

PN-AAP-095

15N 33069

INCORPORATING THE SOCIAL SCIENCES INTO AGRICULTURAL RESEARCH:
THE FORMATION OF A NATIONAL FARM SYSTEMS RESEARCH INSTITUTE

Report of a Five Year Tour of Duty

by

Peter E. Hildebrand

Instituto de Ciencia y Tecnología Agrícolas

- ICTA -

Guatemala

The Rockefeller Foundation

New York

December, 1979

TABLE OF CONTENTS

	Page
PROLOGUE	ii
ACKNOWLEDGEMENTS	iii
INTRODUCTION	1
ORIGINAL GUIDELINES	2-3
FIRST GUIDELINES FROM SER	4-5
INITIAL ACTIVITIES	6-9
LA BARRANCA, A CONTROVERSIAL PROJECT WITH IMPORTANT RESULTS	9-15
TECPAN: FIRING UP THE METHODOLOGY	15-17
GENERAL METHODOLOGY	17-23
SURVEYS AND SONDEOS	23-26
FARM RECORDS	26-29
EVALUATIONS	29-35
CALCULATOR SERVICES AND STATISTICAL CONSULTING	35-37
BUDGET SUPPORT	37-39
GENERAL COMMENTS	40-43

PROLOGUE

This is a report of a five year tour of duty from October 25, 1974 to August 31, 1979. The author, an agricultural economist and field staff member of The Rockefeller Foundation, was assigned as Coordinator of Rural Socioeconomics (SER) in the newly formed Guatemalan Institute of Agricultural and Technology (ICTA) during this time. The experiences described are taken from monthly reports which he used to keep the Foundation advised of progress and activities, from published and unpublished reports, from letters and memos with internal distribution and from recall of actions and discussions that took place at the time. They represent his views and he takes the responsibility for any errors of fact or interpretation.

The report is offered in the same spirit the author offered his services to the Institute -- in the hope that through diligence, perseverance, an open mind and hard work a new concept could be achieved and put into practice. It is his firm conviction that the mission has been accomplished. The social sciences are an integrated part of ICTA and the methodology developed is being utilized as a matter of course. This makes ICTA a unique institution: it has accomplished what others are only discussing or attempting on a pilot basis. All the technical and administrative staff, past and present, should be proud of their contribution toward the creation of the only National Farm Systems Institute in the world at the present time.

Guatemala

August 30, 1979

ACKNOWLEDGEMENTS

It is impossible to name all the people who have contributed to the drama reported in these pages. Some are referred to in the paper by name and others by reference to their publications. Many do not appear except as they influenced actions that took place and are reported or alluded to. Yet all contributed to the success of what ICTA is today. By doing the reporting, I in no way claim the credit for what has happened in these five years; I was only one person on a large team that required all the players to succeed.

I have often been asked what it is that makes some efforts in institution building successful and others failures. My answer is always: luck. This I believe. Without having had the luck of encountering all those who played a part in the Institute during these years--whether their views coincided with my own or were counter to them--the results would not have been the same. And if they had not been the same, the probability is the effort would not have been a success.

I therefore, gratefully acknowledge the contribution of everyone who has been in ICTA during the past five years and in his own way has influenced what is reported here.

INTRODUCTION

This report is a discussion of the process of the incorporation of the social sciences into an agricultural research institute. Emphasis is on the Social Science discipline and its contribution to the development of the Institute and the methodology being used. Though the integrated nature of the Institute dictates that some developments regarding the agronomic disciplines and other support sections such as publications or seed production are included, a report emphasizing their role should accompany this report for a more complete work on the development of the Institute.

The report is oriented both chronologically and by subject matter. The first five sections cover the chronological events through the second full year of operation as background to understanding the following sections which discuss subject matter areas of particular importance. A list of visitors to SER and its projects and a list of the staff of SER are presented in the appendix along with a complete list of the publications written in SER to the present time. Except for a few instances, specific data are not included in this report because they are available from the publications referenced in the text.

ORIGINAL GUIDELINES

In February, 1974, The Rockefeller Foundation first contacted me about the possibility of taking a position with The Institute of Agricultural Science and Technology (ICTA) in Guatemala. Kirby Davidson, Deputy Director of Social Sciences, called me one morning while I was working in CENTA in El Salvador, to ascertain if I might be interested in working as a small farm oriented agricultural economist in a new institute dedicated to working with small farmers to improve the productivity of the basic grains of this country. The Institute, he said, was going to try to integrate the social sciences into an agricultural research institute to help the agronomists understand the needs and problems of the small, traditional farmers of Guatemala.

In May, 1974, I met with Astolfo Fumagalli, then General Manager of ICTA, Robert Waugh, Adjunct Director of ICTA and also of The Rockefeller Foundation, Eugenio Martinez, Technical Director of ICTA and Joe Black, Director of Social Sciences of The Rockefeller Foundation in the offices of ICTA in Guatemala to further discuss the nature of the position as Coordinator of Rural Socioeconomics (SER) in the Institute.

In this meeting it was explained that Guatemala felt if they were to incorporate the small farmers of the country into the economic development processes, it would be necessary to have a better understanding of their need and limitations, something that the social sciences should be able to provide. The aim was to develop an institute in which the social sciences were integrated with the biological sciences to help guarantee that the

research being undertaken was in fact oriented toward the needs of the small farmers. There was a feeling that SER should help evaluate the technology and then help "sell" the technology that was generated to the farmers. That is, there was an indication that part of the reason technology was not reaching small farmers was that the selling job being done by extension was not adequate.

In this meeting, I agreed to the mandate "to help sell the technology to the small farmer." My reason for doing so was not that I thought we should or could act as "salesmen" who could convince a client to buy something that was not necessarily what he wanted. Rather, I contemplated that the social sciences, through a better understanding of the farmer, should be able to help the agronomists produce a technology, or "product" that was, in fact, something the farmers would want and be able to use in their present circumstances.

Though there was general understanding at the May meeting on what the scope of work SER was to be, there was virtually no discussion of the methodology to be used. This was because few precedents existed which could be followed. Instead, there were innumerable cases in which failures had been made or in which only partial advances had been achieved. General guidelines had been written by the Task Force groups that worked on the founding of the Institute and later reported in Robert K. Waugh's "Four Years of History." The Puebla project in Mexico was the closest ongoing program available to use as a guideline. Other projects were underway (Ahmadu Bello University in Nigeria) or being initiated (Cáqueza in Colombia) but little or nothing was known about their methodology, successes or failures. Hence, we began in Guatemala with a quite clean slate on October 25, 1974, when I reported to work at ICTA.

FIRST GUIDELINES FROM SER

On January 27, 1975 we published, "The Role of Rural Socioeconomics in ICTA" (Hildebrand, 1975a).¹ This was a paper for the seminar which we gave as part of the seminar series then being presented twice a month by the Technical Division of the Institute, and gave our preliminary views on our role and methodologies. During these first three months, I frequently asked what the people in the General Manager's office and the head of the Technical Division desired from SER. Following are some of the responses:

- "SER should help sell the technology that is developed because one supposes the sociologist, anthropologist and economist should have the capacity to formulate the technology in such a way that it is acceptable to the farmers."
- "It is necessary to study and understand the traditional systems of the farmers because they have been developed over many, many years."
- "It is necessary that SER help in the experiments and trials that ICTA carries out in order that the results have an economic focus because what interests the farmer in the final instance are the economic aspects."
- "I want you and your group to evaluate the work developed by the programs or ICTA. That is, evaluate and orient the programs because we think that the economist, anthropologist and sociologist have more exact information about farmers needs."

As a result of these discussions, we considered one of the basic roles of SER was, "...to know the small farmers and the conditions that affect them in order to help in the design and development of technology appropriate for them."

¹References are listed in Appendix C.

We also presented the kinds of evaluation we were then thinking about. We said that as we worked with the Programs discussing their projects and trials, we were going to give them the "Why" treatment. That is, why are you orienting the program this way, or why are you doing this trial or why are you designing it in this way? We explained that in this way we hoped to always make sure that the needs and limitations of the farmers were foremost in the minds of the agronomists as they designed their work. Work that was "interesting" but which could not be explained in terms of the needs and limitations of the small and medium farmers should not be undertaken in an Institute so short on resources as ICTA.

We also raised the need to have a full understanding of national policy with respect to crop and farm size priorities so that the work of the Institute and its programs would be in keeping with that desired by higher authorities. We pointed out that there may be conflicts between national policy and the personal policy of small farmers. For example, yields can be increased by applying more fertilizer to maximize profit for farmers who have unlimited capital. But the small farmer, with very little capital, is better off to settle for lower yields and apply less fertilizer so that he maximizes the productivity of scarce capital invested in that input.

INITIAL ACTIVITIES

In November, 1974, at the request of the Sorghum Program, a study was initiated to evaluate three sorghum varieties in small and medium fincas in eastern Guatemala. The objectives were the following:

1. Determine the behavior of the varieties for a representative group of farmers that had planted sample packages which contained full instructions about the technology to be used and evaluate their opinions regarding the varieties.
2. Determine how many of the farmers had utilized the practices recommended by the Sorghum Program.
3. Determine if the small and medium farmer is able to use the recommended technology and if not, what barriers there are to its use.
4. Explore how the technology might be modified for the different conditions under which sorghum is planted in this area.

One of the first conclusions was that the yield obtained by the farmers was very much lower than that advertised by the Institute in the leaflet distributed with the seed and in other advertisements. The advertised yields were from 70 to 76 qq/mz. Mechanized farmers obtained 26 and non-mechanized farmers only 16 qq/mz. Hence, there was a strong recommendation made that the yields advertised by ICTA be much more closely adjusted to the yields the farmers could really expect to obtain. A closely associated recommendation was that farm trials be conducted under conditions much more like those of the farmers who will be using the seed than were those used in the development of the three varieties evaluated.

The seeds of what was to eventually become the evaluation of acceptability based on Farmers' Tests were also planted in this report when it was recommended that "evaluations such as the one that had just been made of farmers who had planted sample packages of seed be conducted in the future to determine what yields farmers can expect to obtain and what problems they may be having with the varieties." (Reiche, et al., 1975).

