answers were filled in by using an answer code number available from a code sheet.

It is far easier to identify and correct errors made by data entry personnel than it is to identify and correct errors made by enumerators in the field. Therefore, the first priority should be directed toward constructing questionnaires that minimize the possibility of field errors. There should be only one household interviewed for a given set of field record sheets, and the household should be identified on the record sheets as should the interviewer; it will then be possible to check back with the interviewer, and if necessary, the interviewed farmer, if there are any questions regarding the entries on the record sheet.

In other words, the field record sheet should be the questionnaire and should contain the complete question asked of the farmer. If the answers are "multiple choice", all alternatives (not just the codes) should be listed on the sheet and the interviewer should circle the answer given by the interviewee. The

interviewer should not have to memorize code numbers or to refer to code sheets when filling out the field record sheet. Memorization and reference to code sheets will further increase the chance of error. Field errors (e.g., inconsistant answers, illegible answers or the circling of more than one alternative when only one should have been cicled) should be caught by the supervisor in the field, and the supervisor should get back to the enumerator (or, if necessary the farmer) to correct the field sheet.

The data entry personnel should not have to refer to code sheets either. Therefore, code numbers, if they are to be used for data entry, should be included with the altertnative answers on the field record sheets, and data should be entered directly from the field record sheets. Field records should never be recopied to another sheet for data entry purposes; doing so would only increase the chance of error (copying errors). Any inconsistant answers discovered at the data entry stage should be referred back to the field supervisor, and if necessary, back to the interviewer or even back to the interviewed farmer. This means that field recording, field checking and data entry and verification should be well coordinated and timely, and that the enumerators and supervisors should be kept on the payroll until all of the data are entered and verified.

Data processing. Questions posed on the questionnaire should relate to data summaries, and the nature of these summaries should be planned in conjunction with the development of the questionnaires and sampling-frame.

The software requirements should be dictated by the survey, not vice versa. If appropriate software can not be identified, it should not be difficult to identify a programmer to serve on a long-term or short-term basis. In any case, someone would have to be identified to coordinate the data processing activies.

Data entry/verification software will have to be identified or developed that can operate on data files which can be accessed by the programs to be used for creating data summaries. Data entry personnel will have to be hired. And a data entry process will have to implemented that guarantees that the person verifying the data different from the person who entered the data originally.

C. Postition of Statistician on Project

Nomatter what decision ADS-II makes regarding the infomation systems component, there will be a need for a statistician and/or data processing professional on the project. As Ms. Sandra Rowland of the U. S. Bureau of the Census noted in her letter of March 23, 1983 to Dr. Abdul H. Wahab of the USAID mission to Haiti, the needs of a survey are multi-fold and require support in three major areas: Survey design, sampling and data processing.

It is important that the project quickly decide on the course of action it will pursue with regards to the information systems component, hire someone with experience in one or more of the three areas, whether or not that person is degreed in any of those disciplines, so that the project can begin implementing the information systems component as soon as possible. Additional expertise can provided through short-term consultancies.