THE RESULT DEMONSTRATION IN ACHIEVING ADOPTION AMONG SUBSISTENCE FARMERS

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ABSTRACT

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By

Earl W. Threadgould

The present study investigated two main areas: 1) to what extent subsistence farmers have adopted practices introduced through a result demonstration, and 2) to what extent certain variables are related to the adoption of farm practices both before and after farmers established the demonstration.

The research was undertaken in El Salvador, Central America, where the Agricultural Extension Service has been administering a result demonstration program since 1965. An area random sample of farmers establishing corn demonstrations in 1966 was selected. These farmers were interviewed in 1970. They were asked which practices they were presently using and which ones they had used in 1966. The adoption of the four introduced practices--hybrid corn, formula fertilizer, nitrogen fertilizer, and insecticide--was the dependent variable in this study. Adoption was correlated with size of planting, landownership, contact with extension, education, literacy, credit obtained and lack of credit problems. These were the independent variables in the study.

The four practices introduced in the program were being used in each case by over 73 percent of the farmers in the sample during the 1970 growing season. In 1966 only 25

percent or less were using each practice.

It appears that the obtaining of credit is significantly correlated with adoption. If a farmer can obtain the means to adopt the practices, he will. Over 96 percent of the farmers said they were convinced in the use of the introduced practices. When asked to state their problems during the last five years, credit was mentioned more than any other item and by more than 59 percent of the sample.

Literacy, education, size of planting, extension contact and landownership were also significantly related to adoption in 1970. Lack of credit problems was not significantly related to adoption. It appears that the farmers who economically and educationally could adopt the introduced practices, did so.

Four of the above variables were correlated with adoption in 1966. Only size of planting was significantly related to adoption in that year.

The average size of planting increased for the farmers in the sample between 1966 and 1970. Even though land was scarce they were planting more land to corn in 1970. The average yield for the farmers in the survey was about 19 cwt. per "manzana" in 1966. By 1970 this average had almost doubled to 37 cwt. per "manzana." The 1966 figure was close to the national average and the 1970 figure was considerably above the national average for 1969.

Thus these demonstration farmers were both adopting the introduced practices and raising their production levels.

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Earl W. Threadgould

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CHAPTER I

INTRODUCTION

Problem

There are many possible ways to reach people with information about new ideas and practices. In broad area studies of the diffusion of innovations, much has been learned about how people adopt these new ideas and practices. Much remains to be learned, however. There are many possible methods available to a change agent for use in communicating new innovations. These methods can be divided into three broad categories: individual contacts, group contacts, and mass media contacts.

Of the many possible individual contact methods, the result demonstration has been used to a great extent both in the United States and abroad to show farmers the advantages of new agricultural practices. It has not been sufficiently evaluated in the developing countries with respect to its effectiveness in securing adoption among the hard-to-reach rural farmers with scarce resources living on subsistence-type farms.

The specific problems that this study investigates are: 1) to what extent have developing-country farmers establishing demonstrations adopted those same practices; and 2) to what extent are certain variables related to adoption of those introduced practices both before and after the farmer

established the demonstration? The specific case we will examine is a "Massive Fertilizer Demonstration Program" in El Salvador.

Adoption and the Demonstration Method

There is an extensive body of diffusion-adoption research knowledge available supporting planned change as a viable approach to helping developing countries. This same research points to methods such as the result demonstration as being useful for diffusion of new practices.

An understanding of at least some of this research is important as background for the subject of research for this thesis--a particular result demonstration program in El Salvador.

A summary is presented in the following section of studies in the area of diffusion of innovations as it is related to the result demonstration method.

Introducing Peasants to Change

According to Rogers (1969:21) at least three-fourths of the population in the less developed countries are peasants. In Asia, Africa and Latin America there are 1.75 billion peasants. These people are characterized by a very low level of living and frequently are landless workers dependent on the large landowners for their subsistence. They consume almost all of the food and fiber which they produce (Rogers 1969:20). In effect the peasant is not actively participating in the economy of the country or area where he resides.

He is concerned with mere subsistence. He might sell a few crops to receive a little money but this money is used to purchase a few goods which maintain his subsistence (Wolf in Rogers 1969:21).

Many peasants continue to produce and subsist year after year, generation after generation, in the same static way (Schultz 1964). Their practices change little from generation to generation and their production remains the same or in some cases drops a little due to decreased soil fertility. Their per capita consumption might be reduced a bit because of increased life span owing to better health conditions and a decrease in infant mortality. The peasant lives in a static system.

This type of farmer does not normally try new practices. There is a certain amount of uncertainty or risk in the trial of something new. Any decrease in production results in increased hunger and suffering for the family. With the old and proven way or method they know what they can expect in terms of yield, but with new and the untried there is a certain amount of uncertainty and this is a large detriment to the adoption of new practices. If a farmer can try out a new practice on a reduced scale and evaluate it, the new practice is more apt to be adopted.

According to Schultz (1964:31) the elasticity of demand for farm foods is between 0.5 and 0.9 in the lesser developed countries. In the more developed countries it is approximately 0.2. Therefore, if farmers receive an additional unit of

income in the lesser developed countries, they will spend the majority of this on food. It can be seen from this that there still is a need for greatly increased food production in these areas and that those living in subsistence farming can and will consume more if given the opportunity.

Using the inputs that are available to them, the subsistence farmers are relatively efficient producers (Schultz 1964:37). However, they do not change their production practices. To alter this static condition of agriculture, farmers must acquire, adopt and learn to use a new set of practices and inputs that are more profitable. They continually need to learn to evaluate new practices as they become available.

If a developing country is to move forward toward modernization, the majority of its farmers must change their life style (Rogers 1969:21). Development becomes more visible the further it proceeds. Each succeeding step makes the next one easier to achieve (Galbraith in Rogers 1969:23).

How can one reach the subsistence farmer with new knowledge and convince him to adopt new practices to help him increase his production and raise his level of living?

Several strategies have been proposed and several studies have been carried out to determine what conditions and what characteristics must occur for a farmer to adopt new practices. It is useful to the change agents to identify the innovators in a community and those who will usually adopt a given practice earlier than their peers. Rogers (1969:86) defines

innovativeness as, "degree to which an individual adopts new ideas relatively sooner than his peers." Through the innovators and early adopters a change agent can introduce a new idea or innovation into the community and if certain conditions are right, it will spread to most members of the community.

Rogers (1969:292) says that innovativeness is a consequent of ten antecedents. They are: 1) literacy, 2) mass media exposure, 3) empathy, 4) social status, 5) achievement motivation, 6) educational motivation, 7) occupational motivations, 8) change agent contact, 9) cosmopoliteness and, 10) opinion leadership. The more a person possesses these qualities or characteristics, the earlier he will adopt a new practice or innovation.

Individual modernization shows that the modernization process is multi-dimensional, composed of at least three dimensions. One factor is the capacity to communicate by mass media and the individual's ability to absorb this information. The second would be a desire for change and a certain disenchantment with the present life style. Third is opinion leaders linked with change agents (Rogers 1969: 334).

In the following pages a few of the above antecedents of innovativeness will be related to the result demonstration. Using some predictors of innovativeness, one can determine some of the individuals who would be the first adopters of a practice or a package of practices.

Stages in the Adoption Process

Many studies have been completed on the adoption process. Until a few years ago the accepted model of adoption was a five-step process. Rogers (1971) has recently proposed a four-stage process model that combines the steps in the previous five-step model and also allows for rejection. Since most of the studies that have been conducted made use of the five-step process, it will be used in our analysis.

Basically the five steps are: (Rogers 1962:81)

1) Awareness stage - an individual first learns of the innovation but lacks information.

2) Interest stage - an individual becomes interested and seeks additional information.

3) Evaluation stage - the individual mentally applies the innovation to his situation and decides whether to try it or not.

4) Trial stage - the individual tries the innovation and judges its usefulness in his situation.

5) Adoption stage - the individual decides to use the whole innovation.

Sharma (1967:7), in a study conducted in India, analyzed the different sources of information for the individual at different stages in the adoption process. He compared the importance of the different channels of communication such as radio, posters, etc. with the different sources of information such as neighbor, village level worker, etc. He found that personal communication, where the source was in direct

contact with the farmer, played a more important role at each stage of the adoption process than did communication through the impersonal channels. The farmers learned more by seeing and doing. The written word in India did not appear to have the effect that it does in the more developed countries.

At the awareness stage neighbors were the most important source of information and posters, filmshows, exhibitions and general meetings were the most important channels.

At the interest stage extension agents (local, area and college) were the most important sources. Radio, printed matter and general meetings were the most important channels.

At the evaluation stage an individual is more apt to seek the advise of his neighbors, followed by village level workers and then village leaders.

During the trial stage the extension agents were again the most important sources of information for the local farmers.

Sharma's study suggests that personal experience is the most significant single factor in determining the decision to adopt a new practice. In agreement with this, Rogers (1969:129) found that interpersonal channels of communication were of prime importance in every stage or function in the innovation decision process. Mass media channels are less important at every stage in the innovation decision process than interpersonal channels of communication and were no more important than interpersonal channels in creating knowledge of innovations and for earlier adopters than for

later adopters. (Early adopters usually have more sources of mass media exposure than do later adopters.)

The farmers in Colombia, in reporting their adoption of 2-4-D weed spray (Rogers 1969:132), reported that interpersonal cosmopolite channels were more important in creating technical knowledge about the innovation but that interpersonal localite channels were more important in changing attitudes toward the weed spray. Even though they gained their knowledge or at least some information about the innovation (2-4-D weed spray) from others than their immediate peer group, the Colombian farmers needed local peer group reinforcement before deciding to adopt the innovation. This role played by the cosmopolite sources of information is more the "how to" type of information and is used at the trial stage. Cosmopolite sources are also important at the awareness stage. Rahudhar (1958: 133) found that in India neighbor-to-neighbor communication was of greater importance in the diffusion of farm innovations than any other communication channel.

Therefore, it can be shown that even though cosmopolite sources of information are important at the awareness and trial stages, localite sources of information are of greater importance in the diffusing of an innovation throughout a community. This is of particular importance in the effects of the result demonstration program where the objective of the program is the creation of mass awareness and adoption of improved farming practices. The result demonstration program paves the way for innovations to gain an entrance into the

community, whether or not any of the farmers had tried the innovations beforehand. Several members of the community who have the demonstration and the others who do not have, hear of the new practices relatively early in comparison with normal communication channels. By exposing many farmers to a direct experience and giving others an opportunity to see the results, the adoption process in the community can be accelerated by the change agency.

Channels of Communication

In many developed societies, mass media influence the innovators or first adopters of an innovation and these people in turn serve as opinion leaders to others (Rogers 1969:221). This is known as the two-step flow of information.

Mass media channels of information do not achieve the same results for subsistence farmers as they do in the more developed countries. The farmers are not able to assimilate mass media communication. They also do not come in contact with as much mass media communication as in more modern societies. In the lesser developed countries communication is carried on mainly through personal contact or by word of mouth (Amend 1970:30).

Rogers (1969:116) suggests that the role of the mass media may be to set a climate for modernization rather than expose the farmers to the specific details needed for the adoption of an innovation. Thus, mass media might be useful in gaining awareness of an idea and interpersonal communication might be used to finally convince the farmer of the

benefits of the practices. When the mass media and interpersonal communication are used in complementary roles, this formula could prove to be the best force in the modernization process.

Opinion Leaders

In many areas of directed contact change, the opinion leader plays a vital role in the dissemination of new information and in influencing the individual's decision to adopt. Rogers (1969:223) states that "opinion leadership is the ability to influence another's opinions consistently in the desired manner." In order to bring about change, opinion leaders should be contacted first. They can then directly or indirectly influence the rest of the population. Once ten to twenty percent of a population has been influenced to adopt a particular innovation it may be impossible to retard its further spread (Havens & Rogers 1961:409). This can be referred to as the interaction or snowball effect. Stated in another way, it is the process through which individuals in a social system who have adopted a particular innovation tend to influence the individuals who have not adopted it (Rogers 1962: 138). Ryan and Gross (1943) noted that the behavior of one individual in an interacting population will effect the behavior of his peers. Therefore, if an innovation is successful on a few farms, this offers new stimulus to the ones who have not adopted. This interaction effect forms the basis for the result demonstration program. If enough demonstrations are established in a community and eventually in the country, all the people who could possibly adopt the innovation

will have heard about it. For a majority of the people, they will know of someone who has tried it or will have tried it themselves, and this will have a direct effect on their decision to possibly adopt the innovation.