For 1975 several activities were planned, all of which contributed to the methodology being developed for integrating the social sciences into the Institute. That which probably had the most far reaching effects was an agro-socioeconomic study of "an important stratum" of small and medium farmers in the Oriente of Guatemala. This, combined with the project called, "farm trials in crop systems in the Oriente" led into what became known as "La Barranca" which will be discussed in more detail later in this report. Also in the eastern part of Guatemala we initiated three separate projects with the Swine Program. One concerned the improvement in the productivity of non-confined pigs or pigs running loose on the farms and in the villages. Another was to work on the transfer of the CIAT technology for pigs in confinement. The third was concerned with the production of feed for pigs in cropping systems with special emphasis on protein sources.

The production of feeds in cropping systems was part of the project initiated in La Barranca and met the same fate. The project on non-confined pigs produced an important and very acceptable technology from the farmer's point of view and could have had a significant impact on all people who owned pigs that ran loose. ICTA, however, decided it could not promote the

practice of loose pigs by extolling a technology for it even if it could have saved a great deal of money for many poor farmers and landless people.

As we began working with the CIAT technology for confined pigs it was immediately evident that there were problems that would make it difficult for the large majority of farmers in dry, eastern Guatemala to accept. In confinement, pigs must be watered and their pens must be washed to avoid unacceptable odors and disease. In this area, during most of the year, the women carry water great distances in jars on their heads for the family to use. Obviously, they would not do this to water pigs, much less to wash the pens where they were confined. This and the fact that the technology was only marginally economic under the best of conditions led to the abandonment of the project as originally conceived.

In 1975 an agro-socioeconomic study was undertaken in the altiplano in Santo Domingo Xenacoj (Corisco, 1976). This study was never as productive as it could have been because decisions taken later moved the area of operation to Tecpán. Also in 1975, I worked with the team in Region I (Quezaltenango) in the design of the trials that were later to be known as "Relevos" or Relay trials. They were based on the double corn row concept that Tito French and I had developed in El Salvador allowing farmers to continue producing the same amount of corn, but also including the intercropping of other crops (Hildebrand, 1975b). The first Farmers' Tests (see the section in this report on methodology) of the relay system were established in 1978 and continued in 1979.

In Region IV (La Máquina), in 1975, we collaborated with the "Production Team" on "Economic Farm Trials" on crop systems and fertilizer use. The

fertilizer trials eventually led to the rejection of the recommendation of fertilizers for that area and a change in the policy of BANDESA (the agricultural credit bank) and DIGESA (extension) towards fertilizer.

LA BARRANCA, A CONTROVERSIAL PROJECT WITH IMPORTANT RESULTS

Although the project at La Barranca in the Municipio of Santa Catarina Mita, Department of Jutiapa, lasted only two years, it may well have been one of the most important features of the five years. The survey and farm trial proposals were written in January, 1975, as part of the training I was giving my staff in project preparation. In February the survey work was begun.

From the beginning, it was evident to us that the largest number of small and medium farmers in the Jutiapa area were located on the steep and often rocky hillsides called "Ladera." In consultation with the Technical Director, we decided to direct our first agro-socioeconomic survey to the farmers of the Ladera because virtually nothing was known about them and their conditions. The efforts that had been made and were planned for the Technology Testing Team and the Commodity Programs working in the area were all on the better, flatter and in some cases, irrigated land. Hence, no experience had been gained working under the very adverse conditions of the Ladera. During the "Sondeo" or reconnaissance survey and preparation of the questionnaire it was decided to limit the survey to farmers with from 1 to 5 manzanas on Ladera. The survey was completed during March and April, 1975.

Originally it was anticipated that our field or "Farm" trials would be conducted on the new Production Center or Experiment Station in Jutiapa in cooperation with the Bean Program that was interested and willing to share funds with us (SER had no budget for such an undertaking). We chose the

poorest land on the station and planned to use bullocks instead of tractors to prepare the land in order to stay as close as possible to the conditions confronting the small farmers. However, the Regional Director wanted to homogenize the Station and our desired use of bullocks and lack of use of fertilizer did not fit within this concept, so in late March, 1975, the decision was made with the Technical Director and the Regional Director that we should move off the station and rent land on which to conduct our farm trials. This undoubtedly was the best thing that could have happened, although it was very difficult to find land so late in the year. Utilizing some of the farmers we had interviewed in the survey as contacts, we found suitable land on April 1, and on April 3, it was rented.

The land, about one kilometer off the road and up a steep path, was all in heavy overgrowth and had to be cleared. While this was underway using the same methods employed by the farmers of the area, we continued visiting our neighbors and becoming more familiar with their conditions and problems. The treatments and the experimental design of the trial, which were planned from preliminary analysis of the survey data, were modified to be more in keeping with the local situation. Before the first rains fell, the land was cleared and the plots staked and we waited for the first rains so we could begin planting. On May 14, we had a good rain and we began planting on May 15 along with all our neighbors.

From the survey it was found that the most limiting resources for the farmers in the area were labor at planting time and amount of been seed (Reiche, et al., 1976). The trial was designed around these factors and in such a manner as to minimize modifications to the present systems used by the farmers so that whatever technology might be developed would be easy for

them to adopt. No insecticides nor fungicides were used and only a minimum amount of fertilizer was included in some of the treatments (Hildebrand, et al., 1975).

The year was very dry and had two prolonged periods without any rain (16 to 26 May and 25 June to 23 July). Visitors (see list in the Appendix) were surprised, if not appalled to see field trials under such conditions and the crops clearly demonstrated the extreme stress under which they were growing. But it was also evident that these conditions were the reality under which the farmers of the Ladera lived and produced. Aside from the comments that it looked just like a trial being run by social scientists and that it was a good thing it was well off the road, the most usual comment was that it was obviously not worthwhile to work under these conditions because nothing could be accomplished.

However, we did accomplish the following: We learned how the farmers plant under those very adverse conditions and closely duplicated their yields on our check plots. That is, we learned how to farm under their conditions. In the best treatment, the productivity of labor for planting was increased 64% and of bean seed 60%. On a per hectare basis the yields in this system compared with the farmers' system were 91, 126 and 117 percent for beans, maize and sorghum respectively. We discovered that the planting of maize and sorghum in close association under these conditions is advantageous because the loss of one or the other allows the surviving crop to utilize the moisture from the space that would otherwise be left vacant. We learned that sorghum is a very important part of the human diet in the area and is not used just for animal feed as had been supposed. Therefore the development of varieties with better characteristics for

tortillas would be readily accepted (Hildebrand, et al., 1975). Also, and very important, the staff from SER learned much about how to conduct field trials, enabling them to talk on the same plane with the biological scientists of the Institute.

A secondary effect of the trials at La Barranca was that they created a tremendous amount of discussion among the technicians of ICTA concerning the role of SER in the Institute, the folly or wisdom of working under poor conditions like those of the Ladera and about who the "clients" of ICTA really were.

It was evident that the agronomists were comfortable, or not threatened by the role of SER in surveying, but this was not the case when we were participants in field trials. Hence, a negative effect of the trials the first year was that they tended to create more separation of the social and biological sciences than integration. However, I feel this was more than offset by the gain in understanding about working under the adverse conditions of the traditional farmer. The difference between transferring the conditions of an experiment station to a farm site and working under the conditions of the farmers was evident. Low yields such as those obtained in La Barranca normally would have been discarded as "lost trials" instead of being used to better help understand the conditions of the small farmer.

In 1976, the second year of trials was planned and planted in La Barranca. The trial was a continuation of the best systems from the trial of the year before, still trying to reduce the labor requirement per manzana for planting and increase the productivity of the bean seed. Two support trials were designed to study the effect of different planting distances of corn and beans on land, labor and seed productivity. Soybeans and pigeon peas were also included in some treatments as a source of protein for swine rations.

The best system from 1975 was also the best in 1976 and resulted in an increase in productivity of capital invested in planting labor and bean seed of 59% over the farmers' system. Results of five Farmers' Tests which SER conducted during 1976 showed that they were able to plant 42% more land with the same amount of planting labor, produce 75% more maize, the same amount of beans, 41% more sorghum and 33% more income using the improved system rather than their traditional system (Hildebrand and Cardona, 1976).

The trial on distance of planting beans in corn confirmed the hypothesis that opening the distance between bean plants would increase the productivity of the seed without seriously decreasing the yield per unit of land area and at the same time increase maize production through less competition. As the distance between bean plants opened up from 30 to 60 cm, the productivity of the bean plants increased 81% while yield per hectare dropped only 8% and maize yield increased 16% (Hildebrand and Cardona, 1977).

As a result of the second year's trials and Farmers' Tests, it was recommended that a larger number of Farmers' Tests be established in the Ladera in 1977, using the system that was best in the two previous years. It was also recommended that the Bean Program continue the work on wider planting distances. Neither of these recommendations was accepted, however. The primary reason is that except for the work described here, ICTA technicians have done very little work, nor desire to, under the severe conditions of the Ladera, and both of these technologies pertain only to those conditions. The technicians' reasons are two-fold: experimental error is high under these conditions and they do not see much possibility of potential increases in production. But the fact remains that these are the realistic conditions of the small producers in the area so they must be dealt with if these farmers are to be helped.

It has been in the Oriente where there has been the most discussion regarding who is or should be the client of the Institute. In other regions the distinction among classes of possible clients is not nearly so sharp. SER has always thought that to follow the mandate of the Institute, the Ladera, where the majority of farmers and the majority of grains are, is where we should be making our major efforts. Virtually everyone else in the Institute has always felt that it is better to work in the more favorable conditions where there is more probability of being able to generate a technology that will increase per hectare yields, even if this action will favor those already more fortunate with larger farms and better land. Recently, efforts are being made to consider criteria other than just per hectare yields. This is a promising trend and may lead to a reconsideration of the importance of working in the Ladera of the Oriente and in other difficult conditions.

