SEEDS OF HOPE PROJECT

CIAT

FINAL REPORT

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Miguel Mendez — Assistant for Honduras
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AN EMERGENCY PROJECT TO HELP AGRICULTURE RECOVER FROM THE EFFECTS OF HURRICANE MITCH

FOR THE DONORS
CIDA AND USAID

JOINT PROJECT BY:

International Center for Tropical Agriculture (CIAT)
International Maize and Wheat Improvement Center (CIMMYT)
International Potato Center (CIP)
International Plant Genetic Resources Institute (IPGRI)

December 2000

Executive Summary

From the 25th to the 30th of October 1998, Hurricane Mitch devastated huge areas of Honduras and Nicaragua, razing bridges and highways, thus leaving some regions isolated and blocking aid efforts.

Facing this situation, four members of the Consultative Group of International Agricultural Centers (CGIAR) joined forces with national institutions and nongovernmental organizations (NGOs) of the two countries to help with seed for small-scale producers[1] that were affected by the hurricane. The four centers were the International Center of Tropical Agriculture (CIAT[2]), the International Maize and Wheat Improvement Center (CIMMYT), the International Potato Center (CIP), and the International Plant Genetic Resources Institute (IPGRI). CIMMYT proceeded to recover control of the genetic sources of its materials. Through the national institutions it was quickly able to increase and distribute maize seed. For its part, CIP, with the support of the CIAT–Seeds of Hope (SOH) and the national institutes, introduced sexual potato seed and vegetative yam seed (*Ipomoea batata*). The CIAT–SOH, using the Atlas for Honduras that was produced with donor-assigned resources, proceeded to identify areas affected by the hurricane, and areas with greater concentration of affected bean producers who were also the poorest. With this information and NGO support, in 1999 SOH proceeded to distribute seed of three improved bean varieties, Dorado, Tío Canela, and Don Silvio, products of two plantings during that year. The seed benefited about 18,000 poor producers and their families that were affected by the hurricane.

Training was given in postharvest handling of seed, in which 59 people (24 technicians and 35 producers) were directly trained, and 220 producers of some NGOs that supported the project in seed distribution were indirectly trained. The concept of the Small Seed Enterprises (PES) originated as a consequence of this training. In a successful case study in Orica Department, a group of producers from San Francisco de Orica produced and sold 6.4 tons of maize seed, variety DICTA Guayape. This benefited 514 producers and generated employment for 573 people, especially women and children, in postharvest work: such as husk removal, threshing, packing, and drying.

Given the importance of seed distribution, SOH carried out research from May to September 1999 to evaluate the adoption and diffusion levels of the three improved bean varieties on the properties of the producers that had benefited. Analysis showed that in Honduras, bean losses averaged 86%, ranging from 56% to 99% (total losses), with greater losses in Nicaragua, averaging 92% and ranging from 82% to 95%. Nicaraguan producers had more soil washed away (about 1.2% losses) than the Hondurans (about 0.8%). Don Félix Pedro Zapata, a small-scale producer from Sertedejas, Danlí Municipality, El Paraiso Department, in Honduras said, "*of my plot, only the memory remains, of seeing how the river swallowed it with all the maize that was ready to harvest.*"

In both Honduras and Nicaragua, a high percentage of producers (76% and 81%) used local bean varieties, and a very low percentage (24% and 19%) used improved varieties. However, the seed had been released many years previously, and farmers' seed was already mixed. This allowed us to discover the reasons why only a low percentage of farmers used the improved varieties: high price, difficult to obtain, and because of lack of knowledge. While the reasons for the use of the local varieties contrasted starkly: low price, easy to obtain, adaptation, and from custom.

The number of producers applying fertilizer diminished significantly when they received seed of the improved varieties in both Honduras (61% down to 37%) and Nicaragua (88% down to 68%). This was

[1] Throughout this document, the term "producer" (in single or plural form) is used in a neutral sense; it may refer to men or women.

[2] Acronyms and abbreviations are given in full in English in the text with, where appropriate, the Spanish acronym. The list on page 89 gives them in full in the language of origin.

because the improved varieties are resistant to bean golden mosaic virus (BGMV) and to whitefly. Thus the introduction of new improved varieties was beneficial in lower use of fertilizer and in higher yields. The local varieties were highly affected in the production area. Yields were from about 938 kg per hectare for the departments traditionally growing bean, and about 623 kg per hectare for departments with adverse agroecological conditions, such as Choluteca in Honduras and Boaco in Nicaragua.