If we can induce a few people to try the innovation, they serve as opinion leaders for others thus achieving a more rapid interaction effect. The result demonstration stimulates the people to try the innovations, and these demonstrators provide a local resource base (Cook in Sanders 1966). Instead of the first adopters having to get their information experience outside the community, the change agency provides the demonstrators with a source of information which would then disperse within the community.

The Result Demonstration in Achieving Adoption

Wilson and Gallup (1954:40) report that during the early years of agricultural extension work in the United States, the result demonstration was used to show farmers that extension work was practical and the methods and practices advocated were locally adaptable. The success of the result demonstration depends on the evidence that shows a new method or practice superior to the one that it would replace and that it is possible that the farmer could acquire the needed inputs or put into practice the methods needed to carry out the superior practice.

They continue in stating that the chief purposes of the result demonstration are to establish confidence by the change agents that the practices are locally adaptable and to show

the farmers the adaptability of the practices on his farm and locality. A successful demonstration in a community leads others to try the practices also.

Additional advantages that Wilson and Gallup (1954:43) point out are the result demonstration's "usefulness in introducing a new project or practice contributing to the discovery of local leaders and its use in working with minority groups with whom extension has had little contact." Cook in Sanders (1966:128-133) also states that the result demonstration is readily visible and reaches certain types of people and provides a good source of information for meetings and yields a high rate of adoption to exposures.

Perhaps another point to consider in the use of the result demonstration is that a farmer is making a public commitment when he agrees to have a result demonstration on his farm. This public commitment can cause the farmer to adopt the practices even if the practices shown in the demonstration do not agree with the previous individual's private beliefs. By having the demonstration he seeks out information to go along with the demonstrated practices and by making the public commitment he usually changes his practices (Everly 1967:96).

Some studies have been carried out to measure the effectiveness of the result demonstration in securing adoption of farm practices in the developing countries. Robertson (1964) states that the effectiveness of a demonstration program can be evaluated by the degree of adoption of the practices

demonstrated. In his study of the 20 farmers in India who had wheat demonstrations which pointed out the advantages of improved seed, fertilizer and insecticides, 19 persons reported that they would use the improved seed the next year, 18 reported that they would use fertilizer, and four reported that they would use pesticides. He concludes that result demonstrations can have considerable impact on the future plans of those carrying out the demonstrations.

Of 40 cultivators in the same village who did not have the demonstrations, 25 stated they would use the improved seed, 23 the fertilizer and only one the pesticide.

However, of those indicating that they were going to use the new practices, many indicated that they did not intend to use the recommended method of planting because of the extra labor necessary, and several indicated that they were going to use lesser amounts of fertilizer.

Proctor (1956) in a study in Uruguay tried to find different rates of adoption between areas where the demonstrations were considered successful and those where it was not. He concluded that although farmers in the communities where the better demonstration was conducted had more contact with the demonstration, there was no corresponding effects upon them. In this particular case the single act of viewing a demonstration for most farmers was a minor incident in formulating their opinion as to the planting of hybrid corn.

Rogers and Leuthold (1962:23) point out that the informal visiting between general farmers and demonstrators is

considerably more frequent than contact through tours set up by change agents. Another advantage that they point out is that a demonstration results in considerable attitude change among those carrying out the demonstrations. However, they point out the problem that the information does not get down to the lower status people.

Chopde (1959:40) reports that farmers in India who had the most formal education were more likely to adopt the demonstrated practices. The size of the family had no relationship with adoption. Farm size in acres operated was positively related with adoption. The demonstration served mostly as an informal source of information. In order for adoption to take place the farmers consulted additional sources of information.

In a cross-cultural comparison between Pennsylvania dairymen and Punjabi (Indian) field crop producers, Fliegel (1968:437) found that the Punjabi farmers attached greater importance to social approval than to financial return. By use of the result demonstration in a community, perhaps social pressures could be brought upon many individuals thus creating a climate for accepting the innovations.

Congruence as a Factor in Adoption

In adopting an innovation Brandner and Kearl (1964:288) suggest that if an innovation, or in this case innovations, are viewed as congruent with a practice that farmers previously evaluated as favorable, they will tend to accept the innovation more rapidly than those who have not had the opportunity

to make such an evaluation. This hypothesis was supported in two communities with in-depth interviews in Kansas and also with data from the whole state. In one area, hybrid corn had previously been grown and in another there was little knowledge of hybrid corn because it was not a main crop. In the community where hybrid corn was grown, hybrid grain sorghum diffused four times as fast as it did in the community where hybrid corn was not widely grown. Those that had tried hybrid corn did not view the hybrid sorghum as a new practice and, therefore, were quicker to adopt. It took those who had not tried the previous innovation longer to form an opinion of the new practice and thus they were not as early to adopt.

In order to achieve maximum success in the promotion of a new practice, change agents should try to associate the innovation which they are trying to promote with something that the farmers have previously evaluated as successful (Brandner and Kearl 1964:302).

Characteristics of Innovations in Adoption

What is important in the adoption of an innovation is how the individual perceives the relative advantage of the innovation as being better than the practice it replaces. This is coupled with the individual's perceptions of the complexity, trialability, compatibility and communicability of the innovation to determine final adoption (Rogers 1962: 124).

The relative advantage of an innovation is the degree to which it is superior to what it supersedes (Rogers 1962:124). If an individual views an innovation, such as the package of improved practices, as superior he will adopt them. The change agent's job and the role of the massive fertilizer demonstration program is to show and convince the individual of the superiority of the new practices. Often this advantage is measured in economic terms, but it could be measured in other ways, too.

The compatibility of an innovation is the degree to which an innovation is in agreement with the values and past experiences of the adopters (Rogers 1962:126-127). Complexity of an innovation is the degree to which an innovation is difficult to comprehend and use (Rogers 1962:130). Still another characteristic which affects the adoption of an innovation is its divisibility or trialability. Obviously an innovation which can be tried on a small scale first, will be more readily adopted than an innovation that needs to be either completely adopted or rejected. Ryan and Gross (1943:18) found that not one of the farmers in their Iowa study adopted hybrid seed corn without trying the innovation first.

The last characteristic of an innovation which affects its rate of adoption is its communicability. This could also be expressed as visibility. Erasmus (1961:23) states that the visibility of an innovation is very important in affecting the rate of adoption in a developing but preliterate society. In several developing countries the visibility of an innovation,

such as the increased growth of corn due to fertilizer, has led to the adoption of the innovation.

In summary, then, diffusion research shows us that a result demonstration program is one logical way to introduce new practices. By establishing a demonstration a farmer is at the fourth stage, the trial stage, in the adoption process. He has already passed the first three stages. If a demonstration is established on the farm of an opinion leader, he helps diffuse information about the new practices throughout the community. A demonstration established on the farm of a person who is not an opinion leader would help make him one. The demonstration shows that the new practices have a relative advantage over the traditional practices. It also shows that the new practices are compatible with existing practices. The demonstration helps communicate the new practices visually to other farmers. A demonstration program is the means by which new practices can be introduced and diffused throughout a community in a relatively short period of time with the advantage of many farmers being able to evaluate the new practices under their own conditions.

The Result Demonstration Program in El Salvador

The result demonstration program in El Salvador was designed following many of the principles discussed above. Its purpose was to diffuse the use of the new practices throughout communities by showing farmers the advantages of these practices. The farmer was to make his own decision on the adoption of the practices.

Possibly every adopter category, innovators to laggards, established demonstrations in some communities. No specific attempt was made to have only the opinion leaders or the early adopters establish demonstrations.

The result demonstration program in El Salvador was called the "Massive Fertilizer Demonstration Program." It was promoted by the Agricultural Extension Service with assistance from the Agency for International Development.

The program began in 1965. The target audience was mainly the small-scale rural farmer with whom the Extension Service had been working. The goal of this program was to introduce farmers to more modern practices of agricultural production which they could put into practice on their farms. Widespread adoption of these practices--hybrid corn, fertilizers and pesticides--was the ultimate goal of the program. The idea was to place several demonstrations in a community so that a number of farmers would either have first- or second-hand experiences with the practices and be able to evaluate them under their own conditions.

The small-scale farmers in El Salvador are an important sector insofar as basic food crops are concerned. In corn for example, eighty-five percent of the land planted to corn is planted by farmers who are on a subsistence or a semi-subsistence type farm (Birdsall 1967). The average planting of these farmers is between one-half and eight and one-half acres. Convincing these farmers to adopt modern practices would not only help increase the corn production in the country, but it would help to raise the level of living of many

rural people.

Each farmer who participated in the program received free, through the Extension Service, a package with enough improved seed, fertilizer and pesticide to plant one-tenth of an acre (400 square meters). This was to be planted as a demonstration. The farmer was to use these new inputs alongside his traditional methods and practices so that he could obtain a ready comparison of the differences between the old and the new. The demonstration was to be planted in a visible area so that neighbors and people passing by could easily observe the demonstration.

During the period 1965-1967, the agricultural extension agent in each of the 49 field offices selected the farmers who were to receive the needed inputs to conduct the demonstrations. Farmer selections were based on the fact that they were not using all of the new practices at that time and that they would plant their demonstration in a visible area. After the farmers were selected, the extension agent gave them the package of materials and demonstrated their proper use. During the course of the growing season the agents also made periodic visits to each farmer to see if he was following the recommended practices and to determine the effect of the demonstration. Since the initiation of the program, over 10,000 demonstrations have been established in corn alone with lesser amounts in rice, beans and sorghum.

The program has been a cooperative effort between the Ministry of Agriculture of which the Agricultural Extension

Service is a part, the Agency for International Development, private enterprise and the local farmers. The Ministry provided the improved seed and the manpower for the program. USAID provided some financial support and a technician during the first three years of the program. Private enterprise donated the needed inputs--such as fertilizer and the pesticides necessary for the several thousand demonstrations--to the Extension Service who then distributed them to the farmers.

During the first three years of the program, each extension agency established anywhere from 20 to 80 corn demonstrations each year. With the objective of reaching as many farmers as possible on an intensive basis in the rural areas, several demonstrations were placed in a community. As many as 15 or more were established in several communities in one given year.

Because he received the demonstration and planted it on his farm, each farmer was expected to have knowledge of the new practices and have a basis for deciding if the practices were applicable in his situation. Some of the farmers establishing a demonstration would have had experience with the practices before being awarded the demonstration and would be more advanced in the stages of the adoption process. This would be the case even though the extension agents were to select those farmers who had not previously used all the practices.

As a result of having been awarded a demonstration, the farmer's knowledge was not expected to depend on his contact

with other people such as neighbors and extension agents or mass media contacts. In effect, each farmer was expected to have comparable knowledge, regardless of his previous experience. Each would be placed at approximately the same stage in the adoption process. These farmers would be able to evaluate the practices using the same criteria and the same information sources.

CHAPTER II

REVIEW OF THE LITERATURE RELATED TO HYPOTHESES

In the present study there are seven formal hypotheses. The dependent variable in each of these hypotheses is the adoption of practices introduced through the demonstration program. The seven independent variables are landownership, size of corn planting, extension contact, lack of credit problems, credit obtained, literacy and education. In the following section a review of the literature specific to each group of hypotheses is presented. Then the hypotheses are stated. Each of the variables will be operationally defined in Chapter III, Methodology.

Economic Position

Several studies have supported the idea that the economic position of the farmer has a direct relationship on the adoption of farm practices. Economic position has been defined differently according to several studies. Frequently it has meant the size of the operation in terms of land units owned and/or cultivated. It could also mean the number of stock owned, etc. Relationships are generally the same whether the studies have been done in the United States or in other countries.

Sharma (1967:18) reports that the higher the economic status of the individual farmer, the more his contact will be

with technically qualified workers. Farmers with higher economic status used radio, posters, exhibitions and printed matter more than the lower status farmers.

Beal (1967:75) in a study of Guatemalan Indians reports a positive correlation between the amount of land cultivated and an individual commercialization score which was partly based on the adoption of new practices.

Deutschmann (1963:31) writing about Colombia states that the size of the farm is the best economic index for access to mass media. The larger the farm, the more the access to sources of information and the better the chances of adopting the innovations.