In 1975, to evaluate the importance of the Ladera in the economy of the Oriente, SER undertook an aerial survey of the area. The results show that 54% of the maize, 58% of the sorghum and 59% of the beans in the area are grown on lands with more than 12% slope. Since the smaller farmers tend to be located on the sloping land, this represents an even greater proportion of all farmers. In addition, it was shown that 87% of the maize, 95% of the sorghum and 83% of the beans are grown in association with one or more other crops (De Leon Prera, et al., 1977). The overwhelming evidence of the importance of associated crops has led to the incorporation of this characteristic in many of the trials of the Commodity Programs in the area, but the trials continue to be conducted on flat land.

The last activity in La Barranca was in 1976 and this was also the last year in which SER had field trials with sole responsibility. However, we did have a second trial in 1976, the year of the earthquake, in Tecpan in the Central Highlands. This activity will be described in the following section.

TECPAN: FIRING UP THE METHODOLOGY

In late 1975, a decision was made by the Technical Director that SER should conduct an agro-socioeconomic survey in the area centering on Tecpan in western Chimaltenango. Because of the separation of SER from the agronomists that was occurring in the Oriente, it was also decided that in Tecpan we should work with technicians from one or more of the Commodity Programs and from the Technology Testing Team, then located at Quezaltenango. This survey was initiated in January, 1976, and was about 2/3 completed on February 4, when the earthquake struck. One person from the Technology Testing Team participated in the survey as did one from the Bean Program. The one from the Testing Team had to return to his own group following the earthquake and did not participate in the analysis of data, but we did continue collaboration with the Bean Program.

Three manzanas were rented in the Aldea of Pueblo Viejo in Tecpan and this served both the Bean Program and SER as a site for farm trials. In the survey, we had detected three classes of farmers (Duarte, et al., 1977a). Treatments were designed for each of the classes and included wheat, vegetables, maize, beans and fava. In addition, we planted 15 varieties of soybeans at the request of the Technical Director to make an initial screening for him at that altitude.

The factors which were discovered to be scarcest for the small farmer in this area were land and capital in that order. Results of the trial

indicated that some of the treatments were very efficient in the use of these resources and utilized technology that was easy for the farmers to adopt. For the farmers who were not able to produce enough maize for the family on the little land they had, a system of "compact double maize rows" showed great promise allowing an increase of 45% in production without changing the basic technology they were using other than the planting of 50% more maize on the same amount of land (Hildebrand et al., 1977).

For farmers who were just on the margin of being self-sufficient in maize, a second system was devised using double maize rows widely spaced but without reducing the normal population, and interplanting with wheat, the usual cash crop for farmers in the area with enough land. This system produced 1,300 kg/ha of wheat while decreasing maize production by only 15%, or 250 kg/ha. This was accomplished with the same basic technology they are presently using.

A third system, for farmers who already produced maize and wheat was the interplanting of cabbages in the wheat. This system permitted the production of nearly 14,000 cabbages per hectare while having a slight positive effect on the wheat, apparently because of the fertilizer used on the cabbage. It was recommended that these systems be put in the Farmers' Tests the following year. Once, again, it was only the personnel of SER who were permitted to have Farmers' Tests with the technology generated by our own trials. Five were established in 1977 and were very well received by the farmers who planted them. The Technology Testing Team, newly formed in Chimaltenango in 1977, however, did utilize the intermediate system of double rows with wheat in their trials and this methodology, utilizing other crops, passed into the Farmers' Tests and is now in its second year in some areas. The system,

interplanting beans instead of wheat, was very well received in the area of San Martín Jilotepeque in northern Chimaltenango.

The experience in Tecpán reinforced the thinking on the benefits of designing field trials around the information obtained in a survey of the area by a multidisciplinary team prior to initiation of work. It also helped us understand the value of utilizing the local farmers both as sources of labor and as advisors in the field trials. And once again, it demonstrated the value of maintaining a simple technology, based on that existing in an area with only a minimum amount of changes.

GENERAL METHODOLOGY

Much of the methodology now in use in the Institute was formulated during 1975 and 1976. In this period each of the three regions having full production teams operated slightly differently. This flexibility was encouraged because the methodology was in a formative stage and it was obvious that changes would be required as better methods were devised. SER was operating with yet a different type of methodology than that used by the production teams.

Because of its controversial and innovative nature, the methodology being developed by SER was more widely discussed than that of the Production Teams and the Commodity Programs. We benefited tremendously from the many interchanges of opinions which took place with the ICTA technicians and with the General Manager and others in the Central Offices of the Institute in Guatemala City.

By mid 1976, following one full year of work and well into another, the methodology that we in SER thought would be the most useful to the Institute,

to help the integration process, and aid in the contributions of the social sciences, had been fairly well formulated. We first presented it to the Institute on a formal basis during the presentation of results to the General Manager in June, 1976. It was at this same approximate time that the first attempt to describe the methodology in written form was undertaken. This attempt was approved by the General Manager of ICTA and presented at a conference in Bellagio, Italy, in August, 1976 (Hildebrand, 1976). However, there still appeared to be some doubt on the part of the General Management and the Technical Director concerning the exact nature of the role that SER should play. In order to try to clear up our concepts, we requested a three day meeting with them, one of which was to be spent in the field at our Tecpán site. This meeting was held Dec. 6-8, 1976. Waugh and Fumagalli attended all three days, Eugenio Martínez two, but Mario Martínez was on vacation.

On the first day we presented a description of how we had been working to develop a methodology for integrating SER into the technology development process in an internal paper we called "Searching for a Methodology." This was the same methodology presented in Bellagio, but the paper discussed more of what we considered "integration" because there was some idea we were trying to separate ourselves from the other technicians. During the course of the discussion, we worked on a schematic diagram to describe the methodology based on one that Fumagalli had developed earlier. This diagram was what was to become known as the "Transistor Radio" diagram that is still in use.

The second day was spent in and around Tecpán where we discussed the specific case of our work there. We had done a survey, conducted a crop

systems trial and had a farm record project underway. These activities included three of the four components basic to our participation in the integrated methodology of the Institute. The fourth is evaluation of acceptability of the technology that follows the Farmers' Test. Except for farm trials these activities will be discussed in more detail in following sections.

On the third morning Waugh, Fumagalli and Eugenio Martínez talked to me about their idea of changing the name of the Production Teams in order to help integration and we discussed the integration of SER into these teams -- particularly in the early aspects of work in a new area. In the afternoon, these ideas were presented to the regional coordinators and were to be put into practice in 1977. The differences from the methodology in use at the time were not great and affected the procedure primarily in the first two years in which the Institute works in a new zone.

It was proposed that during the first year, the Regional Director then called Regional Coordinator, some members from the relevant Commodity Programs (maize, beans, etc.), two from SER and others as required would work as a single team to conduct the agro-socioeconomic survey, design and conduct the cropping trials based on the survey and initiate the farm record keeping project. Heavy emphasis in the first year in both the survey and the crop trials was to be in getting to know the farmer and the region. In the second year the original team was to be augmented by additional personnel and the emphasis would shift more to biological or agronomic concerns but with continuing participation of SER. By the third year, the primary work of SER was to be farm records and evaluations.

Discussions on methodology continued and included clearer definitions of the Farm Trials and Farmers' Tests as well as evaluation of acceptability of

the technology generated. Evaluating the acceptability of technology in 1976 helped a great deal in understanding the function of the Farmers' Tests and a new definition was formulated. The most important conceptual change was that in the Farmers' Tests it is the farmer who becomes the prime evaluator rather than the technician. The technician obtains what information he can from the Test, but our principal evaluation is of the acceptability of the technology to the farmers. With this new definition of the Farmers' Tests as well as the selectivity the farmers were showing in choosing parts of components of a complete technological package, it also became evident that the technology being generated needed to be simpler and designed specifically for the farmers with whom it was being tested. It was clear that it made no sense to test on a large farm, technology that had been developed for a small farmer who works under different conditions, or vice versa, because we could anticipate beforehand that much of it will be rejected as not being acceptable. Hence, the whole concept of orientation to a specific type of farmer came into clearer focus.

Another important effect of the change in definition of the Farmers' Tests is that many more Tests can be carried out when it is the farmer and not the technician who is responsible.

During this same period the concept of the agro-economic farm trials as distinct from the agro-technical trials was developed. In the agro-economic trials the plots are larger and the treatments usually are not replicated. More of them can be installed to obtain a better estimate of regional response and stability, and economic as well as agronomic information can be obtained.

A new attempt to describe the technology in written form was completed and included in an invited address given at the 12th West Indian Agricultural Economics Conference of the Caribbean Agro-Economic Society in Antigua on

April 24, 1977 (Hildebrand, 1977a). The relevant portions of this paper were translated and submitted to the General Management in May of that year (Memo of 15 July 77 to AFC from PEH). Eventually this was incorporated in the 1976 Report of the General Manager (Informe del Gerente) and printed in a special issue of NOTICTA, the news and information pamphlet of ICTA, for wide distribution, and still forms the basis of the methodology in use today with only small modifications.

For SER it was a major breakthrough to finally have the methodology in officially published form. We felt this would end what had been a long struggle to fully integrate SER into the activities of the Institute. But even though the methodology was published and widely distributed, it apparently was not read or understood by most of the technicians, nor all the Regional Directors, because each Regional Team continued to operate along different lines. Many times over the next year we heard the word "flexibility," meaning that it was necessary to maintain flexibility so that the methodology could continue to develop. We argued that flexibility was fine from one year to the next, but that flexibility within the year tended to create a disorientation that was more damaging to SER than to any of the other programs or disciplines within the Institute. This is so, because we work in all the regions and are dependent on a more uniform methodology among regions especially regarding what tasks SER personnel undertake and what tasks are assigned to the Technology Testing Team. It is also extremely important that the Farm Trials and Farmers' Tests are conducted in a standard format so that comparisons can be made for purposes of evaluation.