Once the grain was harvested, 87% of Honduran producers sold it, but Nicaraguan producers kept half for consumption and sold half on the market.

Traditionally the light red bean of the local varieties has been better priced than improved varieties, which are a little darker. However, in the country's emergency situation and confronted with the bean shortage, the middlemen or "coyotes" had to recognize an almost equal or similar price for improved and local varieties. This brought economic benefits to the producers who had bigger yields with the improved varieties.

During the year 2000, two Norwegian students completed their Master's theses. One was on evaluating government and NGO participation in the recovery from the disaster, and the other on how the producers' seed systems gave support during the disaster. The first thesis student found no organized government strategy in the delivery of seed to producers. This allowed that many institutions worked with good will, but in total ignorance of the producers' necessities regarding materials. Cases were encountered of the introduction of hybrid maize that did not adapt to the agroecological conditions of the producers, creating many economic and food problems. On the other hand, the second thesis student found that the seed that producers lost was recovered with the grain that some large producers were keeping for consumption. This also was harmful, because in some cases the grain had been kept a long time. Other producers supplied themselves with what grain they could get in the market, because the few who were able to harvest something from their plots sold a part in order to buy other foods. A smaller quantity of producers supplied themselves from relatives and friends.

In answer to a call for collaboration with SOH, the three CGIAR Centers involved in the proposal carried out activities intended to evaluate damage and recovery both in physical structures and in the biodiversity of crops affected by Hurricane Mitch. As a product of this collaboration, CIP gave support to the National Institutions of Honduras and Nicaragua with sexual seed of potato and vegetative (cuttings) of yam at the same time as training the technicians of these Institutions. Through the Mesoamerican Network for Plant Genetic Resources (REMERFI), in Honduras and Nicaragua, IPGRI carried out a study to evaluate the agrobiodiversity losses caused by the hurricane. They found that producers reported the loss of local materials such as *chile*, *guaniseño*, and *mono* beans, and the *millón* variety in sorghum. They also reported the introduction of new varieties of coffee, banana, and some vegetables, such as "*cayote*," "*pipian*," and tomato. In Olancho and Choluteca, CIMMYT evaluated the impact of international help to alleviate, through the distribution of improved seed, the damage caused by the hurricane. They found that in Olancho, seed aid was appropriate and opportune, but in Choluteca it arrived too late for the planting of the following cycle (first season). Thus some producers kept the seed and later suffered losses in the germination. The conclusion was that the aid program improved production levels and productivity and that, although evidence is inconclusive, it may be that this increase contributed to improving the income of some producers. This conclusion agrees with results of the investigation carried out by CIAT–SOH.

CONTENTS

CHAPTER I

ACHIEVEMENTS

NOVEMBER 1998 TO DECEMBER 1999

Background and Justification

During the week beginning the 25th of October 1999 in Honduras and Nicaragua, Hurricane Mitch devastated large areas in the cities, razed bridges and highways, and left some regions isolated, blocking aid efforts.

The production of basic grains that are obtained in the hillsides, where the poorest farmers live, suffered serious damage. Winds and floodwaters badly hit the productive areas where some farmers were harvesting their crops and others were planting. Great losses were caused (Tables 1 and 2), affecting the economy and production of food of these two countries.

Table 1. Crop losses following Hurricane Mitch, Honduras, 1999.

Crop	Second season – Total loss[a]		Losses by crop (%)
	Planted (ha)	Losses (t)	
Sorghum	27,716	22,727	27
Rice	2,242	4,545	16
Banana	13,024	55,400,000 boxes	88
Maize	102,080	197,454	33
Bean	60,544	35,045	50

SOURCE: Wingert (1999).[3]
a. Numbers are rounded.

Table 2. Crop losses following Hurricane Mitch, Nicaragua, 1999.

Crop	Second season – Total area (ha)[a]		Losses by crop (%)
	Planted	Losses	
Sorghum	175,296	102,995	61.5
Soya			60.0
Rice			22.8
Maize			36.0
Bean	92,132	43,578	47.3

SOURCE: MAGFOR (1999).[4]
a. Numbers are rounded.

[3] Wingert SC. 1999. Plan de reconstrucción del sector agrícola Hondureño, Guía para la recuperación del Huracán Mitch.