Tied in with the size of the operation is its association with the major enterprise on the farm. Bittner (1959) reports that a farmer will follow fewer of the recommended practices on a minor enterprise than on a major one. Fliegel (1968:448) in taking a cross national approach suggested also that the innovations that contribute most to the major enterprise will be adopted first. This hypothesis was supported for the Pennsylvania dairymen but not for a sample of Punjabi (India) field crop producers which farmed between 10 and 15 acres of land. Although the Punjabi farmers were not subsistence farmers, they were not commercial farmers in the American sense. The Punjabi farmers did not have so clear a major enterprise as did the American farmers. More than just financial incentives were necessary to obtain the widespread adoption of new practices.

The farmers' actual perceptions of the attributes of the innovations were related to adoption behavior. The Punjabi farmers were like the small-scale Pennsylvania dairymen and unlike the large-scale dairymen in that the substitution of technology for human labor was a disincentive for adoption.

Basically what various authors have found is that the bigger the farm, the better the financial position of the farmer to adopt the innovation. Relating this situation to El Salvador where some farmers who had the demonstration were landowners and others planted their crops on rented land, we would expect that the landowners would have higher rates of adoption. The landowner would be in a better position financially to acquire the needed inputs and would be better able to do so. The land renter has to pay for the rent of the land. In some cases he gives the landlord a cash payment and in other cases he gives a certain percentage of the crop. Those who rent, therefore, are not in as good an economic position and probably would not adopt the practices as readily as landowners. Those farmers planting more land units to corn are probably in a better economic position to purchase the inputs than those farmers planting smaller land areas. This leads us to the following two hypotheses:

H_1: Landownership is positively related to adoption.

H_2: Size of planting is positively related to adoption.

Extension Contact

Another factor that could greatly affect adoption of innovations among farmers is contact with sources outside their communities. This is commonly called cosmopoliteness. One aspect of cosmopoliteness, contact with extension, will be dealt with in this study.

A change agent is a professional person employed for an organization which is usually funded by the government who tries to influence decisions in a direction thought of as desirable by a change agency (Rogers 1962:17). The extension service is a change agency and the agents who work for it are change agents. A change agent has many roles. He can be a great help to many farmers who are seeking to improve their situation. In some cases they are responsible for the changes that farmers make in their paths toward modernization.

Fliegel (1965:287) supports the idea that contact with personnel of the extension service has been significantly positively related with the adoption of modern practices. The more contact that a farmer has, the more he should learn and as a consequence put into practice or adopt.

Beal (1967:104), in his study of Guatemalan Indians, shows that there is a positive relationship between information received from extension and the adoption of farm practices.

Dhalival (1965:60), in India, goes even further in his statement that the adoption of practices increases in direct proportion to the frequency of contact with extension

personnel. However, he also states that the higher the social and economic position the farmers had, the more extension contact they had also.

Rogers (1969) states that the contact with the outside world (or in any case, outside his own locality) could be viewed as an initiator of a drive toward modernization.

Bittner (1959) states that the closer a dairy farmer associates himself with the change agency, the more recommended practices he will tend to accept.

Sharma (1967:13) investigates the most influencial sources of information on farmers and compares them on adoption. He concludes that personal contact between farmers and change agents had greater influence on the adoption of practices than did the personal contact between farmers and local sources of information.

Therefore, we can see that change agents have considerable influence on their clients, the farmers. If a change agent works at it, he can help change practices in the community in which he works. The above leads us to the following hypothesis.

H_3: Extension contact is positively related to adoption.

Credit

The introduction of a package of innovations, even though they might be perceived as having relative advantage to the farmer and he was convinced of the acceptability on his farm, might not be adopted because of the required

capital outlay. Most subsistence farmers consume what they produce and do not have available cash so that they can buy the necessary inputs to adopt the innovations. In order for them to adopt these innovations, they would need to acquire the necessary money by means of credit or other off-farm income. This lack of available money could be the most critical limiting factor for the acceptance of new practices in many of the developing countries. Without some outside income, they can never hope to adopt the new practices.

Many governments, such as Brazil's ACAR program, (Wharton 1969:430) classify many farms as "too small to produce minimum subsistence living or to provide a modest base for capital formation and are too deficient in all respects to be able to take advantage of the program."

Beal (1967:73), in his study of a subsistence farm economy, finds a positive correlation between an individual's orientation towards credit and his adoption of farm practices.

Some farmers because of their beliefs or ideas do not want to go into debt. They are afraid of losing what they already have. Others with a different attitude will be more inclined to seek credit. Others might want it but do not know where or how to get it.

Fliegel (1968:444) in his study of Pennsylvania dairymen showed that the low-income farmer saw credit as necessary for success but was not willing to use it. The small-scale Pennsylvania dairymen were similar to the Punjabi farmers in that capital investment was a disincentive for adoption.

Credit would be a problem to many of the small farmers in El Salvador wanting to adopt the innovations. The government credit programs of El Salvador were able to make less than 6,000 loans during 1967 (ABC Annual Report 1967). This was less than the total number of farmers receiving demonstrations in 1965 and 1966 (see Appendix D). Adoption might, therefore, be directly related to the farmers' perception of, and actual use of credit. If a farmer does not view credit as a problem, he might not need it to acquire the inputs or he might be able to obtain credit easily and, therefore, would probably be able to adopt new practices if he wants to. In contrast, if a farmer views credit as a problem, he either does not have the economic resources to purchase the inputs or is not able to obtain credit easily and he would not adopt the new practices.

H_4: The obtaining of credit is positively related to adoption.

H_5: Lack of credit problems are positively related to adoption.

Literacy

One of the key factors in predicting innovativeness is literacy. Rogers (1969:70) states that literacy is important in the modernization process because: 1) the individual can extend his scope of experience through print and mass media channels, 2) the print media permit the individual to control the rate of message input, 3) the individual can store and then retrieve the print information and 4) literacy seems

to be a key enabling an individual to have more complex mental abilities.

Deutschmann (1963:27), in a study in Colombia, defined literacy as a simple report of whether the respondents could read and write. He found that the literates had more exposure opportunity to media than did the illiterates. This exposure extended to radio and movies even though these two media did not demand literacy to be exposed. In examining the illiterate group alone, the idea media exposure was related to adoption of new practices when education was held constant.

Rogers (1969), in Colombia, found positive relations between agricultural innovativeness in five Colombian villages and literacy. However, only half of these relationships were significant. He concludes tentatively that literacy and innovativeness are positively related. Rogers reasons that the innovator or the first to adopt a new practice cannot rely on his neighbors to gain knowledge. He must be able to evaluate the innovation from abstract communication messages. By being literate, the subsistence farmer is better able to do this.

Beal (1967:75), in Guatemala, found that the educational level of the respondent was positively related to the adoption of new practices.

Rogers and Herzog (1966:13-14) found a positive relationship between literacy and several variables of a modern orientation including mass media exposure, empathy, agricultural innovativeness, achievement motivation, cosmopoliteness

and political knowledge. A common implication of literacy is that it is more than just an ability to read and write. It appears to affect processes which show up in more modern attitudes and behaviors. By becoming literate, an individual has more than just the simple skill of reading but a whole new capacity to process information.

Rogers (1965-1966:618) found that literates are more likely to be radio listeners than are the illiterates. Literacy was more highly related to printed media exposure than non-printed media exposure. Rogers also found that there was a positive significant relationship between media exposure and measures of innovativeness in five villages in Colombia. He concludes also that literacy is more than just a facilitator of mass media exposure.

Sharma (1967), in his study in India, found no significant differences in the use of the village level workers, village leaders and the college extension personnel between literates and illiterates in his study. He found, however, that farmers with more education obtained more information from the area extension agents than did the illiterate farmer. This suggests that illiterates are satisfied with information from lower levels of personal communication.

It appears that if a farmer is literate he comes in contact with more sources of information and adopts the new practices earlier than the illiterate farmer. The more years of education a farmer has, the more information contact he should have and the better his ability to reason. He

should adopt more practices. This leads to the following two hypotheses.

H_6: Literacy is positively related to adoption.

H_7: Education is positively related to adoption.

CHAPTER III

METHODOLOGY

The Sample

The population that we are studying in this survey are the farmers who established result demonstrations in corn. The demonstrations were administered by the Extension Service in El Salvador. Farmers having demonstrations in 1966 were selected for the sample. The total sample consisted of 467 farmers. Returns were received from 204 or 44 percent.

Sampling Procedure

The method used to do this study was a sample survey of the farmers who established demonstrations during 1966. This year was selected because many extension agents had experience with the program the previous year and did a good job of selecting the participants and supervising the demonstrations. Many of the participants in 1966 had not yet tried the new practices introduced through the demonstration. By selecting the farmers who had demonstrations in 1966 we could revisit them in 1970, four years later, to measure their adoption of the introduced practices.

Forty-five extension agencies had record sheets in the central extension office for 1966 corn demonstrations. Of these forty-five, four were no longer extension agency sites. These agencies were not included in the sample. The record

sheets for each agency were numbered consecutively. Not included in the numbering were: 1) farmers who did not have a successful demonstration, 2) 4-C club members who were given demonstrations and 3) demonstrations with yellow corn. Thirty percent of the record sheets for each agency were selected for the sample using a table of random numbers. Therefore, the sample is an area random sample. A list of farmers selected for the survey was prepared for each agency.

Farmers who did not have a successful demonstration were not included in the sample because they would be less inclined to adopt the practices. The demonstrations that were awarded to 4-C club members were not included because the demonstration might not have been planted on the land of the father or the decision maker in the family. The father might not have first-hand experience with the improved practices and thus be less inclined to adopt. There were a few demonstrations that were given out with yellow corn instead of the commonly grown white corn. These too were not included in the sample because the farmer does not normally plant this type of corn and he might be less inclined to adopt the practices. This corn did not germinate well either, resulting in reduced yields in the demonstrations. For this survey an effort was made to select farmers who had comparable experiences. It was felt that the three cases cited above were not like the rest and therefore, were left out of the sample.

Data Collection

The data for the present study were gathered through

personal interviews conducted by extension agents in El Salvador. Each agent was responsible for interviewing the farmers in his area of work included in the sample. The interviews were conducted on the respondent's farm or in his home.

In a meeting of each of the five extension zones (there were four zones in 1966) the whole survey was explained to the extension agents. The questionnaires were thoroughly reviewed and a sample filled out. About four days after the zone meetings, a written instruction sheet was sent to the agents. The author went with four extension agents to interview the farmers. This was mainly to see how the interviews were carried out.

The questionnaires were passed out on June 12th, 15th and 16th, 1970. The deadline for returning the questionnaires was July 10, 1970. The cover letter was signed by the author who was a USAID extension advisor at the time, and by the sub-director of the Extension Service. The majority of the returns came in during the middle to the end of July. Sixteen of the 41 agencies had responded when the author left the country on July 25th. Returns from 7 more agencies were received in September, and were forwarded to the author. A list of agencies not returning questionnaires was compiled. Lists of their farmers in the sample along with another set of questionnaires were sent to the non-responding agencies. Due to the extension sub-director being out of the country and year-end extension acitivites, the follow-up was not

made until January 1971. Three more agencies responded and the author received these responses in February, 1971. No more returns were received by April 15th so the data were tabulated.

Most agents who responded could not contact all the farmers in the sample for their agencies. Some farmers had moved, a few had died, others were no longer planting corn and still others could not be contacted after three visits. Approximately one-third of the sample that agents tried to contact could not be interviewed because of one of the previously mentioned reasons.

Table 1

Data Returns

Agency	Total	Available For Sample	Sample	Returned
Zone 1				
Armenia	85	73	22	17
Lourdes[1]	35	27	0	0
Tacachico	42	42	13	0
Ciudad Arce	76	51	15	10
Candelaria	50	40	12	9
Chalchuapa	37	20	6	5
Sonsonate	45	45	14	5
Metalio[1]	41	34	0	0
Atiquizaya	35	24	7	5
Texistepeque	50	21	6	3
Metapan	50	28	8	5
Ahuachapan	37	29	9	0
Opico	48	48	14	9

Table 1 (cont'd.)