During 1978, the definition of Farm Trials was fairly well standardized, but there continued to be a great deal of discussion about the Farmers' Tests. Many felt (perhaps the feeling was strongest in the Maize Program) that a

year was lost between the Farmers' Tests and the evaluation. In a way, the need for this wait is related to the client. For the larger, commercial farmers who can accept or absorb a certain amount of risk, there is probably no need for the evaluation of acceptability before the technology is released to the extension service. But for the small, traditional farmer for whom the methodology was developed, the wait helps assure that the technology is, in fact, acceptable to this class of farmer who cannot accept the risk inherent when evaluation of materials or practices is conducted only by technicians even though they live and work in the area.¹⁾

A meeting was held in Region VI in September, 1978, in which the team from that region and SER agreed on what the Farmers' Tests were and how they should be managed. An important conclusion was that there should be no "check" plot representing the farmer's own practices. In some cases the farmers put themselves into competition with the ICTA plot and tended to use a higher level of technology than on their own crop. In others it appeared that they waited for instructions on what to do on the check plot like they did on the ICTA plot so that it suffered and produced less than their own crop. Instead of using a check plot, the suggestion was to sample from the farmer's own field. This procedure would have three uses: 1) it would eliminate any possible bias on the farmer's part with respect to the check plot, 2) it could be used as a measure of yield for the farm records if the

1) The frequently conceived notion that a pool of technology is available and waiting for appropriate extension techniques to get it into the hands of small farmers is mostly invalid. Technology must be finely tuned to the needs and conditions of the small, traditional farmer through such a process as that described here before investment in extension activities will pay off.

farmer were also a record keeper, and 3) it could be used to locate sources of error in the way the farmer measured his own yield. However, it also has two disadvantages: 1) it requires more time on the part of the technicians, and 2) it is subject to sampling error.

In 1979, the Farmers' Tests generally follow the model described above except that there is still a check in most of them. However, it has been agreed to try the sampling procedure in the Farmers' Tests in 1980. The difference in number of Farmers' Tests that can be carried out under the new definition compared with the old is large. Now we are involving from 50 to 150 farmers in Tests in each crop in each area of work each year, compared with only around 15 or even less in the earlier years when the technicians considered they were responsible for installing the Tests. Hence, the validity of the following evaluation is greatly enhanced and the promotion of the technology is facilitated. It is also easier under the new definition to incorporate personnel from the extension service in the Farm Testing procedure and this is being done.

SURVEYS AND SONDEOS

The first three full-scale agro-socioeconomic studies or surveys that were undertaken were: 1) The Jutiapa area in the Oriente that led to the La Barranca trials, 2) The Tecpan area that led to the trials in Pueblo Viejo, and 3) a second survey in the Oriente in the area of Yupiltepeque (Diaz, 1977), that was designed to determine if that area could be considered part of the homogeneous area of the Ladera in Jutiapa. All of these surveys took at least a year to complete from initiation to publication of the report. We began to question the need of these full-scale surveys in 1976. In my January-February, 1977 Report, I said:

"The main purpose of the survey is to provide information for the Regional Team to use in orienting and planning its work, and that is accomplished now shortly after the survey is completed. We have been writing them in the past to pass on to the Regional Production Teams, but with the integration of SER into these teams, that is not really necessary because the same team will be doing its own analyzing and interpretation. Also, the information we are now getting from the farm records which we initiate at the same time we are doing the survey provides more accurate information on the economic aspects. On the other hand, the survey does provide some information from the year before the records begin, so it may still be useful."

I indicated that a decision would be made on streamlining the surveys after there was time to evaluate the information in the survey reports. We did, however, continue the full-scale surveys (in Totonicapan: Duarte, 1977; and La Blanca: Castaneda, 1978) while we were pondering their fate.

In all these full-scale surveys we utilized a "sondeo" or preliminary survey to obtain the first impression of the area and to write the questionnaire. We were finding frequently that these first impressions, gained through the eyes of a multidisciplinary team, with each discipline making a contribution, were quite correct. This led us more and more to doubt the need for spending the relatively great additional amount of resources for a relatively small additional amount of information. This, particularly in light of the fact that the additional information was seldom published for at least a year, and in that time we had the information from the first year's farm trials and from the first year's farm records.

In 1977 we conducted Sondeos in two areas (Montufar: Duarte, et al., 1977b, and Izabal: Ruano, et al., 1977b) that were supposed to be followed by surveys but for which there was never time to complete the full survey. We found in both instances that the Sondeo provided a great deal of useful information and this was appropriate to be written as a report for "internal use."

In 1978 we conducted three Sondeos and one survey. A Sondeo in Moyuta in Southeastern Guatemala was the first to be conducted without the thought that it would be followed by a survey. We found that when we did it on this basis, much more information was forthcoming than when the Sondeo was conducted as a forerunner to a survey like that done in Jalapa (the eastern Highlands) the same year. In Zacapa, in September, 1978, we began to firm up the methodology for the Sondeo. By October the methodology was sufficiently well defined to be reported in written form for another international conference (Hildebrand, 1978b).

Briefly, the Sondeo methodology is as follows. A technician from SER is paired with one from the Technology Testing Team or a Commodity Program to form an interviewing team. Approximately five such teams are formed for the area. Following each half day's interviewing, the full group meets to discuss the findings, raise doubts, formulate tentative hypotheses and orient the next half day's interviewing. Interviews are without questionnaires and no notes are taken, so the farmers are much freer with the information they give. Convergence of opinion is surprisingly rapid, so in four or five days enough information has usually been obtained for the team to write the report and make recommendations on the nature of the technology that needs to be generated for the farmers of the area. The technicians who participated in the Sondeo will have an excellent understanding of the problems the farmers in the area have and the conditions they face. No quantitative information is obtained, but this is accumulated through the farm record project that is initiated during the first year of work in the area.

By 1979, the Sondeo had become the accepted method to be used for obtaining preliminary information for an area and five, week-long Sondeos

were conducted early in the year. The methodology, as now used has been published in expanded form (Hildebrand, 1979c).

Our first survey on livestock, in Nueva Concepcion on the south coast in early 1978, ended in diaster when we failed to take into consideration the interaction of the livestock with the crops. It is anparently possible to consider crops without a full consideration of livestock, but when livestock are to be studied, it is essential to account for the crops. As a result of the problems with the survey in Nueva Concepcion, we have been looking at livestock with every Sondeo whether or not it was part of the primary focus.

FARM RECORDS

The ICTA farm record project with small farmers began in 1975 as an additional method of obtaining agro-socioeconomic information in areas where "Technology Testing Teams" are assigned. The project began modestly and grew over the years into a national project with records on many crops and cropping systems. From the beginning, the project was conceived as a crop record project and was not intended as a farm record program. That is, no attempt was made to take full farm inventories, impute depreciation costs of equipment to each crop, or to enter into household expenses and use of farm products, etc.; rather family owned machinery and animal power, family labor and owned land rent were all charged at the current contract or hired cost for similar items. This characteristic had three important advantages. One is that it held to a minimum the amount of time and bother the farmer had to put into the data gathering process. Second, training of personnel was simplified, and third, the analyses were simplified. This probably was one of the main reasons the project has had the success

it has enjoyed. Had it been designed as a full farm record project from the start, it would have been so complicated that it probably would have failed before producing enough data to demonstrate its productivity.

During the first year, two technicians from Socioeconomics were assigned to an agrarian reform parcelization project comprised of 20 ha farm units. These two worked with the ICTA Technology Testing Team that had just been organized and some of the technicians from the ICTA Commodity Programs who were also initiating programs in the area. The target number of farmers was 30 and originally that many farmers were keeping records. However, during that first year, 10 of the farmers dropped out leaving 20 for analysis at the end of the year. All of these farmers had maize, 5 planted rice and 15 planted sesame, so 40 separate records were kept.

From this modest beginning, the project grew in four years to include 34 different sets of crop or crop system records in 11 work areas and included a total of 583 separate records, Table 1. One person from Socioeconomics was assigned to each of the work areas, and one from the Central Office was given responsibility for supervising the farm record project.

Table 1. Growth of the ICTA Farm Record Project with Small Farmers.

	Y e a r			
	1975	1976	1977	1978
Number of areas	1	3	8	11
Number of crops/systems	3	4	23	34
Number of records	40	93	347	583
Total area, has	390	619	1,288	1,404

Source: SER/ICTA.

In the field, a significant change was made in the personnel who were working with the farmers on their records. Instead of using only personnel from Socioeconomics, members of the Technology Testing Teams were also being used in this capacity. This provided more opportunity for them to get acquainted with farmers and helped the technicians to better understand the farmers' problems. In return, personnel from Socioeconomics began to participate in the field trials of the Technology Testing Teams.

The incorporation of the agronomists from the Technology Testing Teams into the farm record project has not been without some problems. Some have been slow to accept the work probably because of the way it was introduced. That is, first it was undertaken by peritos agronomos with high school level training and later agronomists with university degrees were asked to participate. Also, the record project was added to the other work they were doing without a reduction in other responsibilities. For this reason, many thought of the farm records as socio-economics work they were given to do so they put much less priority on it than on the field trials. Third, they felt the work had been "imposed" on them and they had not been given the opportunity to express their opinions.

In general, it has been found that an agronomist who is conducting around 20 farm trials can work with 10 farmers on records. If a technician is working only on farm records he can work with from 40 to 50 farmers and provide them adequate supervision.

It has been found to be feasible, inexpensive and efficient to organize the record system around the hand-held programmable calculators. These calculators are now sufficiently inexpensive that each area team could have them. In 1978, with only four programmable calculators of the capacity required for the record analyses in ICTA, Socioeconomics was able to complete all the analyses on time for the annual meetings for presentation

tion of results shortly following harvest. And these same machines were being used at the same time by other technicians to do their farm trial analyses for presentation at the same meetings.

EVALUATIONS

In March, 1975, there was a two day meeting to discuss SER's responsibilities and that of the Programming Division with respect to evaluation of ICTA and its programs. From the beginning the idea was to have SER participate in evaluations, but Programming, the third Division in the Institute, also was to have evaluation functions. The meeting was attended by Mario Martinez, Fumagalli, Waugh, Eugenio Martinez, myself and Armando Fletes, Director of Programming. At that meeting it was decided that Programming would have responsibility for analyzing the progress of each program toward its stated goals; that is, number of farmers interviewed, number of trials initiated, number of farm records established, etc. Also they were to keep track of budget expenditures and be charged with obtaining the information necessary for the various reports required by the government.

SER was to have the responsibility for technical evaluation. This included an analysis of the orientation of each program, its contribution to the overall objectives of ICTA, and the efficiency of the projects in making progress toward raising incomes and production of the small and medium farmers. It was agreed that we would work with each of the programs in helping to write their project proposals for the next year in such a way that the orientation toward the goals and objectives of ICTA was clear and the relationship between the project and the goals was evident.