[4] MAGFOR (Ministerio Agropecuario y Forestal). 1999. Informe de los daños del Huracán Mitch en el sector Agropecuario. MAGFOR, Honduras.

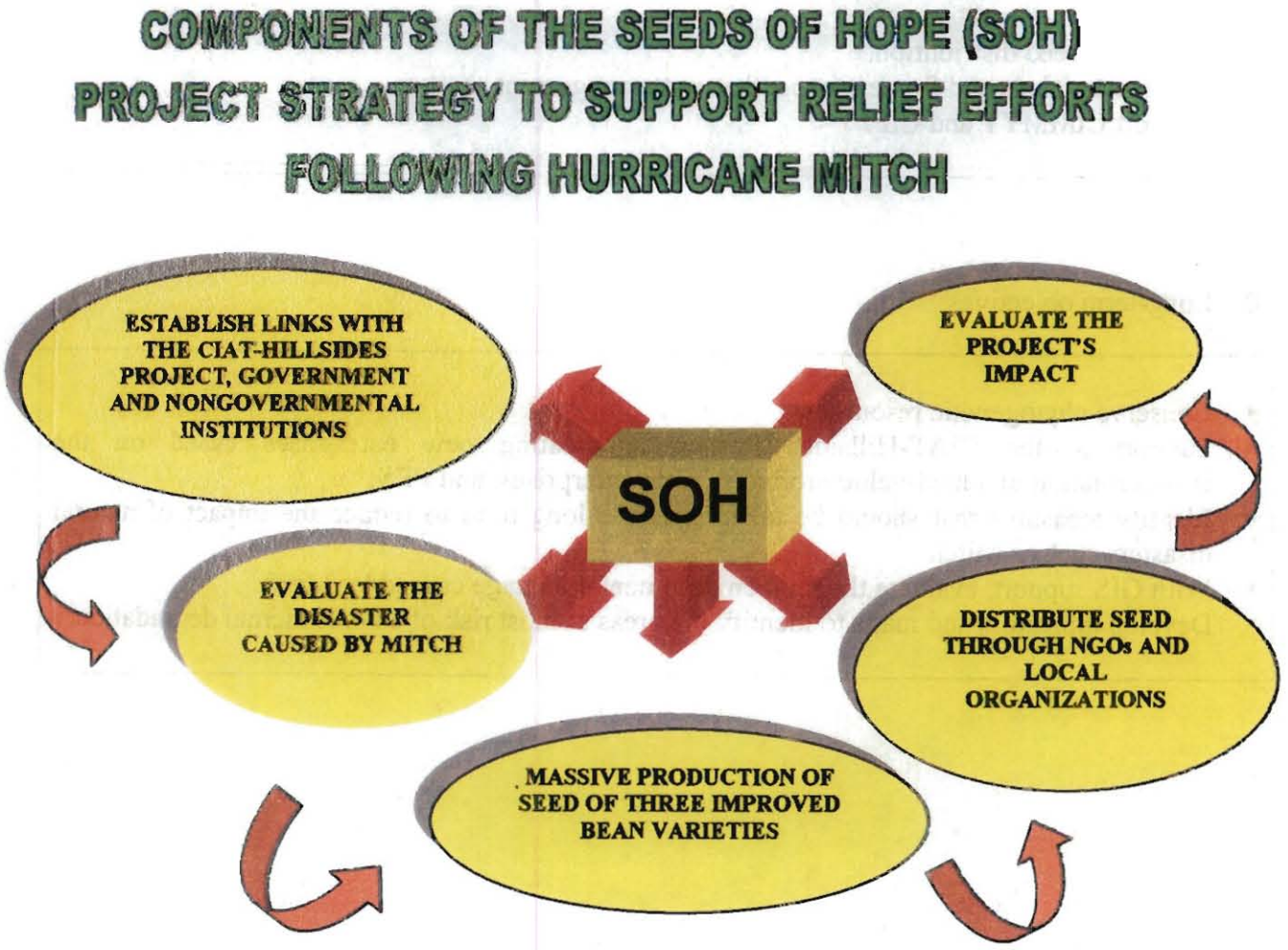
Facing this situation, four CGIAR centers, CIAT, CIMMYT, CIP, and IPGRI proposed and supported an emergency Project called "Seeds of Hope". This united efforts with government organizations (GOs) in Honduras such as the Office of Agricultural Science and Technology Research (DICTA) and the Ministry of Agriculture (MAG), and the Nicaraguan Institute of Agricultural Technology (INTA). In both countries it also involved some NGOs and Committees for Local Agricultural Research (CIALs).