Agency	Total	Available For Sample	Sample	Returned	
Zone 2					
San Salvador[2]	60	35	0	0	
San Martin	72	55	17	9	
Tejutla	59	55	16	13	3
Tonacatepeque	50	40	12	9	
Nueva Concepcion	74	54	16	8	
San Rafael Chalate	90	64	19	10	
Aguilares	59	32	10	0	
Suchitoto	58	46	14	12	
Chalatenango	72	32	10	10	3
Quezaltepeque	30	29	9	9	
Zone 3					
Cojutepeque	36	9	3	3	3
Zacatecoluca	47	34	10	3	
Santa Maria Ostuma	64	46	14	0	
Sensuntepeque	61	50	15	10	
San Pedro Masahuat	25	22	7	3	
Ilobasco	70	46	14	14	
San Pedro Nonualco[1]	40	31	0	0	
San Sebastian	40	35	11	0	
Villa Victoria	45	45	14	0	
Tecoluca	31	26	8	5	
San Vicente	92	43	13	9	
Mercedes Umana	31	12	4	3	
Zone 4					
Santa Rosa de Lima	27	18	5	0	
Chinameca	29	22	7	0	
Osicala	29	22	7	6	
Encantado	71	52	16	13	
Gotera	47	10	3	0	
Ozatlan	50	41	12	11	
La Union	32	32	10	2	
Usulatan	100	39	12	0	
Santa Elena	69	47	14	14	3
Jocoro	75	62	19	0	
Other Government Departments	300	0	0	0	
	2666	1668	467	244	
			Returned too late -	40	
			Used -	204	

1 No longer an extension site.
2 Not used in the survey because of the tremendous shift in clientele around the capital city.
3 Questionnaires returned too late to be analyzed.

Instruments

The questionnaire was drafted with the help of USAID staff members working in agriculture. The sub-director of the Extension Service helped revise the questionnaire and the zone supervisors, besides giving advise, served as a pre-test.

The questionnaire consisted mainly of check-list type questions. There were a few open-ended questions also. The check-list question was used mainly to get uniformity in response and to make data tabulation easier.

Data Tabulation

Data were tabulated for 26 agencies. The total number of returns tabulated were 204. The questionnaires were edited by the author. Using a code book written by the author, the data from the questionnaires were coded onto a pad and then punched onto IBM cards. These cards were run through the counter-sorter and different categories counted to get the desired information.

Operationalization of the Variables

The adoption index score for 1970 was computed from the practices that farmers had adopted. There were four main practices introduced through the demonstration. They were hybrid corn, formula fertilizer, nitrogen fertilizer and insecticide. The total points possible for adopting each practice was six points, making the total possible score of 24. A respondent could receive 6, 5, 4, 3, 2, or 0 points for each practice depending on his use of the practices.

He could receive 5 points if he was using one practice on part of his land and another practice under the same section on the other part of his land. For example, if a farmer was using hybrid seed bought this year on part of his land and hybrid seed of a second generation on another part of his land, he would receive 3 and 2 points respectively, or a total of five points for that practice.

Table 2

Adoption Index Score 1970

Practice	Score		
	Part of land used for practice		
	All	Part	None
Improved seed bought this year	6	3	0
Improved seed of a second generation	4	2	0
Formula fertilizer applied at planting	6	3	0
Formula fertilizer applied after planting	4	2	0
Nitrogen fertilizer used after formula	6	3	0
Using only nitrogen fertilizer	4	2	0
Foliage insecticide	6	3	0

Landownership is defined as a farmer owning the land where he plants his corn. This was determined by the respondent in answer to the question if he was an owner or a renter.

The size of the corn planting was determined by the

respondents reporting the number of "manzanas" (about 7,000 square meters or 1.7 acres) planted. This was determined for both 1966 and 1970.

Credit obtained was determined by the respondent's answer to the question of whether or not he had obtained credit during the preceeding four years.

Credit problems were determined by the respondents giving credit as one of their major problems during the preceeding five years.

Three items were included in the extension contact index score. Each item counted one point. The total possible score was three. The extension contact index score was determined by the respondent's answers to three questions:

Table 3

Extension Contact Index Score

	Score
Wife a member of the homemakers clubs	1 pt.
Children members of the 4-C clubs	1 pt.
If had problem in corn, to whom would you go	
Extension agent	1 pt.
Agronomist	½ pt.
Any other	0 pts.

The index score was an indication of extension's contact with the whole family. The rationale for including the first two items and for weighing them equally, was that if any part of the family had extension contact, this should more favorably dispose other members of the family toward working with extension and taking extension advice. This index is based

on the subjective decision of the author.

Education or the number of years of schooling was determined by the number of years the respondent said he had completed.

Literacy was determined by the respondents assessing their own ability to read and write.

In addition, an adoption index score was computed for 1966. It contained four parts. A respondent could receive a maximum score of two points for each section or a total possible score of eight points.

Table 4

Adoption Index Score 1966

Practice	Score		
	Part of land used for practice		
	All	Part	None
Hybrid corn	2	1	0
Formula fertilizer	2	1	0
Nitrogen fertilizer	2	1	0
Insecticide	2	1	0

Statistical Tests

The statistical tests that were used in this study were Pearsons' product-moment coefficient of correlation (r) and the point-biserial coefficient of correlation. These tests were selected because of the desire to determine the extent of relationship between the variables in this study.

When both variables to be correlated were continuous,

the Pearsons' r was used. Borg (1963:150) says that "the product-moment correlation (r) is used when both variables that we wish to correlate are expressed as continuous scores." The point-biserial correlation was used when one of the two variables was a genuine dichotomy. Guilford (1956:301) says "when one of the two variables in a correlation problem is a genuine dichotomy, the appropriate type of coefficient to use is the point-biserial r."

The dependent variable, the adoption index score for 1970, was taken to be continuous. Other variables that were continuous were size of the corn planting, contact with extension and years of schooling (education). The variables that were dichotomus in nature were ownership, credit problems, credit obtained and literacy.

There might be some question as to the validity of the Pearsons' r since the distribution on many of the continuous variables was not normal. However, Kerlinger (1966:261) and McNemar (1962:136-137) say that when r is used to determine the relationship between two continuous variables and not to infer to larger populations, there is no need to assume a normal distribution in the data.

The Effect of the Program and Other Factors

To measure the effect that the Massive Fertilizer Demonstration Program had on the farmers and on the country as a whole, we will look at several indicators.

If the farmers in the program were fairly typical of the rural farmers in El Salvador, their corn production

should be approximately the same as the national average before they had the demonstration. If the demonstration had any effect on their production practices, their corn yield should be above the national average in 1970, four years later. Comparison will be for corn yields in 1966 and 1970.

If there was an increased demand in rural farming areas for agricultural inputs, this might be due, in part, to the demonstration program. This increased demand for inputs might be reflected in the number of outlets of agricultural products. A comparison would be made between the years 1966 and 1970 as to the number of outlets. This might be done by having the national distributors report the number of outlets they had for each of the two years. Another method of measuring increased demand would be to determine the volume of sales of these distributors on the national level. No such data were available to the author at the present time so only the number of distributor outlets as an indicator was used.

Another way to measure the impact of the program would be to measure the change of the farmers between 1966 and 1970. During the personal interviews, the farmers would report the practices that they were using in 1966 and those that they were presently using in 1970. If the program had impact, we would expect a greater number of farmers to be using the improved practices in 1970 than were using them in 1966.

As a result of adopting the improved practices, farmers

might have more working capital. With increased capital do they plant more land to corn? The problem in planting more land is that most of the available and tillable land is presently in production and no new lands are available. In this survey we will look at the average acreage planted to corn by farmers to determine if it increased between 1966 and 1970.

Another facet that the study will investigate is how the farmers have altered the practices shown them in the demonstration. Two cases that merit investigation are hybrid seed and formula fertilizer. The demonstration showed the farmers the method of applying the fertilizer at the same time as planting the corn. Some farmers apply this formula fertilizer about 15 to 20 days after the corn has germinated because they want to see if their corn germinated before they apply the fertilizer so as not to "waste" the fertilizer. In this survey we want to find out the incidence of this practice.

In the case of hybrid corn, many farmers--because of the smallness of their operation and their not wanting to spend money for new seed every year--might tend to use or continue planting a second, third or fourth generation of the hybrid seed. In this study we also want to investigate the incidence of this practice among the farmers.

CHAPTER IV

FINDINGS

The number of farmers planting at least part of their land to the new practices showed a substantial increase between 1966 and 1970. This increase could be due in part to establishing a result demonstration which convinced them of the advantages of using the new methods. Almost 100% of the sample stated that as a consequence of the demonstration they were convinced in the use of improved seed, fertilizers and insecticides. The figures are:

Table 5

Farmers Convinced of the Advantages of the Introduced Practices

N = 204

Practice	Percent Convinced	Number Not Convinced
Improved seed	99.5	(1)
Fertilizers	99.0	(2)
Insecticides	96.5	(8)

Even though almost all the farmers were convinced they should use the improved methods, not all of them did. The cost of the new practices might be the major limiting factor in their decision not to adopt. It appears that if they had the resources, they would adopt the innovations.

To show the change between 1966 and 1970, Figure 1 is

presented. It shows graphically the increase for those planting at least a part of their land to the new practices.

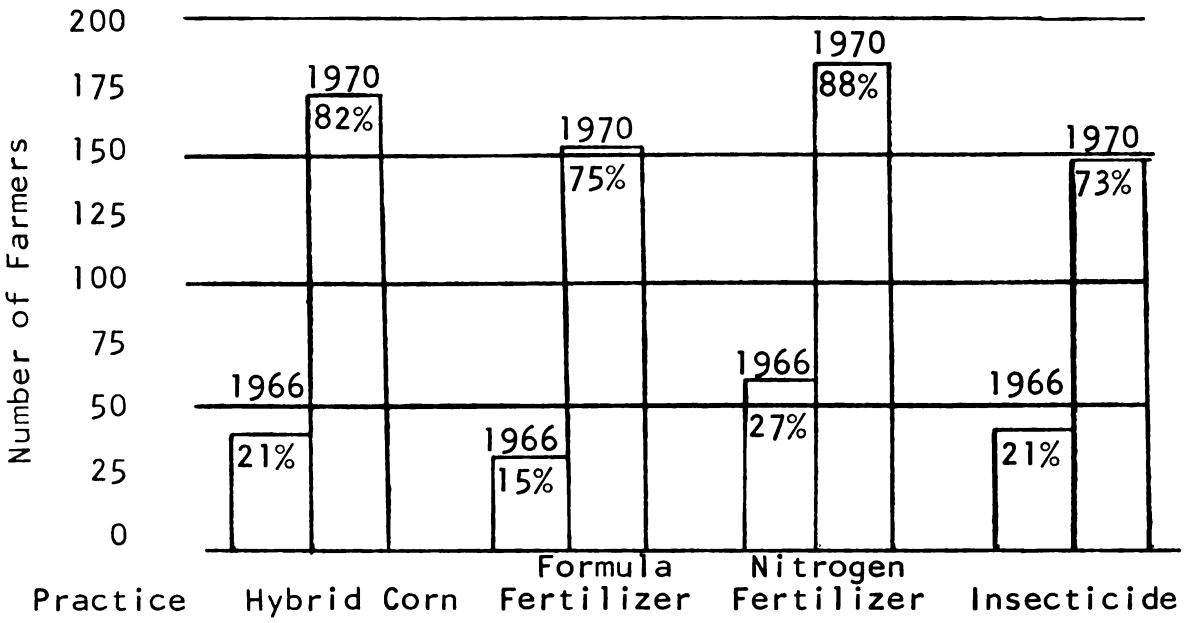

Figure 1

Number of Farmers Planting at Least Part of Their Land to the New Practices

The question was asked the farmers on what part of their land were they using the new practices. Measures for two years were taken. The year 1966 was used as a base since that was the year they had a demonstration. The year 1970 was used to determine what effect the demonstration had on the practices they were using four years later.

The following Tables 6 and 7 show the change between 1966 and 1970. More questions were asked for the crop year 1970 to determine the incidence that the second generation of hybrid seed was being used and also to the extent that formula fertilizer was being applied after planting instead of at planting.