In the five year plan of ICTA which was drafted in May, June and July, 1975, the section on evaluation states in part:

"Technical evaluation of ICTA will be in charge of SER. The reason for putting this group in charge of evaluation is to assure an orientation not only of the agronomic factors, but also of the socioeconomic factors of the farmers. By doing this, the Institute hopes to have an orientation directed towards resolving the problems of the small and medium farmers of the country and avoid investing in projects that would have little potential for increasing the income of the clients or increasing national production.

"Because they are assigned the evaluation task, SER will have the responsibility of knowing the farmers in the different priority zones of the country. This understanding will include the agronomic, socioeconomic and cultural factors that affect their potential to produce and earn.

"The evaluation process will begin with the development of new projects, continue during the execution to assure that it is being done under conditions relevant to the farmers, include the evaluation of recommendations and of the results of the technology when it is placed in the farmers' hands by determining the grade of acceptance of the technology and finally will close the circle with recommendations based on an analysis of the previously described process. Although SER is in charge of the evaluation process, it is obvious that in all stages it will be necessary to depend on the collaboration and coordination of all the personnel of the Production and Testing Programs and on the solution of different points of view in a way that is satisfactory to all."¹

In practice this has meant that the Coordinator of SER acted equally with all the other Coordinators and Regional Directors in the evaluation of new project proposals and in the evaluation of research results which are accomplished in regional meetings following the termination of the crop year. SER has had a lesser role and a smaller impact on the execution of the projects, but has played a strong part in the definition of Farm Trials and Farmers' Tests, as mentioned previously. Perhaps the strongest role that SER has had in evaluation is in the evaluation of "Acceptability" of technology based on interviews of farmers who participated in Farmers' Tests.

The first evaluations of this nature were conducted in 1976 in La Maquina in Region IV, Quezaltenango in Region I and Jutiapa in Region VI. Though two of three studies were very useful (the one from the Jutiapa area was never

¹Informal translation from Spanish.

published because of various objections), they were based on three erroneous concepts that were later changed. At first we called these studies "Evaluation of Acceptance of Technology." It was soon obvious that this created a wrong impression as to the nature of the evaluation. People thought of it as an "impact" study, which it was not. By changing the name to "Evaluation of Acceptability of Technology," this problem was solved. Secondly, the "Acceptance Index" we used the first year was not appropriate. The error originated because the first evaluation was done in La Máquina where some of the technology being tested was already being used by many farmers. We studied the area on which the farmer used each of the components in 1975, in the year of the Farmers' Tests, and the area on which he used the components the year following the Tests. The index was the percentage increase in area using 1976 as the base year. The proportion of farmers who used the technology was not incorporated into the index. Many technicians complained that through this void, the index was not complete. In the second year our "Acceptability Index" was based only on data from the year following the Farmers' Tests. It was the percentage of farmers who put the technology component into practice on their own on even a small part of their farm, multiplied by the percent of their crop on which they used it and divided by 100. This index has proved to be sensitive to farmers' opinions and useful in detecting what technology they would accept and reject. It also has satisfied the criteria of the agronomists who generate the technology under evaluation.

An index of 100 obviously means complete acceptability and 0 means full rejection. We have tentatively set an index of 25 as the minimum for a technology to be "acceptable" provided at least 50% of the farmers used it the year following the Tests. But other, lower values can also be useful. For:

example, if 90% of the farmers use a component, but do so only on 10% of their crop, it can be interpreted that the technology interests them, but they want to continue experimenting with it. If 10% of the farmers use a component on a large percent of their crop, it means that for 90%, the technology was rejected and is not acceptable. But for the 10%, it was obviously very acceptable, so if one can determine the characteristics of the farmers for whom the technology is acceptable, it can be provided to the extension service as an "Acceptable" technology for farmers with those certain characteristics.

The third faulty concept on which the evaluations were based the first year was the nature of the "Farmers' Tests" that had been conducted in 1975. In most instances, the technicians installed the Tests and there was only minor participation by the farmers. The following table demonstrates some very interesting aspects of the development of the Farmers' Tests and the evaluation of technology.

Table 2. Index of Acceptability of Technology for Maize Production, La Máquina, Guatemala 1976 to 1978.

Technology Component	Index of Acceptability for Year ¹		
	1976	1977	1978
Improved seed	41	61	71
Planting distance	13	28	60
Insect control (plant)	53	66	48
Herbicides	1	12	11
Fertilizer	0	4	-
Insect control (soil)	0	4	-
Land preparation	0	-	-
Planting date	50	-	-
Number of components	8	6	4
Average Index	19.8	29.2	47.6

¹Percentage of farmers using the component on their own the year following the test multiplied by the percent of their crop on which they are using the component divided by 100. The year shown is the year of the evaluation; the Tests were conducted the previous year in each case.

Source: Busto Brol, et al. (1976a), Ruano (1978) and Chinchilla and Hildebrand (1979b).

This table clearly demonstrates that farmers are very selective of the technology components they choose. Early in the life of ICTA, a complete technological package was being recommended. Gradually the number of components was reduced and the index of acceptability increased accordingly. The increase in the average index can be attributed to three factors. One is the reduction in number of components. Second, as more was learned about the farmers, remaining components were modified to be more appropriate to their conditions. Third, ICTA's methodology improved so farmers were more aware of the technology being tested and were more involved in evaluation. That is, the method of conducting "Farmers' Tests" improved over this period of years.

That this index of acceptability does differentiate the farmers' opinions regarding acceptability is shown by the following table taken from farm records in the same area, but not necessarily from the same farmers who participated in the Tests.

Table 3. Technology Used in Maize in La Máquina, Guatemala, 1975 to 1978.
(Percent of area in maize)

Technology Component	1975	1976	1977	1978
Improved seed	45	60	59 ¹	85
Insect control (plant)	57	74	78	103
Herbicides	1	0	0	0
Tractor cultivation	NA	35	40	49
Fertilizer use	1	5	1	0
Insect control (soil)	0	2	0	0
Number of cases	20	49	46	25
Area in maize (has)	237	574	566	318
Average yield (kg/ha)	1,948	2,078	2,013	2,324

¹ Does not follow trend because seed imports from Nicaragua were stopped due to an outbreak of coffee rust in that country.

Source: Busto Brol and Calderón (1975), Busto Brol et al. (1977), Guerra, et al. (1978) and Gonzalez, et al. (1979).

The use of herbicides, fertilizer and control of insects in the soil all received very low indices (Table 2) and all are completely rejected by the farmers for use on their own crops (Table 3). The use of improved seed and control of insects on the plants received high indices and are being used by the farmers on a large scale. Following is a list of crops and areas for which evaluations have been made.

Table 4. Crops and areas for which evaluations of acceptability have been made by SER/ICTA, 1976 to 1978

Year	Area	Region	Crop or crop system evaluated	No. of Components	Average Index
1976	La Máquina	IV	Maize	3	19.8
	Quezaltenango	I	Maize	7	19.3
	Jutiapa ¹	VI	Maize	5	16.8
			Beans	5	2.0
			Sorghum	3	0.5
1977	Quezaltenango	I	Maize	9	14.5
			Wheat	3	44.0
	La Máquina	IV	Maize	6	29.2
1978	Quezaltenango	I	Maize	7	32.4
	La Máquina	IV	Maize	4	47.6
			Sesame	1	80.0
	Jutiapa ¹	VI	Beans	7	8.0

¹Not published

Source: Published and unpublished reports SER/ICTA.

The evaluation of impact is being accomplished through the use of the farm records being kept in each one of the work areas. There are not enough resources in the Institute, nor especially in SER, to conduct the census type survey that would be required periodically to monitor impact and use of technology on a more adequate basis. However, it is felt that the data accumulated over time from the farm records sufficiently demonstrate trends in adoption of the

technology being utilized and is an appropriate substitute for a benchmark study and follow-up studies for which the Institute has inadequate resources.

A study conducted in 1978 demonstrates the capability of the farm records to provide information for evaluation of technology. This study, based on three years of farm records in La Maquina shows that improved seed and control of insects on the plants were the technologies influencing crop yield, and also quantified their effect on the increasing yield that was being achieved in the area (Pelaez and Shiras, 1978).

CALCULATOR SERVICES AND STATISTICAL CONSULTING

SER "acquired" primary responsibility for providing calculator services to the Institute and also has provided a great deal of statistical consulting since the beginning. Initially, we obtained a contract with IBM for computer services and used their facilities for several analyses during the first two years. In particular, the Bean Program utilized the analysis of variance and regression programs that I brought with me from El Salvador.

However, it soon became evident that with the increasing capacities of the hand-held, programmable calculators, much more efficiency could be achieved using them than trying to depend on the computer. We first obtained the Hewlett Packard 65 in 1975 and were able to program it for many of the analyses that were being done by the technicians at that time. Later we acquired the HP-67 with a great deal more capacity for which we wrote programs for more complicated analyses and also to analyze the farm records. With the purchase of a TI-59, we were able to expand, once again the analyses we are able to undertake.

At the present time, ICTA has two HP-65's, three HP-67's and one TI-59. The HP-65's, one HP-67 and the TI-59 are located in SER where the technicians

come to use them and where they can consult with us at the time. One HP-67 is with the Bean Program and one is at the regional office in Region I, Quezaltenango.

The advantages of using the hand-held calculators are tremendous. First, this way the technician can make his own analyses without having to invest a great deal of time laboriously doing the calculations on a standard calculator. He also does not need to depend on others to code, punch, run and interpret results which is common in institutes that depend upon computers for their analyses. Secondly, by knowing beforehand the capacity of the calculators, the experimental design can be adjusted, keeping the nature of the trials simpler and easier to analyze and understand. Third, it is much more rapid to do the analyses in the field directly from field books and save the time of coding, punching, verifying, etc., inherent in the use of the electronic computers.