Project Objectives

To develop the project and guarantee its success, a strategy was implemented in which, through the CIAT-Hillsides Project in Honduras and Nicaragua, contacts were established with different national institutions:

- INTA and the Ministry of Agriculture and Forestry (MAGFOR) in Nicaragua,
- DICTA and the Secretariat for Agriculture and Livestock (SAG) in Honduras,
- NGOs,
- CIALs, and
- Other groups of producers.

This contact allowed the development of the work plan that was presented to donors.



The activities thus structured, the objectives proposed to the donors were developed.

1. Objectives to short- and medium-term (November 1998 to October 1999).

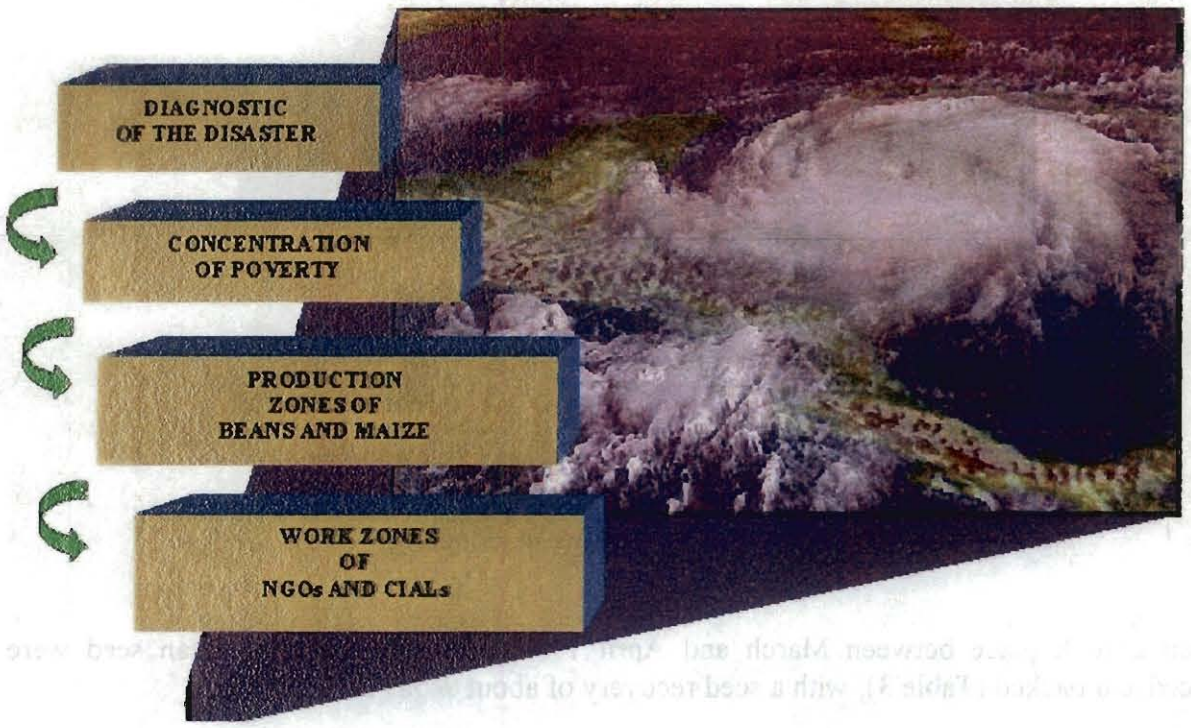
- Gather together reserves of good quality seed for multiplication in Honduras.
- From this seed, produce seed to help satisfy the needs of the poorest farmers most affected by Hurricane Mitch.
- With the support of geographic information systems (GIS), identify the poorest and most affected areas for seed distribution.
- Distribute the seed in Honduras and Nicaragua through National Institutions, NGOs, and CIALs.
- Follow up seed distribution.
- Train technicians and farmers in postharvest management.
- Support CIMMYT and CIP.

2. Long-term objectives.

- Conserve phytogenetic resources.
- Support to the CIAT-Hillsides Project in creating new enterprises based on the transformation of added-value products, microenterprises, and PES.
- Identify measures that should be taken over the long term to reduce the impact of natural disasters such as Mitch.
- With GIS support, evaluate the total environmental damage caused by Mitch.
- Develop indicators and maps to identify the areas at most risk of environmental degradation.