Table 6

Practices Used 1966

N = 204

	Part of Land Used for Practice			
	All	Part	None	No Response
Hybrid seed	13	29	162	0
Formula fertilizer	17	14	173	0
Nitrogen fertilizer	23	32	154	5
Insecticide	13	30	158	3

Table 7

Practices Used 1970

N = 204

	Part of Land Used for Practice			
	All	Part	None[2]	Report Using Both[1]
Hybrid seed bought this year	76	13	36	29
Hybrid seed--second generation	28	22		
Formula fertilizer at planting	48	12	52	13
Formula fertilizer after planting	65	14		
Nitrogen fertilizer applied after formula	109	24	24	10
Nitrogen fertilizer applied without formula	26	11		
Insecticide	106	43	55	

1 These farmers were planting part of their land using one practice and part of their land using the other for the practice indicated.

2 These farmers were not using either practice.

More than seventy-three percent of all the farmers in the sample were using each improved practice on at least part of their land in 1970. The practice with the highest percentage of use was nitrogen fertilizer. This also happened to be the practice that had the highest adoption in 1966. Insecticide and formula fertilizer each had about twenty-five percent who had not yet adopted in 1970.

The following Tables show the regression in the use of the practices from 1966 to 1970. Farmers using each introduced practice in 1966 were isolated from the rest of the sample. The author then looked to see how many of them were still following each of the same practices in 1970.

Table 8

Farmers Who Used Hybrid Corn in 1966

N = 42

		Part of Land Used for Practice			
		All	Part	None	Report Using Both
Practices Used 1970	Hybrid seed bought this year	22	0	5	7
	Hybrid seed second generation	4	4		

Table 9

Farmers Who Used Formula Fertilizer 1966

N = 31

		Part of Land Used for Practice			
		All	Part	None	Report Using Both
Practices Used 1970	Formula at planting	8	0	8	2
	Formula after planting	13	0		

Table 10

Farmers Who Used Nitrogen Fertilizer 1966

N = 55

		Part of Land Used for Practice			
		All	Part	None	Report Using Both
Practices Used 1970	Nitrogen fertilizer with formula	37	3	4	4
	Nitrogen fertilizer without formula	5	2		

Table 11

Farmers Who Used Insecticide 1966

N = 43

		Part of Land Used for Practice		
		All	Part	None
Practices Used 1970	Insecticide	29	10	4

The regression was highest for formula fertilizer and lowest for nitrogen fertilizer. Over 25 percent of those who were using formula fertilizer in 1966 were not using it in 1970. Less than eight percent of those who were using nitrogen fertilizer in 1966 were not using it in 1970. This compares with hybrid corn 12 percent and insecticide 10 percent.

Testing the Hypotheses

The adoption index score for 1970 appears as the dependent variable for each of the seven formal hypotheses in this

study. It was determined by giving a point value for the degree to which they were using the new practices. The range in scores on the adoption index was from 0-24. The average adoption score for the whole sample was 15.667. The independent variables in this study were ownership, size of corn planting, lack of credit problems, credit obtained, contact with extension, literacy and education. A positive relationship was hypothesized between each independent variable and the dependent variable.

The results of the correlational analysis showed the seven hypotheses to be positive in direction. Six of the seven correlations were statistically significant at the .05 level or less. Each hypothesis is discussed separately below.

H_1: Landownership is positively related to adoption.

In this study there were 89 farmers who were renting their land, 100 who were owners and 11 who were both owners and renters. For purposes of analysis, those who were both owners and renters were included with the landowners. Because they owned land it was assumed that they were more like the owners than the renters. They would also control more of their resources than renters. The dependent variable is adoption which is discussed above.

The point-biserial r correlation between landownership and adoption is .144. This relationship is significant at the .05 level for the sample of 200. The hypothesis is

supported. For a closer look at the data for these two variables, see Appendix A, Table 24.

Landowners do not have to pay rent on the land they plant and therefore, have a greater margin if their crops fail. Landowners would also be surer that they will have the land in each succeeding year and therefore, are more apt to put improvements in the land. Renters, particularly if they have to give part of their crop to the landlord for payment of rent, will not be so inclined to adopt because their returns to investment will not be as great. The landlord probably would not share in the cost of the inputs.

H_2: Size of planting is positively related to adoption.

The size of planting for the farmers in the survey varied from one-fourth of a "manzana" (less than one-half acre) to 28 "manzanas" (about 48 acres). In the total sample, only seven farmers out of 204 were planting more than 10 "manzanas" in 1970. Of the total sample 93 were planting one "manzana" or less in 1970. This was approximately 46 percent of the total. Only 29 farmers planted 4 "manzanas" or more (about 7 acres) in 1970. This is 14 percent of the total. We can see, therefore, that the acreages planted to corn by the farmers in the survey are quite small. In most cases for the small farmer corn is the primary crop. We can see that the overall operation of these farmers is not too large and that they are subsistence farmers. The dependent variable, adoption, was measured by

the adoption index score described above.

The Pearson product-moment correlation between the size of planting and adoption was .361. This relationship is significant at the .01 level. Therefore, the hypothesis is supported. See Appendix A, Table 26 to get a closer look at the data.

It appears that as the size of the planting increases the farmer is more apt to adopt the practices.

H_3: Extension contact is positively related to adoption.

The amount of extension contact was based on 1) contact that extension had with the whole family and 2) asking the farmer if he would go to the extension agent if he had a problem in corn. The range on the extension contact index score was from 0-3. Since some of the farmers in the sample did not have wives or children belonging to extension groups, the scores ranged around the 1.0 level. Forty respondents in the sample had extension contact scores of 2.0 or more. Of these, only seven had adoption scores of less than 12. The dependent variable, adoption, was measured by the adoption index score described above. It appears that the more contact extension has with the whole family, the greater the adoption of new practices. It appears that when the wife and children are predisposed toward change through extension contact, the father will be also.

The Pearson product-moment correlation between the two variables is .227 which is significant at the .01 level.

The hypothesis is supported. For a complete description of the data, see Appendix A, Table 28.

H4: The obtaining of credit is positively related to adoption.

The obtaining of credit was measured by the farmers reporting whether or not they received credit from any source during the past five years. The sample, by chance, was evenly divided between those who had obtained credit and those who had not. Of the total sample, 98 obtained credit, 98 did not obtain credit, and eight did not respond. The dependent variable, adoption, was measured by the adoption index score described above.

The point-biserial r correlation between obtaining credit and adoption is .434 which is significant at the .01 level. Thus, the hypothesis is supported.

A farmer obtaining credit is acquiring the means to adopt. Many times the farmer receives agricultural inputs instead of money as credit. He, therefore, has to use the inputs to repay the loan. Once he obtains credit he has almost adopted because the inputs he has are not going to do him any good unless he uses them. It is still possible for a farmer to adopt the practices and not use credit. This would be the case where the farmer was quite wealthy and could afford the inputs. However, for our sample with the small plantings, this would not too often be the case. Once a farmer has had credit for a couple of years he might save enough money to purchase the necessary inputs without credit.

First having credit to get him started would allow him to do this. For the data on this hypothesis, see Appendix A, Table 23.

H_5: Lack of credit problems are positively related to adoption.

The farmers were asked what were their problems during the past five years in relation to their corn crop. Out of 204 farmers, 122 listed credit as one of their problems. Therefore, 82 did not view credit as a problem. It is possible that these 82 farmers did not have credit problems because they could obtain it without too many problems or they did not need credit to acquire the inputs. By lacking credit problems, they would be more inclined to adopt the new practices because acquiring the inputs would not be a problem. The dependent variable, adoption, was measured by the adoption index score mentioned above.

The point-biserial r correlation between non-credit problems and adoption is .116 which is not significant at the .05 level. Therefore, the hypothesis is not supported. See Appendix A, Table 25 for analysis of the data for H_5.

There could be several reasons why the correlation is not statistically significant. The item in the questionnaire was not worded in a way to sort out the various possibilities. Thus it is possible that some farmers with credit problems had acquired credit and stated they had problems with it. Those farmers saying they had no credit problems might not see the need for credit. Further analysis showed that

approximately one-half of the respondents who had credit problems obtained credit. Likewise one-half of those farmers lacking credit problems obtained credit. So at least for about half the sample, there did not seem to be a lack of credit involved. See Appendix A, Table 35 for this further analysis of the data.

H_6: Literacy is positively related to adoption.

Literacy was measured by the respondent stating if he could read and write. In the total sample there were 68 persons who said they could not read and write, 135 who said they could and 1 who did not respond.

Point-biserial r correlation between the two variables--literacy and adoption--is .164 which is significant at the .05 level. Therefore, the hypothesis is supported.

What may be operating is that if a person can read and write, he can obtain more sources of information and therefore, he is more inclined to adopt more modern practices. See Appendix A, Table 22 for data on H_6.

H_7: Education is positively related to adoption.

The independent variable, education, was measured by the respondents reporting the number of years of education they had received. The range was from 0 to 12 years of education. Sixty-nine farmers received less than one year of formal education, and all but 12 received less than 7

years. Only three farmers had more than nine years of education.

Pearsons' product-moment correlation between education and adoption is .179 which is significant at the .05 level. Thus the hypothesis is supported. For the complete data on H_7, see Appendix A, Table 27.

It appears that the correlations between education vs. adoption and literacy vs. adoption are quite similar. The difference between these two correlations and adoption is .015. It seems that these two variables affect adoption in the same manner. Education and literacy seem to be very closely related and are not independent of one another. If a farmer went to school, he would report that he could read and write. Even though these two correlations are not too high, there is a positive significant relation between education vs. adoption and literacy vs. adoption.

Summary of the Hypothesis Testing

The testing of the seven hypotheses in the present study shows a positive correlation between adoption and the seven independent variables. Six of these relationships are statistically significant. These are the correlations between adoption and landownership, size of planting, extension contact, obtaining of credit, literacy and education.

The other independent variable, lack of credit problems, is positively related to adoption but is not statistically significant.

The mathematical results of the correlations are

presented in Table 12.

Table 12

Results of Statistical Tests

Hypothesis Number	Adoption 1970 vs. Independent Variable	r Value	Level of Significance (p)
1	Landownership	.144	$p < .05$
2	Size of planting	.361	$p < .01$
3	Contact with extension	.227	$p < .01$
4	Obtaining of credit	.434	$p < .01$
5	Lack of credit problems	.116	$p > .05$(n.s.)
6	Literacy	.164	$p < .05$
7	Education	.179	$p < .05$

Other Findings

In an attempt to further investigate the role of the result demonstration in the adoption process, adoption as it had taken place in 1966 was correlated with four of the independent variables. Adoption in 1966 was correlated with: landownership, size of planting, literacy and education. The rationale behind this additional analysis was to determine if the positive relationships that were found for adoption in 1970 had existed for those who had adopted in 1966.

The adoption index score for 1966 was computed based on the farmers' adoption of the four practices. The correlations for adoption 1966 and the four named variables are summarized in Table 13 along with the level of significance.

Adoption 1966 and Landownership. The operationalization of these variables was the same as in hypothesis 1

except the adoption index score for 1966 was used. The correlation between these two variables was .062. This was not significant at the .05 level. There was a low correlation between landownership and adoption in 1966. One would expect a higher correlation than was evident from the data presented. By 1970 the correlation was statistically significant. See Appendix A, Table 32 for data on these two variables.

Size of Planting 1966 and Adoption 1966. The operationalization of these variables was the same as for hypothesis 2 except that the size of planting for 1966 was used along with the adoption index score for 1966. The correlation between these two variables was .250 which is significant at the .01 level. See Appendix A, Table 30 for data on these two variables.

Literacy and Adoption 1966. These variables were operationalized the same as for hypothesis 6 except for the differences noted in the adoption index score above. The correlation between these two variables was found to be .132 which was not significant at the .05 level. See Appendix A, Table 31 for data on these two variables.

Education and Adoption 1966. These variables were operationalized the same as for hypothesis 7 except that the adoption index score for 1966 was used. The correlation between these two variables was found to be .136 which was not significant at the .05 level. See Appendix A, Table 29 for data on these two variables.

Table 13

Summary of Variables Not Tested in Formal Hypotheses

Adoption 1966 vs. Variable	Correlation	Significance
1. Landownership	.062	N.S.
2. Size of planting 1966	.250	.01
3. Literacy	.132	N.S.
4. Education	.136	N.S.

It is possible that the four introduced practices used to compute the adoption score were so new in 1966 that the usual correlations did not have time to show. This could explain the fact the correlations were lower in 1966 than in 1970.

In addition, two other variables were correlated to measure the change from 1966 to 1970. These were landownership and yield. Landownership was defined in hypothesis 1 above. Yield was measured for 1966 and 1970 as reported by the respondents. Their responses are the most accurate available because farmers frequently do not harvest all their corn at one time and very seldom weigh all of it. They only weigh the part they sell.