At the present time, SER has the following programs available for the HP-67 and TI-59 calculators:

1. Analysis of variance (Anova), split plots, without limits
2. Anova, randomized blocks, up to 6 replications, no limit on treatments
3. Missing plots, randomized blocks, up to 6 missing plots
4. Anova, without limits
5. Multiple regression, 3 independent variables
6. Multiple regression, 5 independent variables
7. Quadratic regression, 2 independent variables, with interaction
8. Linear, exponential and quadratic regression for one independent variable
9. Duncan's analysis
10. Tukey's analysis

11. Yates method
12. Farm record analysis for labor
13. Farm record analysis for inputs
14. Several different programs for converting plot data to kg/ha.

Two people in the Institute have the capacity for programming these machines (one in SER and one in Region I) so the technology will continue to be used. Also, plans are being made to purchase at least one calculator for each of the regions next year.

BUDGET SUPPORT

The personnel budget varied greatly during the five years, and is not an accurate reflection of support to Socio-economics because some were budgeted to other units, some as part of training, and some had contracts rather than regular appointments and were also budgeted separately. Therefore, staff budget is not reported here. Rather, a complete list of personnel is presented in Appendix B.

For the central unit in Guatemala City, non-personnel services, materials and supplies, and machinery and equipment did, however, vary significantly during the five years, Table 5.

In general, budget support was adequate for the staff located in Guatemala City. One of the major problems was that most of the time the budget was not approved before work had to begin in the year. Many years we had to initiate work only hoping that we would have the personnel requested, but not being certain.

One of the most difficult budget problems involved SER Staff located in the regions. In 1977, the Perito Agronomos were transferred to the regions and the budget that was deleted from the Central SER group was supposed to be added to

Table 5. Budget support for SER (excluding personnel) Central Unit, Guatemala City, 1976-1979. (Current Dollars)

Item	1976	1977	1978	1979
<u>Non-personnel services</u>	<u>\$12,085</u>	<u>\$ 3,802</u>	<u>\$ 5,760</u>	<u>\$ 6,070</u>
Per diem, in country	10,560	2,772	4,800	4,800
All other categories	1,525	1,030	960	1,270
<u>Materials and supplies</u>	<u>10,965</u>	<u>5,972</u>	<u>4,966</u>	<u>5,016</u>
Gas and oil	7,265	4,500	2,951	2,951
All other categories	3,700	1,472	2,015	2,065
<u>Machinery and equipment</u>	<u>7,420</u>	<u>5,000</u>	<u>110</u>	<u>xxx</u>
Vehicles and motorcycles	6,100	5,000	xxx	xxx
Office equipment	1,320	xxx	110	xxx
Total excluding personnel	30,470	14,774	10,836	11,086

the regional budgets. This, however, was never accomplished so that we were put in the position of begging from the other regional programs. Funds were already tight and the need to share with SER did little to create goodwill for the discipline.

In 1977 and again in 1978, attempts were made and orders given to the Regional Directors to create specific budgets for SER regional personnel, but that was never accomplished. The result was that the Regional Directors, seeing that the SER personnel were budgeted through their regional Technology Testing Teams, wanted to use them as if they were their own staff. Obvious conflicts arose as to the nature of the work that they should be undertaking.

In 1979, even though they are still being budgeted as part of the Technology Testing Teams of the regions, there is a much better understanding of the nature of their work and they are, in fact, completely integrated into the regional teams as reported in other sections of this report. All have responsibility for some Farm Trials or Farmers' Tests and other technicians help them with Farm Records. Generally, budget is shared on an equitable basis by all the technicians in a Region or Sub-region.

It is evident, though, that budgeting procedures can have important positive and negative effects on attempts at integration of the social sciences with the biological sciences in an agricultural institute.

GENERAL COMMENTS

What were the real accomplishments during this five year period? Was the investment in time and funds worthwhile from The Rockefeller Foundation's point of view, from that of the Guatemalan government and of ICTA, and from the point of view of the small, traditional farmer of Guatemala? I think the answer is "yes" for most. Can one say that the social sciences were, indeed, incorporated into an agricultural institute? If so, has this helped the agronomists provide appropriate technology to the small and medium farmers more efficiently and in a shorter period of time than would have been the case had the Institute not chosen to try to incorporate the social sciences into agricultural research methodology? Here, I think the answer is a very definite "yes." What does the future hold for the social sciences in ICTA? It depends.

To answer these questions, it is difficult, if not impossible to single out the social sciences and say this or that occurred because of the social sciences. As mentioned in the Prologue, the results are not due to the efforts of one or a few persons. Rather they represent the combined effect of the efforts of everyone who was involved. There is at least as much interaction effect among people with different points of view and from different disciplines as there is among the factors affecting plant and animal production. Still, it is possible to discuss what has happened during the time the social sciences were playing a strong role in the Institute.

Now, for the first time, the small farmer has really become a partner in the technology generating process. He does not have to be satisfied any longer with whatever crumbs sift down from "above" but is having an influence on what is being done "above." Though small farmers in

Guatemala are only just beginning to feel the effects of the Institute on their productivity and income, I think most of those who have been touched by the process would be in favor of the "experience in social sciences."

Certainly, considering the farmers from the beginning of the technology generating process has increased the speed and efficiency with which the Institute produces technology appropriate to them. The probability of spending several years producing a new variety that has very limited geographical adaptability or that is rejected for not having characteristics important to the producers is greatly reduced under the methodology that has been developed.

ICTA, itself, still has certain reservations about the "social science experience." Not all are convinced it has been positive. Some technicians feel that it is not necessary to consider the farmer's point of view. They feel that a technology that increased production is good in and of itself. This is now a minority opinion, but it does still exist. Unfortunately, the controversy that was created in the integration process has been misinterpreted by some from ICTA and has been associated with the social scientists, themselves, or with the social sciences in general. This is a negative effect that may or may not ever be solved. But in balance, I think that the prevailing opinion at the present time is that the contribution of the social sciences during this period has been positive and the value of the integrated methodology is felt.

It is more difficult to interpret the Government of Guatemala's point of view. First, the government has changed since the activities of the Institute were initiated. Policy changes influence how they view the Institute. Secondly, it is difficult for the government to evaluate the

"impact" of a research institute. Many times this can lead to doubts about its usefulness or productivity simply because of the measurement problem.

Perhaps the greatest effect of the "social science experience" has been at the international level. The Rockefeller Foundation is more interested in this aspect than are the other groups and I think they should be well satisfied with the international recognition and "replicability" of this experience. ICTA has taken some pride in their role in developing a methodology with a strong international implications and recognition, but again, this pride is not unanimous in the Institute.

Has the social science experience led to the integration of the social sciences into the Institute? Of this there is no doubt. It is evident from the technicians' analyses of research results. It is evident from the information used and discussed by the technicians as they evaluate and plan their research program and projects. It is evident from the demand for Sondeos from the Technology Testing Teams, the Regional Directors and the Technical Director. It is evident from the nature of the methodology in general. It is even evident from the general attitude of most of the technicians in the Institute toward their work and toward the farmers for whom they work. Yes, the social sciences definitely have infiltrated the Institute.

What then, are the long-run prospects for the social sciences in ICTA? This, too, is difficult to answer. During 1979, besides the author, SER lost an anthropologist (M.A.) and a sociologist (B.A.). Another anthropologist is out of the country studying toward an M.S. degree and will not return for another year. This leaves one agricultural economist (M.S. level), one agronomist (Ing.) with less than 2

year's experience and a new agronomist (Ing.) in the unit. One position was vacant at the time the author left the country, and because of the scarcity of social scientists in Guatemala, will probably also be filled by an agronomist. In addition, the position occupied by the author had not been budgeted either for 1979 or 1980, so the unit is suffering from a net reduction of one position.

During the course of the 5 years, we experimented both with a centralized organization in SER and with regionalization. It was always hoped that we would be able to regionalize, but maintain a professional core at the national level for supervising, consulting and the provision of specialized expertise when required in any of the regions. Because of budget restraints, this never came about (other than with respect to the non-professional level Peritos). It was finally decided to maintain a centralized unit with each person having regional and subject matter responsibilities. Now it appears that the unit will be broken up and only the Coordinator will remain at the national level. The advantage is having more constant SER input at the regional levels. The disadvantage, and danger, is that this will dilute SER efforts. My fear is the combined effect of the loss of most social scientists in SER with the decentralization of the unit will gradually diminish their impact over time, providing an environment in which the agronomists will slowly revert to their more traditional methodology and new staff who have never been exposed to the social sciences begin to have influence on the decision making process of the Institute.

Appendix A

LIST OF VISITORS BY INSTITUTION¹

<u>Institution</u>	<u>Name</u>	<u>No. of Visits</u>	<u>Comments</u>
Rockefeller Foundation	* Joseph E. Black	(4)	
	Mary M. Kritz		
	* Ralph W. Cummings, Jr.	(2)	also as IADS
	* Ed Wellhausen		
	* John A. Pino	(2)	
	Sue W. Almy		
	Larry D. Stifel		
Woodward Wickham			
	Kirby Davidson		
CENTA	* Tito French	(2)	
	* Frank Calhoun		also with UFLA
	* Jesus Velez Fortuno		"
	* Tom Burton		"
	* John Bieber		"
	Tom Walker		"
Ford Foundation	Wes Craig		
	Santiago Friedman		
	Reed Hertford		
CIAT	John Nickel	(2)	
	Eduardo Alvarez		
	* Mario Infante		
	Alberto Valdez		
	* Fernando Fernandez		
	Alex Grobman		
Iowa State University	Harry Wing		
	Lehman Fletcher		
National Ag. Committee, Nicaragua	Rafael Samper		
	Ernesto Davila		
UFLA	* Chris Andrew	(6)	
	* Max Langham		also ADC
	* Jose Alvarez		
AID	Ron Tinnenmeier		
	* Ken McDermott	(5)	
	Leo Hessar		
	Howard Steele		
	Duane Jelinek		
	Jim Riordan		
U. Minnesota	* Leo Langer		

<u>Institution</u>	<u>Name</u>	<u>No. of Visits</u>	<u>Comments</u>
Standard Fruit	* Homer Eaton David Sauerwine Jorge Gonzalez		Vice President Dir. of Research Horticulturalist
CIMMYT	Don Winkleman	(2)	
Michigan St. U.	* Dale Harpstead Leonard Kyle Kim Wilson		
IADS	Hugo Manzano Jack Traywick S.N. Lohani		Nepal also IDIAP Nepal
CATIE	* Rufo Bazan * Jorge Soria Damon Boynton Joe Saunders Myron Shenk Pedro Oñoro Ed Locatelli Benjamin Quijandria	(2)	
OAS	Claudio A. Oddone		
Cornell U.	William F. Whyte Jim Converse Foster Cady	(2)	
LIFE	Hugh Roberts		
Rodale Press	Richard Hardwood	(2)	
Stanford	Bruce Johnston		
CIP	Doug Horton Raymond Meier Robert Werge		
FAO	Arnold Van Huis		
USDA	Ken Laurent		
Texas A & M	Warren Barham		
ICRD	Ed Weber		
IRRI	Hubert Zandstra		
Acad. for Educ. Dev.	Richard Tenney		
Purdue	Roy Bronson	(2)	
U. Wisconsin (Green Bay)	Emil Haney		

45

<u>Institution</u>	<u>Name</u>	<u>No. of Visits</u>	<u>Comments</u>
IDIAP/Panama	Damaris Chea		
PNIA/Honduras	Dan Galt Joshua Posner		
Wayne State U.	Carol Browner		
CID	Bill Shaner Bill Schmehl Perry Phillips		
U. Arizona	Doug Williams		
Brockport State U. (New York)	Sherwood Lingenfelter		

1 Institutions in order of first appearance.
Persons in order of first arrival.

* Visitors to the La Barranca site.