Strategy Components

Also, taking advantage of CIAT's strength in GIS, and with the resources assigned for this activity in the budget, an Atlas was generated for Honduras. This allowed the identification of areas most affected by the hurricane with the greater concentration of poor producers (less than 3.5 ha). Within these areas, the regions of greater bean and maize production could be identified to concentrate on these areas the distribution of the seed produced from the two plantings.



Seed Production

First Planting– Irrigated or Dry Season Planting

In November 1998, collection began of the biggest quantity possible of good quality bean seed for multiplication in Honduras. In January 1999, 123 hectares were planted with three improved varieties with genetic origin in CIAT's bean germplasm: Dorado, Tío Canela, and Don Silvio. They were planted in four departments: Danlí, Francisco Morazán, Juticalpa, and Comayagua, by 12 producers and the national Agricultural Development Experiment Center (CEDA). All producers had irrigation and infrastructure facilities (Figure 1).

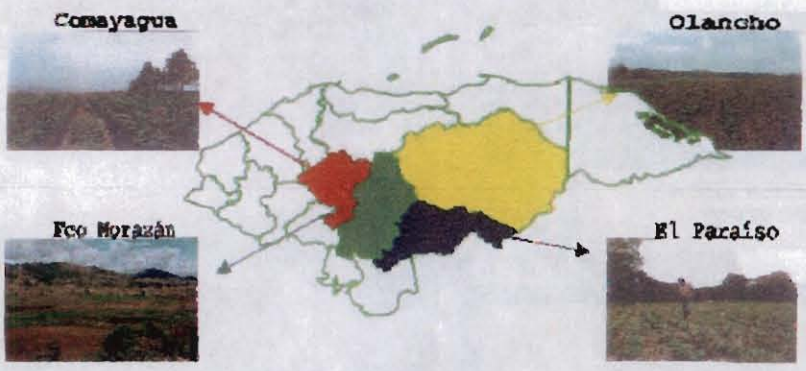


Figure 1. Areas of the first multiplication planting in Honduras.

Harvesting took place between March and April 1999, and 155.4 tons of clean seed were produced and packed (Table 3), with a seed recovery of about 94% (Table 4).

Table 3. Bean production by department and variety, Honduras, 1999.

Departments	Bean yields by variety (t)[a]		
	Dorado	Tío Canela	Don Silvio
El Paraiso	22.9	-	-
Francisco Morazan	30.6	16.9	13.8
Olancho	54.1	-	4.0
Comayagua	-	13.0	-
Total / variety	107.6	29.9	17.8
Overall total	155.3		

a. Numbers are rounded.

Second Planting– With Seed from First Planting

During May and June, about another 123 hectares were planted in seven municipalities of four Departments: Francisco Morazán, El Paraíso, Olancho, and Comayagua. About 139 tons of clean seed were produced and packed (Table 4, Figure 2). Approximately 8000 more producers affected by Mitch in Honduras and Nicaragua benefited through most of the same NGOs and CIALs that participated in the first distribution.

Table 4. Estimated bean yields[a] from second planting, Honduras, 1999

Municipality	Area (ha)	Yield (t)
Orica	51.0	59.3
Guayape	22.5	26.2
San Matías	15.8	13.9
San Antonio	7.0	8.2
Danlí	15.5	18.0
Potrerillos	7.0	8.2
Meambar	5.0	5.7
Total	123.8	139.5

a Numbers are rounded.