Because landowners would be better able to acquire the inputs, a positive correlation between landownership and yields would be expected. Also, as discussed earlier (H_1) landowners would expect to reap the benefits of improvements on their lands.

The correlation between landownership and yield for 1966

was .036. This was an extremely low correlation even though it is in a positive direction. There is hardly any relation between the two variables.

When these same two variables were measured for 1970, a different relationship was found. The correlation was .188. As a result of the demonstration, landowners increased their production much more than did the renters. After learning about the new practices, it appears that landowners are in a better position to take advantage of the new practices. See Appendix A, Tables 33 and 34 for data on these variables.

Effects of the Program

The farmers in this survey averaged 19.085 cwt. per "manzana" (approximately bushels per acre) for their corn crop during 1966. According to the crop reports put out by the Ministry of Agriculture, the average yield in corn production for that year was 19.5 cwt./mz. for the nation as a whole. From this one can see that the production techniques for the farmers in this survey did not vary too much from the general population of farmers.

In 1970 the average production for the farmers in the survey was 37.477 cwt./mz. This was a considerable increase from 1966. The average production for the country as a whole for 1969 was 22.8 cwt./mz. The preliminary report for the crop year 1970/71 was that total corn production had increased by about 14.5% but the average yield per "manzana" had not been calculated yet. However, we can see that the average yield of all the farmers in the study for 1970 was

considerably higher than the national average for 1969. Table 14 summarizes the results.

Table 14

Corn Yields

	Farmers in Survey Average Production	National Average	Total National Production
1966	19.085 cwt./mz.	19.5 cwt./mz.	5,780,730 cwt.
1969		22.8 cwt./mz.	6,107,000 cwt.
1970	37.477 cwt./mz.		7,000,000 cwt.(est.)

To view the trends in corn production for El Salvador as a whole, see Appendix F.

An increased demand in farming areas for the inputs introduced through the demonstration program would show up in an increase in the number of distributors of agricultural inputs in the country. According to a survey done by the government credit organization (Administracion de Bienestar Campesino), there were 117 distributors in 1966. By 1970 there were 430 distributors or an increase of 286 percent. This increase would be due, at least in part, to meeting the demands of the farmers for agricultural inputs in their respective areas. The increase in volume of sales was not analyzed in this study.

To get another idea of how the farmers were changing their production practices, we asked them to report the number of "manzanas" planted to corn in 1966 and 1970. The average planting in 1966 was 1.845 "manzanas" and in 1970 it had increased to 2.266 "manzanas." To get another idea

of the change in land planted to corn, the study found that 80 respondents out of a total of 201 had increased their plantings, 71 were planting the same amount of land to corn in 1966 as they were in 1970, and 50 farmers had decreased their size of corn plantings. The total number of "manzanas" planted by the 204 farmers in the survey in 1966 was 372.75 and the number in 1970 was 460.00. No definite trend is noted in national figures (see Appendix F) showing increased amounts of land planted to corn. No attempt is made in this study to determine where this additional land came from that farmers were planting to corn.

Yield Increase Per Zone

The Extension Service in El Salvador was divided into four different zones in 1966. The average yields for farmers in the sample per zone for 1966 and 1970 are shown in Table 15. We find that in each zone the average yield increased. The increase was greatest in zone 1 and smallest in zone 4. In three of the zones the increase was statistically significant at the .01 level and in the fourth zone the increase was not statistically significant.

The adoption score varied between the zones also. As with the yields, adoption was highest in zone 1 and lowest in zone 4. The mean adoption index score for 1970 for all zones was 15.667. The possible adoption score was 24. Table 16 shows the average adoption index score for each zone in 1970.

Table 15

Corn Yields in 1966 and 1970

Zone	1966	1970	Level of Significance (t) of Increase
1	23.76	48.10	.01
2	17.32	41.44	.01
3	14.08	34.02	.01
4	17.25	23.25	N.S.

Table 16

Adoption According to Zone

Zone	Adoption Index Score 1970
1	17.721
2	15.679
3	15.854
4	11.000

Additional Findings

To get a total picture of the farmers in the survey, several other questions were asked.

To determine where the farmers were receiving credit, the question was asked: if they had credit, from whom was it obtained? A total of 98 farmers had received credit in the previous four years. Some of these farmers had received credit from more than one source. Table 17 gives the number of farmers receiving credit from each source.

Table 17

Sources of Credit

N = 204

	Number
Administracion de Bienestar Campesino (government credit)	73
Catholic Cooperatives	18
Cajas de Credito (private bank)	12
Private Loans	12
National 4-C Committee	9
Fedecaces Cooperatives	1

Even though several farmers had obtained credit and as shown earlier this was significantly related to adoption, several farmers were purchasing the inputs themselves. The question was asked the farmers: if they were using inputs in 1970, where did they get the money to purchase the materials? Table 18 shows the responses they gave.

Table 18

Sources of Money to Purchase Inputs 1970

N = 204

Source	Number
Self-financed	116
Credit	62
No response	19
Other	4
Farm owner	3

The farmers were asked what problems they had had in the past five years in respect to their corn crop. The results to this question are in Table 19. Up to four responses were taken from each farmer.

Table 19

Problems of the Farmers in the Last Five Years

N = 204

Problem	Number Answering
Credit	122
Weather	109
Land	105
Storage of corn crop	76
Marketing	67
Technical problems	40
Others	14

To get an idea of other crops on which the farmers might have adopted the practices learned through the demonstration the question was asked: have you fertilized other crops as a result of the demonstration? Table 20 gives the responses to this question.

Of the total sample, 76 farmers said that they had problems storing their corn. Some farmers have metal or wooden bins for on-the-farm storage. To see what effects the increased production had on the on-farm storage, the farmers were asked: if they had storage bins in 1966 and how many they had in 1970? In 1966, 69 farmers had storage bins or 34 percent of

the total. By 1970 this number had increased to 106 or 52 percent. Thirty-seven additional farmers or 18 percent of the total sample had storage bins in 1970 that did not have them in 1966.

Table 20

Crops Farmers Are Now Fertilizing

N = 204

Crop	Number Fertilizing
Beans	61
Rice	57
Vegetables	42
Fruits	18
Others	18
Sorghum	17

One method of measuring the economic well-being of the farm family is if their corn lasts for family consumption for the whole year. Table 21 gives the responses to this question asked of the total sample.

Table 21

Corn Lasting for Consumption for Whole Year

N = 204

Yes	=	142
No	=	52
Sometimes	=	9
No response	=	1

There are two practices that the farmers are using that merit further investigation. One of these is to what extent farmers are using second generation seed and the other is the incidence that formula fertilizer is being applied after planting instead of at planting.

According to Table 7, 28 farmers or 14 percent of the total sample were planting all of their land to second generation hybrid seed. In addition however, 51 or 25 percent were planting part of their land to a second generation seed. A total of 39 percent of the sample was using second generation seed.

With formula fertilizer, the incidence of those applying it after planting was higher than those applying it at planting. The number of farmers applying formula fertilizer after planting on all their land was 65. For those applying it at planting the number was 48. In all, 105 farmers were applying the formula fertilizer after planting on at least part of their land. This was over 51 percent.

CHAPTER V

SUMMARY AND CONCLUSIONS

Summary

The purpose of the present study was an attempt to discover how the result demonstration affects the adoption process with subsistence farmers in developing countries. The study was carried out in El Salvador, Central America, where the Agricultural Extension Service has been promoting a result demonstration program. This program has been in existence since 1965.

To determine the change or the adoption of practices introduced through the demonstration program, an area random sample was taken of farmers who had been awarded corn demonstrations in 1966. Thirty percent of farmers who had demonstrations were selected from each extension office. The farmers were interviewed and asked which practices they were using. They were also asked their yield and number of "manzanas" planted to corn for 1966 and 1970. Additional questions were over demographic data, such as years of education, literacy and landownership. Other questions were over extension contact, credit received and credit problems.

The Findings

In the testing of the hypotheses a positive relationship was found between adoption of the improved practices and each

of the seven independent variables tested. A positive relationship had been predicted. In six of the seven hypotheses tested, the relationship was statistically significant at the .05 level or less.

Below are the seven hypotheses, along with the r correlation and the level of statistical significance:

H_1: Landownership is positively related to adoption.

$r = .144$ $p < .05$

H_2: The size of planting is positively related to adoption.

$r = .361$ $p < .01$

H_3: Contact with extension is positively related to adoption.

$r = .227$ $p < .01$

H_4: The obtaining of credit is positively related to adoption.

$r = .434$ $p < .01$

H_5: Lack of credit problems are positively related to adoption.

$r = .116$ $p > .05$ N.S.

H_6: Literacy is positively related to adoption.

$r = .164$ $p < .05$

H_7: Education is positively related to adoption.

$r = .179$ $p < .05$

Only one hypothesis, H_5, was not statistically significant. This could be due in part to the manner in which it was stated and also the manner in which it was operationalized.

Four of the above hypotheses were tested using an adoption score for 1966 to determine the effect of the demonstration

on some of the variables. The variables used in this section were education, literacy, landownership, and size of planting.

Each of the four above-mentioned variables is significantly related to adoption in a positive direction for 1970. In contrast, three of the four variables are not significantly related to adoption in 1966. Only one, size of planting, is related to adoption in 1966. Below is the summary of results for 1966.

Ownership	vs. Adoption 1966	$r = .062$	p	N.S.
Size of Planting	vs. Adoption 1966	$r = .250$	$p < .01$	
Literacy	vs. Adoption 1966	$r = .132$	p	N.S.
Education	vs. Adoption 1966	$r = .136$	p	N.S.

Perhaps the reason that the correlations between adoption and the independent variables are higher in 1970 than in 1966 is that the practices had not yet diffused throughout the country. Many farmers, regardless of their position, had not yet adopted the practices in 1966. As a result of the demonstration, those farmers who had more education, larger plantings, more extension contact, more credit and were literate and owners adopted more practices. The demonstration increased the correlation between the variables so that all but one was statistically significant in 1970.

In addition, yield was correlated with ownership for both 1966 and 1970. Yield was significantly related to landownership in 1970, $r = .188$ $p < .01$. However, this was not the case for 1966 where $r = .036$ and was not significant.

The percentage of farmers who were using each of the four improved practices in 1970 had increased over 200 percent from the base period of 1966. A minimum of 73 percent of the total farmers in the sample were using each practice on at least part of their land in 1970. The percent adoption for 1966 ranged from 15 percent in formula fertilizer to 27 percent for nitrogen fertilizer. Farmers adopted the practices introduced through the result demonstration.

The farmers' yields, as reported by them, almost doubled from 1966 to 1970. The increase was from an average of 19.09 cwt./mz. to an average of 37.48 cwt./mz. During the same period, the national average increased from 19.5 cwt./mz. to 22.8 cwt./mz.

During the period 1966 to 1970 the number of distributors of agricultural inputs increased 286 percent from 117 distributors to 430.

The farmers in the survey increased their average planting in corn from 1.845 "manzanas" to 2.266 "manzanas." Forty percent of the farmers in the survey had increased the size of their planting and 25 percent had decreased. We see a trend here that shows that as the improved practices become adopted, farmers are planting more land to corn. This, however, would depend on the availability of land in their particular area and the resources of the individual farmer. In the total sample, and possibly for all those who established demonstrations, the increased land planted to corn must be taken from smaller-scale farmers who are decreasing their plantings, from those who were not demonstrators or

from other crops. The increased plantings are not likely to come from previously unused land.

The average yield increased among farmers sampled in each zone during the four years, with the biggest increase coming in zone 1 and the smallest increase in zone 4. Correspondingly, the average adoption score was highest for zone 1 and lowest for zone 4.

Farmers had received credit from a number of sources. The source which gave the farmers the largest number of credits was the government credit organization (ABC). In 1970 a total of 116 farmers reported that they bought the inputs they were using themselves and 62 reported they acquired them through credit.

Credit, land and the weather were reported as the biggest problems that the farmers had during the past five years.

Several farmers reported that they were now fertilizing other crops. Beans, rice and vegetables were the most frequently mentioned.

Thirty-seven farmers reported that they had storage bins in 1970 that did not have them in 1966.

One hundred and forty-two farmers reported that they had enough corn for their family consumption to last the whole year.