Appendix B

LIST OF STAFF OF SOCIOECONOMICS, ICTA

Through July 31, 1979

<u>NAME</u>	<u>POSITION</u>	<u>ENTER</u>	<u>LEFT</u>	<u>TO WHERE</u>
Miriam Morales de Lopez	Secretary	15/6/73	26/12/74	Frijol/ICTA
Carlos E. Reiche C.	Economist	1/3/74	to present	
Amalia Corisco G.	Sociologist	1/4/74	31/12/76	Pvt. Business
Peter E. Hildebrand	Ag. Econ.	25/10/74	to present	
Sergio Rolando Ruano A.	Anthropologist	29/11/74	to present	
Lidia Ines Tujab M.	Bilingual Secy.	27/12/74	to present	
Bruno Busto Brol	Ag. Eng.	16/1/75	15/1/77	Reg. Dir.VI, ICTA
Essau J. Samayoa G.	Perito Agron.	5/3/75	to present	
Jose Angel Andrade	Driver	5/3/75	25/2/76	Pvt. Business
Osman Alfredo Calderon A.	Perito	17/5/75	12/10/77	Station Mgr. ICTA
Jaime T. Tyld W.	Chemist	1/6/75	17/10/77	Soils - ICTA
Carlos de Leon Prera	Ag. Eng.	1/4/74	19/7/77	BID
Roberto Bosarreyes G.	Driver	23/7/75	to present	
Rolando Duarte Mendez	Anthropologist	1/10/75	15/6/79	INCAP
Gilberto Santa Maria	Ag. Econ.	1/11/75	13/5/76	Univ. San Carlos
Thelma Reyes de Guerrero	Secretary	17/11/75	to present	
Roberto Guillermo Loranca	Perito Agr.	1/12/75	14/3/76 +	Died
Daniel Jose Cardona B.	Perito Agr.	21/1/76	to present	
Victor Manuel Corzantes	Driver	16/3/76	1/7/76	Gerencia, ICTA
Leonel Ortiz Orellana	Perito Agr.	19/4/76	to present	
Jose Teodoro Lopez Yos	Perito Agr.	17/5/76	23/4/78	Tech. Testing V, ICTA
Leonzo H. Godinez	Perito Agr.	1/6/76	to present	
Luis Pando Canella	Ag. Econ.	1/10/76	28/4/77	Pvt. Business
Miguel Angel Garcia	Perito Agr.	16/12/76	to present	
Hector Manfredo Orozco	Perito Agr.	3/1/77	1/1/78	Tech. Testing I, ICTA
Esau Guerra Samayoa	Perito Agr.	16/2/77	16/2/79	Tech. Testing I, ICTA
Jose Hoffman	Ag. Econ (PCV)	2/1/77	1/7/77	U.S.
Marco Tulio Palma Espina	Perito Agr.	1/3/77	7/11/78	Pvt. Business
Jose Guillermo Pelaez	Ag. Eng.	1/3/77	to present	
Denis Amory Barrientos	Perito Agr.	1/3/77	31/7/77	Coffee Rust Prog.
Humberto R. Castaneda M.	Ag. Eng.	10/5/77	29/12/77	Univ. San Carlos
Axel Esquite Catillo	Perito Agr.	16/8/77	15/2/78	INCAP
Perfecto Apolonia Gonzalez	Perito Agr.	17/10/77	to present	
Maria E. Chinchilla M.	Sociologist	16/11/77	to present	
Peter Shiras	Ag. Econ.	2/1/78	15/7/78	U.S.(U. of Cornell
Julio Cesar Leal	Perito Agr.	1/2/78	to present	
Jorge Alfredo Cardona	Perito Agr.	1/2/78	to present	
Christina Gladwin	Ag. Econ.	1/8/78	31/8/79	U.S.(Northwestern
Santos Garcia	Perito Agr.	16/2/79	to present	
Valerio Macz Pacay	Perito Agr.	15/10/76	15/1/78	DIGESA
Sandra Calderón	Ag. Eng.	16/8/79	to present	

11

Appendix C

LIST OF PUBLICATIONS

1975 to August 1979

1975

Busto Brol, Bruno. 1975. Pasos sugeridos para que el Instituto de Ciencia y Tecnología Agrícolas pueda tomar en consideración las solicitudes de organizaciones interesadas en obtener asistencia técnica. ICTA, Guatemala.

Busto Brol, Bruno y Osman Calderón. 1975. Registros económicos de producción con agricultores colaboradores del parcelamiento La Máquina. ICTA, Guatemala.

Busto Brol, Bruno; Esau Samayoa y Osman Calderón. 1975. Evaluación del maíz ICTA Tropical 101 en varias plantaciones de la República de Guatemala. ICTA, Guatemala.

Corisco, Amalia; Bruno Busto Brol y Sergio Ruano. 1975a. Evaluación del trabajo del Instituto de Ciencia y Tecnología Agrícolas en la Cooperativa Santa Lucía R.L., Departamento de Sololá y con el Programa de Vecinos Mundiales, Departamento de Chimaltenango. ICTA, Guatemala.

Corisco, Amalia, Gilberto Santamaria y Rolando Duarte. 1975b. Evaluación de la Fundación del Centavo. ICTA, Guatemala.

Hildebrand, Peter E. 1975a. El papel de socioeconomía rural en el Instituto de Ciencia y Tecnología Agrícolas. ICTA, Guatemala.

_____. 1975b. Multiple cropping systems are dollars and "sense" agronomy. Invited paper presented at the Multiple Cropping Symposium, American Society of Agronomy Meeting. Knoxville, Tenn.

_____. 1975c. Sistemas de producción agrícola y proyectos de reforma agraria. Presentada en la 9a Reunión Anual de los Institutos de Reforma Agraria de Centroamerica. ICTA, Guatemala.

Hildebrand, Peter E., Carlos E. Reiche y Esau Samayoa. 1975. Sistemas de cultivos de ladera para pequeños y medianos agricultores, La Barranca, Jutiapa. ICTA, Guatemala.

Reiche, Carlos E., Peter E. Hildebrand y Sergio Ruano. 1975. Evaluación de algunas variedades de sorgo (maicillo) en pequeñas y medianas fincas del oriente de Guatemala. pp. 329-372 In Programa Cooperativo Centroamericano para el Mejoramiento de Cultivos Alimenticios (PCCMCA) Vol. II. San Salvador, El Salvador, C.A.

- Ruano A., Sergio R. 1975a. Terminología agrícola del sur-oriente de Guatemala. ICTA, Guatemala.
- _____. 1975b. Análisis económico en ensayos comparativos del uso de raciones con Maíz Opaco 2 y Maíz Común, en cerdos de engorde, realizado en la Aldea Tiucal del Municipio de Asuncion Mita. ICTA, Guatemala.
- _____. 1975c. El Altiplano, ¿una zona maicera en el futuro? ICTA, Guatemala.
- _____. 1975d. Razonamiento del enfoque del trabajo del ICTA hacia el pequeño y mediano agricultor. ICTA, Guatemala.
- 1976 Busto Brol, Bruno; Osman Calderón y Peter E. Hildebrand. 1976a. Evaluación de la aceptación de la tecnología generada por ICTA para el cultivo de maíz en el parcelamiento La Máquina, 1975. ICTA, Guatemala.
- _____. 1976b. Registros económicos de producción con agricultores colaboradores del Parcelamiento "La Máquina". In Informe Anual 1975-76. ICTA, Guatemala.
- Corisco, Amalia. 1976. La influencia de la mujer en la producción y comercialización agrícola en el área del altiplano central. ICTA, Guatemala.
- Hildebrand, Peter E. 1976a. Multiple cropping systems are dollars and "sense" agronomy. Chap. 18 In Multiple Cropping. American Society of Agronomy Special Publication No. 27. Madison, Wisconsin.
- _____. 1976b. Generando tecnología para agricultores tradicionales: una metodología multidisciplinaria (Generating technology for traditional farmers: a multidisciplinary methodology) preparado para presentarlo en la conferencia sobre: Desarrollo de economía en regiones agrícolas: Búsqueda de una Metodología. Centro de Conferencias de la Fundación Rockefeller. Bellagio, Italia. ICTA, Guatemala.
- Reiche, Carlos E., Peter E. Hildebrand, Sergio Ruano y Jaime T. Wyld. 1976. El pequeño agricultor y sus sistemas de cultivos en ladera: Jutiapa, Guatemala. ICTA, Guatemala.
- Ruano A., Sergio R. 1976. Estudio antropológico de la producción porcina una importante actividad en la economía del campesino de Jutiapa. ICTA, Guatemala.
- 1977 Busto Brol, Bruno, Osman Calderón y Peter E. Hildebrand. 1977. Registros económicos de maíz con agricultores colaboradores del parcelamiento La Máquina, 1976. ICTA, Guatemala.