Factors for Non-Adoption

One of the factors that could cause a farmer not to adopt the introduced practices could be lack of money. Even though a farmer would perceive the innovations as having a relative

economic advantage, he might not adopt because he did not have the money to buy the inputs. Therefore, credit has a direct influence on adoption. This was shown by the correlation of .434 between credit obtained and adoption.

Another factor that might discourage the farmer from adopting would be the low net return in relation to the cost of buying the inputs. The net return to the farmer would depend on whether the farmer owned or rented his land. According to Schickele (1971) a benefit:cost ratio of 2 or more is often needed for a farmer to adopt. A breakdown on the benefit:cost ratio for a farmer planting one "manzana" of corn is given in Appendix E. Also a benefit:cost ratio is calculated for a farmer planting corn as a first crop and beans as a second crop as is commonly done in El Salvador. A farmer renting the land and just planting one "manzana" of corn would have a benefit:cost ratio of about 2.1.* However, if one computes the benefits as the farmer's total production minus his family's consumption, a ratio of 1.26 is derived. He is hardly getting his money back and with the high risk as perceived by the farmer, he might not adopt the practices completely or to the extent recommended by the Extension Service. In contrast, a farmer owning his land has a benefit:cost ratio of 4.1 in comparison to 2.1. With

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*The adoption of new technology by a renter is related to his tenure situation. The dominant form is cash rental in El Salvador and so the author has used this as a basis for the benefit:cost ratio. A share rental or other form of tenure would change this ratio and thus affect the incentive for adoption of the new technology.

these benefit:cost ratios, an owner will be more inclined to adopt than would a renter.

It appears that for a farmer to adopt the new practices sufficient economic returns in the market economy are needed to pay for the additional inputs. If a farmer and his family consume a portion of their production, this they cannot sell. If they do not receive enough monetary return to pay for the inputs and some to cover the risk involved, they would not adopt the practices. This would be the case even though increased production is demonstrably advantageous.

The benefit:cost ratio was computed without labor figured in as a cost. It is assumed that the farmer is not working and will plant corn regardless. Anything he earns will be more than he has.

Another factor for non-adoption might be that the inputs are not available. With 430 distributors in a country that has only 8,000 square miles, this should not be a factor for very many farmers. Only a few farmers would be more than 10 or 15 kilometers away from a town where there was a distributor.

Limitations of Present Study

There are several limitations to the present study. One is that the farmers in this study are not typical of the whole population of farmers in El Salvador. No attempt is made to generalize to all farmers in El Salvador nor to say that if all the farmers in the country had been awarded a demonstration, they would have adopted the practices. The farmers in the sample, by being awarded a demonstration by the Extension

Service, would have more extension contact than the average farmer and probably be more inclined to seek out information and accept new ideas. They would be above average in some respects.

Another limitation of the study was that it was ex-post facto research. Farmers were asked to state the practices they were using in 1966. There was no way of checking the accuracy of their responses. Farmers might not remember in exactly what year they began using the practices.

No attempt was made to determine in which year the farmers adopted the practice nor if there had been regression of the adoption of practices from one year to the next. Only the regression between 1966 and 1970 was determined.

The interviewers were extension agents and, outside of one training meeting, they had no experience in interviewing. No attempt was made to determine inter-agent reliability. No rigid interview schedule was set up. The agents generally followed the questionnaire in asking the questions.

The question might arise as to why extension agents were used as interviewers in the present study. If a stranger to the community were to interview the farmers, they might think that the government was going to levy a tax and therefore, would not give reliable data. In contrast, the extension agent is known in most communities and the farmers confide in him. He explained at the start of the interview that the purpose of the interview was to evaluate extension programs. The threat of unreliable data is actually reduced by having

the extension agents do the interviewing.

Certain responses by the farmers might be questioned as to their reliability, especially the question on yield. The answer given by the farmers is probably the best available. Many farmers do not weigh their total harvest and therefore, do not know what is their exact production. Frequently they begin to consume part of their crop as it matures. These farmers are quite observant and can tell the changes in yield from one year to the next. Their estimates are as good as can be obtained.

There is a possibility that the extension agents might have influenced the answers. This could be the case with all interviewers. Accuracy was stressed and discussed in detail with them at zone meetings. It was also stated that one agency would not be compared with another. This would lessen the effect of inter-agency rivalry.

Returns were low on the total sample because there was no immediate follow-up and because of the mobility of the farmers. Follow-up was difficult because the author left the country and conducting a survey from thousands of miles away is difficult. Many farmers could not be interviewed because they were no longer living in the same place. Of those that the extension agents tried to interview, 34 percent could not be interviewed or were no longer planting corn.

There does not seem to be any reason why some agents conducted the interviews and returned the questionnaires while others did not. Each extension zone had some agencies

not responding. Some of what were considered the better agents did not return the data along with some not so highly rated.

In measuring adoption of the new practices, no attempt was made in this study to determine differences between amounts of the inputs applied. For some practices this might be critical, such as for fertilizers. In others, such as seed, it would not be critical.

A farmer might obtain higher yields if he applied four hundred pounds of fertilizer than if he applied one hundred pounds. Adoption was measured only by a farmer using the practice but not by the amount used. No attempt at an economic evaluation of the practice was made.

The sample might be a little biased on the ownership variable. Landowners are more likely to be residing in the same location four years later than are landrenters. The renters might not be able to rent land and would change locations. Agents doing the interviewing would be able to contact a higher percentage of landowners than landrenters.

Observations

One observation that arose out of the study was that farmers are hesitant to apply their formula fertilizers at planting time. Over one-half of the farmers applying formula fertilizer did so after planting. They are afraid they will "lose" their fertilizer if the corn does not germinate. Traditionally the farmers have had corn with low germinating power and therefore, did not have faith that it would all

germinate; therefore, their hesitancy now to apply fertilizer at planting. Farmers can be taught to do simple seed germination tests. Once they know the germination potential of the seed they should be shown, perhaps by demonstrations, the increased yields they would obtain by applying their fertilizer earlier.

Another observation was that several farmers were not using new hybrid seed every year but hybrids of a second generation. Perhaps hybrid corn is not the answer for all subsistence farmers. Anything they have to spend money for is a disincentive for adoption. Perhaps varieties should be bred that are not hybrids and that subsistence type farmers can plant year after year.

The farmers use of insecticides would depend to a large extent on the amount of damage to the crop. Farmers in some cases would not buy these inputs unless they could see insect damage in their fields. This practice was the least adopted of the four practices introduced through the demonstration program.

Nitrogen fertilizer was the practice that had the highest adoption before 1966. In 1970 only 12 percent of the farmers in the survey were not using this practice on at least part of their land. Nitrogen fertilizer, such as ammonium sulfate, was one of the first fertilizers introduced in the country. Today this fertilizer costs less than three dollars per 100 pounds and is easily obtainable in all parts of the country. With this prior orientation to nitrogen fertilizer, one can

see why it is used by a vast majority of the farmers in the survey.

Conclusions

As a result of this study it appears that the establishing of a result demonstration increases the adoption of the practices introduced through the demonstration. Farmers came into personal contact with new practices in this manner. Sometimes they would not have tried these new practices if they had not been awarded a demonstration. It appears that those farmers who were owners, planted larger amounts of land, had more education and more extension contact adopted more of the practices. The farmers who were better able to adopt the practices did so. The role that the demonstration played was to introduce the farmers to the new practices, give them first-hand experience and through this, give them a basis for evaluating the practices under their own farming and economic conditions.

It appears that in order for more farmers to adopt the more modern practices, the means need to be available. This means credit. The correlation between credit and adoption was quite high. Many more farmers than presently have the chance want to acquire credit. This was shown by the response that credit was the number one problem of all the problems that farmers had. More credit needs to be made available to those farmers who just are planting one "manzana" of land.

The farmers in the sample were close to the national average in corn production in 1966, the year they were awarded

the demonstration. Four years later their production had almost doubled while the national average increased no more than 25 percent. It appears that the farmers who had demonstrations were starting to produce more than just for subsistence. With their increased yields, they would sell some and thus enter into the economy.

There are important issues that need to be investigated when the potential production in a country reaches self-sufficiency in human consumption. Any extra production that is channeled into exports, livestock production or processing has a different elasticity of demand. This breakpoint or market outlet change becomes critical in the economic justification for further production increases.

It has to be determined that the corn market price for other outlets--processing, livestock and export--is sufficiently high to justify adoption of these inputs.

This study recognizes this as important but does not focus on this aspect and the author does not have data to make an evaluation of this problem. Additional research is needed in this area.

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APPENDICES

APPENDIX A

Table 22

Adoption Score 1970 vs. Literacy

		Adoption Score 1970									
		0	1-4	5-8	9-11	12-14	15-17	18-20	21-23	24	
Read and Write	Yes	6	7	13	7	12	19	13	27	31	135
	No	5	5	8	9	8	9	9	7	8	68
		11	12	21	16	20	28	22	34	39	203

$r = .164$ $p < .05$

Table 23

Adoption Score 1970 vs. Credit Obtained

		Adoption Score 1970									
		0	1-4	5-8	9-11	12-14	15-17	18-20	21-23	24	
Credit Obtained	Yes	2	1	2	6	9	14	11	24	29	98
	No	9	10	17	9	8	14	11	10	10	98
		11	11	19	15	17	28	22	34	39	196

$r = .434$ $p < .01$

Appendix A (cont'd.)

Table 24

Adoption Score 1970 vs. Ownership

Adoption Score 1970		0	1-4	5-8	9-11	12-14	15-17	18-20	21-23	24	
Ownership	Yes	4	6	10	6	12	17	9	19	28	111
	No	6	6	11	9	8	11	13	15	10	89
		10	12	21	15	20	28	22	34	38	200

$r = .144$ $p < .05$

Table 25

Adoption Score 1970 vs. Lack of Credit Problems

Adoption Score 1970	0	1-4	5-8	9-11	12-14	15-17	18-20	21-23	24	
Credit Problems	7	8	13	12	14	18	12	17	21	122
Lack of Credit Problems	4	4	8	4	6	10	11	17	18	82
	11	12	21	16	20	28	23	34	39	204

$r = .116$ N.S. at the .05 level

Appendix A (cont'd.)

Table 26

Adoption Score 1970 vs. Size of Planting

Size of Area Planted in Manzanas	Adoption Score 1970									
		0	1-4	5-8	9-11	12-14	15-17	18-20	21-23	24	
	5+	0	0	1	0	0	1	1	4	5	12
	5	0	0	0	0	0	0	2	0	0	2
	4	0	0	0	1	2	2	2	2	6	15
	3	0	1	2	0	5	4	4	7	6	29
	2	0	0	7	4	7	7	7	9	11	52
	1	11	11	11	11	6	14	7	12	10	93
		11	12	21	16	20	28	23	34	38	203

$r = .361$ $p < .01$

Appendix A (cont'd.)

Table 27

Adoption Score 1970 vs. Education

Adoption Score 1970

Years in School	0	1-4	5-8	9-11	12-14	15-17	18-20	21-23	24	
10+	0	0	1	0	0	1	0	0	1	3
7-9	0	0	0	0	1	4	1	0	3	9
6	2	2	1	0	0	1	2	1	7	16
5	1	0	0	0	0	0	0	2	2	5
4	1	0	0	0	2	1	0	1	3	8
3	0	2	1	2	0	2	3	12	5	27
2	1	0	4	7	6	5	3	6	5	37
1	2	2	6	0	4	5	2	4	3	28
0	4	6	8	7	7	9	10	8	10	69
	11	12	21	16	20	28	21	34	39	202

$r = .179$ $p < .05$

Appendix A (cont'd.)

Table 28

Adoption Score 1970 vs. Contact with Extension

Adoption Score 1970

Contact with Extension	0	1-4	5-8	9-11	12-14	15-17	18-20	21-23	24	
3.0	0	0	0	0	2	2	2	2	5	13
2.5	0	0	0	0	0	1	0	0	0	1
2.0	1	3	1	2	2	6	2	4	5	26
1.5	0	1	0	0	0	1	0	4	4	10
1.0	0	6	11	7	9	14	7	10	17	81
0.5	0	1	5	2	3	3	9	7	4	34
0.0	10	1	4	5	4	1	3	7	4	39
	11	12	21	16	20	28	23	34	39	204

$r = .227$ $p < .01$

Appendix A (cont'd.)