- De León Prera, Carlos; Jaime T. Wyld y Peter E. Hildebrand. 1977. Alcance geográfico de los sistemas de cultivo en el área piloto del ICTA, Region VI 1975. ICTA, Guatemala.
- Díaz Sch., Roberto. 1977. Situación agro-económica de las pequeñas explotaciones de ladera. Jutiapa, Guatemala. ICTA, Guatemala.
- Duarte, Rolando. 1977. Tecnología y estructura agro-socioeconómica del minifundio, Totonicapán. ICTA, Guatemala.
- Duarte M., Rolando; Peter E. Hildebrand y Sergio Ruano. 1977a. Tecnología y estructura agro-socioeconómica del minifundio del occidente de Chimaltenango. ICTA, Guatemala.
- Duarte, Rolando; Sergio Ruano, Ildeberto Martínez, Emilio Merck y Amado Navarro. 1977b. Estudio preliminar sobre las condiciones agro-socioeconómicas del parcelamiento Montúfar, Jutiapa. ICTA, Guatemala.
- Godínez, Leonzo H., Luis M. Pando y Peter E. Hildebrand. 1977. Registros económicos de producción con agricultores colaboradores en el sistema maíz-sorgo y cultivos de maíz y sorgo solo, en plano, Asunción Mita, Jutiapa. 1976. ICTA, Guatemala.
- Hildebrand, Peter E. 1977a. Generating small farm technology: an integrated, multidisciplinary system. An invited paper (principal address) for the 12th West Indian Agricultural Economics Conference, Caribbean Agro-economic Society. April 25-30, In Antigua. ICTA, Guatemala.
- _____. 1977b. Consideraciones socioeconómicas en sistemas de cultivos múltiples. Un informe solicitado para la Mesa Redonda sobre sistemas de producción agrícola XVI Reunión Anual de la Junta Directiva. Instituto Interamericano de Ciencias Agrícolas IICA. Santo Domingo, República Dominicana. ICTA, Guatemala.
- Hildebrand, Peter E. y Daniel Cardona. 1977. Sistemas de cultivos de ladera para pequeños y medianos agricultores, La Barranca, Jutiapa, 1976. ICTA, Guatemala.
- Hildebrand, Peter E., Sergio R., Ruano A., Teodoro López Yos, Esau Samayoa y Rolando Duarte. 1977. Sistemas de cultivos para los agricultores tradicionales del occidente de Chimaltenango. ICTA, Guatemala.
- López, José Teodoro, Sergio Ruano, Rolando Duarte y Peter E. Hildebrand. 1977. Registros económicos de producción con agricultores colaboradores del occidente de Chimaltenango, 1976. ICTA, Guatemala.

- Ortíz O., Leonel, Peter E. Hildebrand y Luis M. Pando C. 1977. Registros económicos de producción en: maíz-frijol-sorgo; maíz-sorgo; maíz-frijol; y maíz solo en ladera, Area Piloto ICTA Región VI, 1976. ICTA, Guatemala.
- Ruano A., Sergio R. 1977. El uso del sorgo para consumo humano: características y limitaciones. ICTA, Guatemala.
- Ruano A., Sergio R., Valerio Macz Pacay y Peter E. Hildebrand. 1977a. Evaluación de la aceptación de la tecnología generada por ICTA para el cultivo de maíz en la Región I, 1975. ICTA, Guatemala.
- Ruano A., Sergio R., Guillermo Valentín F. y Marco Tulio Palma E. 1977b. Estudio preliminar sobre las condiciones agro-socioeconómicas de una zona de Izabal (Sub-Región VII₁). ICTA, Guatemala.
- 1978 Cardona, Daniel; Leonel Ortíz, Peter E. Hildebrand y Jose Guillermo Peláez. 1978. Registros económicos de producción en maíz, frijol, sorgo y arroz en Jutiapa, Región VI, 1977. ICTA, Guatemala.
- Castañeda M., Humberto, Peter E. Hildebrand y Rolando Duarte. 1978. Informe de la encuesta del parcelamiento La Blanca, 1976. ICTA, Guatemala.
- Chinchilla, Maria E, Sergio Ruano A. y Peter E. Hildebrand. 1978. Evaluación de la aceptabilidad de la tecnología generada para los cultivos de maíz y trigo en Quezaltenango, 1976-1977. ICTA, Guatemala.
- Godínez, Leonzo, Miguel Angel Garcia y Guillermo Peláez, 1978. Registros económicos de producción en maíz y trigo. Quezaltenango y Totonicapán, 1977. ICTA, Guatemala.
- Guerra S., Esau, Perfecto A. Gonzalez, Hector Orozco, J. Guillermo Peláez y Peter Shiras. 1978. Registros económicos de producción en: maíz, ajonjolí y arroz, La Blanca, La Máquina y la Nueva Concepción. 1977. ICTA, Guatemala.
- Hildebrand, Peter E. 1978a. An integrated approach to the improvement of farm production systems. Presented at the Seminar on the Improvement of Farm Production Systems. Sponsored by the Club du Sahel. Bamako, Mali 20 Feb-1 March. ICTA, Guatemala.
- _____. 1978b. Motivating small farmers to accept change. Prepared for presentation at the conference on: Integrated crop and animal production to optimize resource utilization on small farms in developing countries. The Rockefeller Foundation Conference Center, Bellagio. Italy. Oct. 18-23, 1978, ICTA, Guatemala.
- Hildebrand, Peter E. and Sergio Ruano. 1978. Integrated multi-disciplinary technology generation for small, traditional farmers of Guatemala. Presented at the Annual Meeting of the Society for Applied Anthropology. Mérida, México April 2-9. ICTA, Guatemala.

Peláez, J.G. and P.G. Shiras. 1978. Análisis de los factores que inciden en el rendimiento de maíz en el parcelamiento La Máquina, Guatemala. XXIV Reunión Anual del PCCMCA, San Salvador, El Salvador.

Peláez Guillermo, Daniel Cardona y Leonel Ortíz. 1978. Análisis agro-económico de las características de los sistemas de cultivos de maíz, frijol y sorgo en Jutiapa, Guatemala. XXIV Reunión Anual del PCCMCA. San Salvador, El Salvador.

Ruano A., Sergio R. 1978. Evaluación de la aceptabilidad de la tecnología generada por el ICTA para el cultivo de maíz en el parcelamiento La Máquina, 1976-77. ICTA, Guatemala.

Ruano Sergio; María E. Chinchilla y Peter E. Hildebrand. 1978. Evaluación de la aceptabilidad de la tecnología generada por el ICTA para los cultivos de maíz y trigo en Quezaltenango. Región I, 1976/77. ICTA, Guatemala.

Samayoa G., Esau, José Teodoro López Y, Guillermo Peláez y Peter Shiras. 1978. Registros económicos de producción en milpa (maíz, frijol, haba), trigo, papa y frijol de suelo, Chimaltenango, 1977. ICTA, Guatemala.

Samayoa, Esau; Peter Shiras y Guillermo Peláez. 1978. Registros económicos de producción de maíz y trigo en el occidente de Chimaltenango, 1977. ICTA, Guatemala.

1979

Cardona, Jorge A. 1979. Registros económicos de producción maíz, ajonjolí, sorgo, Chiquimulilla y Montufar, Región VI-3, 1978. ICTA, Guatemala.

Chinchilla, María E. 1979. Condiciones agro-socioeconómicas de una zona maicera-hortícola de Guatemala. Trabajo presentado en la XXV Reunión Anual del PCCMCA, Tegucigalpa, Honduras, 19-23 de marzo, 1979.

Chinchilla María E, y Peter E. Hildebrand. 1979a. Evaluación de la aceptabilidad de la tecnología generada para el cultivo de maíz en Quezaltenango, 1977-1978. ICTA, Guatemala.

_____. 1979b. Evaluación de la aceptabilidad de la tecnología generada para los cultivos de maíz y ajonjolí en el parcelamiento La Máquina, 1977-1978. ICTA, Guatemala.

García, Miguel, A.; Leonzo Godínez y María E. Chinchilla. 1979. Registros económicos de producción, Quezaltenango y Totonicapán, Región I, 1978. ICTA, Guatemala.

González Perfecto A.; Esau Guerra y Julio C. Leal. 1979. Registros económicos de producción en maíz, ajonjolí y arroz, La Blanca, La Máquina y La Nueva Concepción, 1977. ICTA, Guatemala.

52

Hildebrand, Peter E. 1979a. Generating technology for traditional farmers - the Guatemalan experience. Prepared for presentation in the symposium on Socioeconomic constraints to crop protection. IX International Congress of Plant Protection, Washington, D.C., August 5-11, 1979. ICTA, Guatemala.

_____. 1979b. The ICTA farm record project with small farmers - four years of experience. ICTA, Guatemala.

_____. 1979c. Summary of the sondeo methodology used by ICTA. ICTA, Guatemala.

ICTA. 1979. Condiciones agro-socioeconómicas de una zona maicera-hortícola de Guatemala. Informe de un sondeo.

ICTA. 1979. Condiciones agro-socioeconómicas de tres áreas paperas de Quezaltenango -Informe de un sondeo.

ICTA. 1979. Condiciones agro-socioeconómicas del proyecto de riego-Zacapa - Informe de un sondeo.

ICTA. 1979. Condiciones agro-socioeconómicas de una zona manzanera en Chichicastenango, El Quiche. Informe de un sondeo.

Ortiz Orellana, Leonel. 1979. Prueba agro-económica de tecnología arrocera por agricultores en Jutiapa, Guatemala. Presentado en la XXV Reunión Anual del PCCMCA, Tegucigalpa, Honduras, 19-23 de marzo, de 1979.

Ortiz Leonel y Daniel Jose Cardona. 1979. Registros económicos de producción maíz, frijol, sorgo y arroz Jutiapa Región VI, 1978. ICTA, Guatemala.

Palma, Marco Tulio y José Guillermo Peláez. 1979. Registros económicos de producción en: maíz, frijol y arroz Izabal Región VII, 1977. ICTA, Guatemala.