Table 29

Adoption Score 1966 vs. Education

Years in School	Adoption Score 1966 0	1	2	3	4	5	6	7	8	
10+	2	1	0	0	0	0	0	0	0	3
7-9	2	3	0	1	2	0	0	0	1	9
6	9	2	0	1	0	1	1	0	2	16
5	4	0	0	0	1	0	0	0	0	5
4	5	0	1	2	0	0	0	0	0	8
3	15	5	3	1	1	1	1	0	0	27
2	22	5	1	2	4	2	0	0	1	37
1	17	4	2	4	0	0	0	1	0	28
0	44	11	3	5	1	1	2	2	0	69
	120	31	10	16	9	5	4	3	4	202

$r = .136$ $p > .05$ (N.S.)

Appendix A (cont'd.)

Table 30

Adoption Score 1966 vs. Size of Planting

Size of Area Planted 1966	Adoption Score 1966									
	0	1	2	3	4	5	6	7	8	
5+	4	0	1	1	2	0	0	1	0	9
5	1	0	0	1	1	0	0	0	0	3
4	4	0	1	3	1	0	0	0	1	10
3	6	5	0	2	0	2	1	1	0	17
2	34	11	4	5	3	2	2	1	2	64
1	72	15	4	4	2	1	1	0	1	100
	121	31	10	16	9	5	4	3	4	203

$r = .250$ $p < .01$

Table 31

Adoption Score 1966 vs. Literacy

N = 203

Adoption Score 1966

		0	1	2	3	4	5	6	7	8	
Read and Write	Yes	75	22	6	11	8	4	3	2	4	135
	No	46	9	4	5	1	1	1	1	0	68
		121	31	10	16	9	5	4	3	4	203

$r = .132$ $p > .05$

Table 32

Adoption Score 1966 vs. Ownership

N = 200

Adoption Score 1966

		0	1	2	3	4	5	6	7	8	
Ownership	Yes	69	9	6	11	6	2	3	2	3	111
	No	48	23	4	5	3	3	1	1	1	89
		117	32	10	16	9	5	4	3	4	200

$r = .062$ $p > .05$

Appendix A (cont'd.)

Table 33

Yield 1970 vs. Ownership

N = 197

Yield 1970

		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81+	
Ownership	Yes	3	12	15	35	15	12	10	5	2	109
	No	2	18	18	20	20	7	2	0	1	88
		5	30	33	55	35	19	12	5	3	197

$r = .188$ $p < .01$

Table 34

Yield 1966 vs. Ownership

N = 195

Yield 1966

		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81+	
Ownership	Yes	23	51	16	15	0	1	1	0	0	107
	No	23	39	15	9	0	1	1	0	0	88
		46	90	31	24	0	2	2	0	0	195

$r = .036$ $p > .05$

Appendix A (cont'd.) Table 35

Credit Obtained vs. Credit Problems

Credit Obtained

		Yes	No	No Response	Total
Credit	Yes	59	58	5	122
Problems	No	39	40	3	82
	Total	98	98	8	204

APPENDIX B

INSTRUCTION SHEET TO THE AGENTS

(Translated into English by the Author)

To: Agricultural Extension Agents

From: Jose Perez Guerra, Sub-director of Agricultural Extension and (Earl) William Threadgould, Agricultural Extension Advisor, USAID

Subject: Instruction for the Sheets over the Inquiry for the Massive Demonstrations in Corn - 1966

This is an evaluation of the program of massive demonstrations and an inquiry over the adoption of the technology taught by means of these demonstrations.

In order to do a better and deeper evaluation, we have selected only one year (1966) and one crop (corn) for this inquiry. Even though the data are of only one year, you can make conclusions for all the years.

Each agency has received a sheet with the names of various farmers and some questionnaires. The farmers on this list were randomly selected from the sheets of the demonstrations that were in the central office. We have discounted the demonstrations of yellow corn, the lost demonstrations and those with 4-C members. In the lists, according to our information, there are only farmers with demonstrations of white corn (H-3, Compuesto No. 1 or Compuesto No. 2). We have counted the total number of farmers with demonstrations of white corn and selected 30% of the total. The reason why some agencies have more questionnaires to fill out is because

that agency had more demonstrations with farmers.

In the lists of the farmers are the name of the farmer, area of residence (canton), class of seed used, estimated yield in qq/mz (bushels/acre) and directions to find the plot. You must remember that these directions are for the plots and in some cases the farmer does not live where he had the demonstration. In other cases there were not directions, some sheets were filled out with a ballpoint pen and not on a typewriter. It could be that some names and addresses are mistaken. If you know of someone with a similar name, you can interview him.

The numbers that appear on the left side of the names we have used only to select the persons.

Suggestions to fill out the sheets

1. Please read this questionnaire before interviewing the farmers. If you know well about which you are asking, you will lose less time in the interview and the data will be better.

2. Look for the persons in the list, put the name on the questionnaire and add the address of each one.

3. If a farmer has some additional comments, please put them after the last question.

4. Try to get correct data, not those that seem favorable. The success of this study depends on you.

5. This questionnaire is large, but in various questions you only need to mark an "X."

6. In question No. 3 if someone is using H-3 corn

bought this year, he cannot be using improved corn of a second generation; and the same if one is using formula fertilizer at planting, he cannot be using only one application of nitrogen per year. Put an "X" only in the practices that he is using.

7. In question No. 3 in the fifth part, you can put a "5" after the "3" to read at 35 days.

8. In question No. 9 if a farmer thinks that he has three of these as a problem, put only these three in order of importance.

9. In question No. 18 you must write a few words; please do not just put an "X."

10. These questionnaires must be filled out and in the central office at the latest on July 10, 1970.

11. Please put the name of the agent who does the interviewing and the date in the upper part of the first page of the questionnaire.

Thank you for your collaboration

Jose Perez Guerra
Sub-director of
Agricultural Extension

William Threadgould
Agricultural Extension
Advisor, USAID

APPENDIX C

Inquiry about the Massive Demonstration Program for Corn in 1966

Agency _____

Name of the farmer _____

Township or city _____

Landowner _____ Renter _____

How many years in school _____ Can you read and write _____

Number of persons in your household _____

1. Before you had the demonstration did you use:

	on all your corn	on part	on none
improved seed	_____	_____	_____
formula fertilizers at planting	_____	_____	_____
second application at 35-40 days	_____	_____	_____
insecticides	_____	_____	_____

2. As a result of the demonstration, are you convinced of the use of:

improved seed _____

fertilizers _____

insecticides _____

3. This year are you using:

	on all your corn	on part	on none
improved seed bought this year	_____	_____	_____
second year improved seed	_____	_____	_____
formula fertilizer after planting	_____	_____	_____
formula fertilizer at planting	_____	_____	_____

3.(cont'd.)

	on all your corn	on part	on none
second application of nitrogen at 35-40 days	_____	_____	_____
foliage insecticide	_____	_____	_____
only one application of nitrogen for the whole year without formula fertilizer	_____	_____	_____

4. If you are not using these practices, why? _____

_____

5. Estimated yield before 1966 _____qq/manzana (approximately bu./acre)

   Estimated yield this year _____qq/manzana

6. Area planted in corn before 1966 _____Manzanas (approximately 1.7 acres)

   Area planted in corn this year _____Manzanas

7. Have you had credit in the last four years? _____

From whom	How many years
ABC (government agency)	_____
Rural credit bank (private)	_____
Catholic cooperatives	_____
FEDECACES cooperatives	_____
Private loans	_____

8. If you are using improved practices this year, where did you get the materials?

   credit _____

   self financed _____

   landlord _____

   other _____

9. Problems that you have had in the last five years--put them in order of importance.

credit	_____	marketing	_____
land	_____	others (list)	_____
storage	_____	technical problems of the crop	
weather	_____	_____	

10. As a result of your demonstration in corn, have you fertilized other crops? Which ones? _____

11. How many neighbors visited your demonstration? _____

12. How many neighbors who visited your demonstration are putting into practice that which you showed them? _____

13. Whom would you consult if you had a problem with your corn? _____

14. Did you have a grain storage bin in 1965 before the demonstration? _____ How many do you have today? _____

15. Is your wife a member of the homemakers clubs? _____

16. How many sons or daughters do you have in the 4-C clubs this year? _____

17. Do you have a family vegetable garden? _____
What size? _____ square meters

18. How have you bettered your living conditions since 1966? Indicate how.

What improvements have you made in your house? _____

Have you bought new agricultural implements? _____

Are your children in the school longer? _____

Does your production of corn last for your consumption during the whole year? _____

18.(cont'd.)

Have you increased your household conveniences? (stove furniture, etc.) _____

Have you built a latrine? _____

Others _____

APPENDIX D

NUMBER OF DEMONSTRATIONS ESTABLISHED
MASSIVE FERTILIZER DEMONSTRATION PROGRAM/EL SALVADOR

Crop	1965[1]	1966[1]	1967[1]	1968[1]	1969[2]	1970	Total
Corn	3,200	3,420	2,620	1,035		300	10,575
Rice	80	530	485	220			1,315
Beans		720	460	370	265	500	2,315
Sorghum		1,340	1,260	700		400	3,700
Others		70	200	63			333
Total	3,280	6,080	5,025	2,388	265	1,200	18,238

1 Informe Sobre el Programa de Demonstraciones Masivas, 1968

2 Informe Anual de Labores: 1970 Ministerio de Agricultura y Ganaderia

APPENDIX E

BENEFIT:COST RATIOS

Cost of Planting 1 "Manzana" (7,000 sq. meters or 1.7 acres)

Corn		
Hybrid seed	25 lbs.	¢11.00
Formula fertilizer 20-20-0	440 lbs.	38.00
Ammonium sulfate 21% N	330 lbs.	17.10
Insecticide dust 4%	50 lbs.	11.75
		¢77.85
Beans		
Seed	100 lbs.	¢40.00
Fertilizer 18-46-0	220 lbs.	25.50
Insecticide (Folidol M-2)	100 lbs.	22.50
		¢88.00

	Corn Alone renter	Corn Alone owner	Corn and Beans renter	Corn and Beans owner
Cost of Inputs	¢ 77.85	¢ 77.85	¢166.85	¢166.85
Soil Preparation	25.00	25.00	25.00	25.00
Land Rent	100.00	--	100.00	--
Total Expenditures	¢202.85	¢102.85	¢290.85	¢190.85
Production				
Corn	50 cwt.	50 cwt.	50 cwt.	50 cwt.
Beans	--	--	20 cwt.	20 cwt.
Total Value				
Corn	425.00	425.00	425.00	425.00
Beans	--	--	450.00	450.00
Total	¢425.00	¢425.00	¢875.00	¢875.00
Benefit:Cost Ratio	2.095	4.132	3.008	4.584

Benefit:Cost Ratio figured with consumption as a factor.
Family consumes 20 cwt. of corn and 5 cwt. of beans.

Sales Corn	¢255.00	¢255.00	¢255.00	¢255.00
Sales Beans	--	--	337.50	337.50
Total	¢255.00	¢255.00	¢592.50	¢592.50

Appendix E (cont'd.)

	Corn Alone renter	Corn Alone owner	Corn and Beans renter	Corn and Beans owner
Total Expenditures	¢202.85	¢102.85	¢290.85	¢190.85
Benefit:Cost Ratio	1.257	2.479	2.037	3.104

Note: 1 dollar U.S. = 2.50 Colones (¢)/El Salvador

APPENDIX F

CORN: AREA, PRODUCTION AND YIELD/EL SALVADOR

Year	Area Planted (manzanas)	Production (cwt.)	Yield (cwt./mz.)
1959/60	254,600	3,272,916	12.9
1960/61	253,690	3,870,200	15.3
1961/62	221,795	3,144,665	14.2
1962/63	282,594	4,629,181	16.4
1963/64	246,686	4,501,665	18.2
1964/65	236,792	4,165,451	17.6
1965/66	275,820	4,413,175	16.0
1966/67	296,600	5,780,730	19.5
1967/68	274,095	4,540,000	16.6
1968/69	285,350	5,598,900	19.6
1969/70	274,200	6,107,000	22.8
1970/71	N.A.	7,000,000(est.)	N.A.

Data from "Anuario de Estadisticas Agropecuarias"
Ministerio de Agricultura y Ganaderia, El Salvador