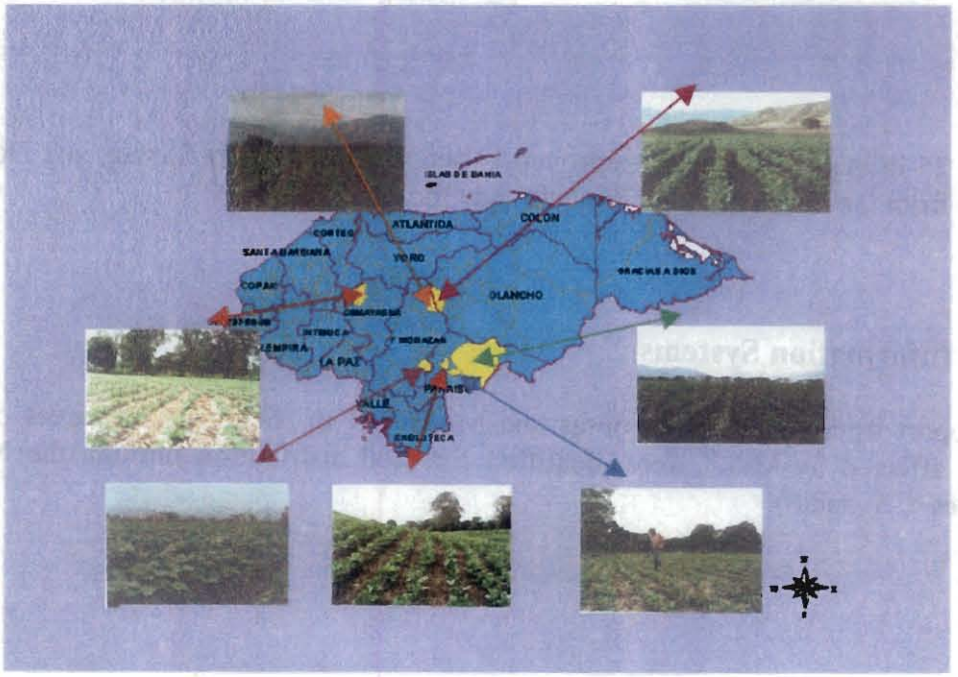


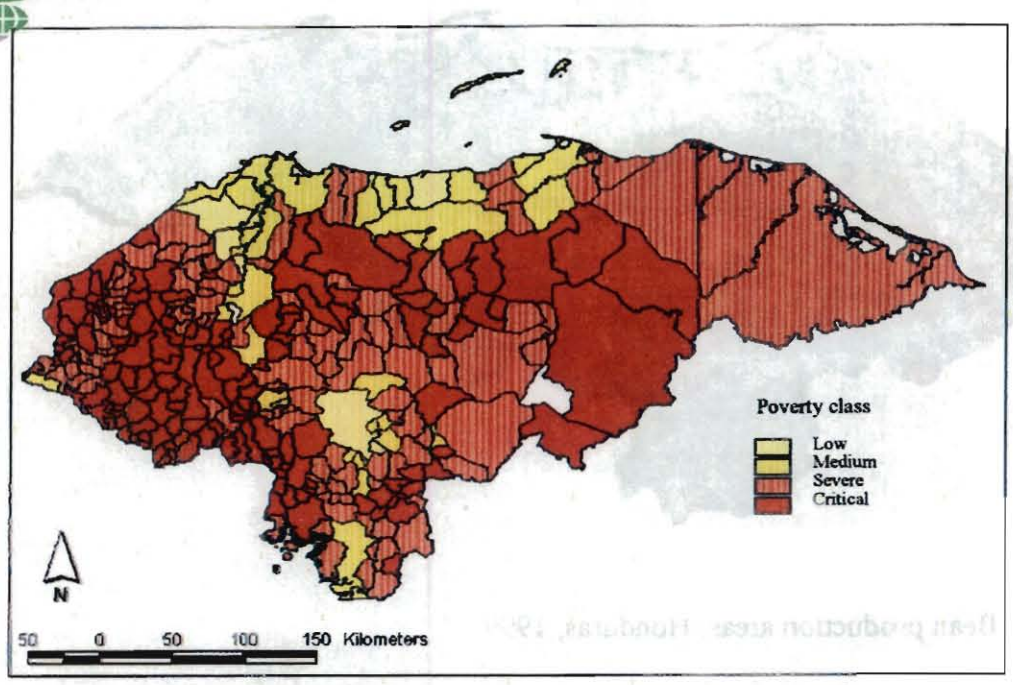
Figure 2. Second bean planting in seven municipalities, Honduras, 1999

The seed was distributed by the private company "Hondugenet" in Tegucigalpa, and packed in 25-lb bags bearing the SOH logo and those of the involved international centers and donors (Figure 3).

Figure 3. 25-lb bags of beans of improved varieties (Dorado, Tío Canela, and Don Silvio) from the Seeds of Hope Project ready for distribution.

Geographic Information Systems

With GIS support from CIAT in Honduras and MAGFOR in Nicaragua, the areas of greatest poverty most affected by Mitch were identified for seed distribution through the NGOs and CIALs (Figures 4, 5, and 6).



SOURCE: Honduras population census 1988.

Figure 4. Extent of poverty, Honduras 1999.

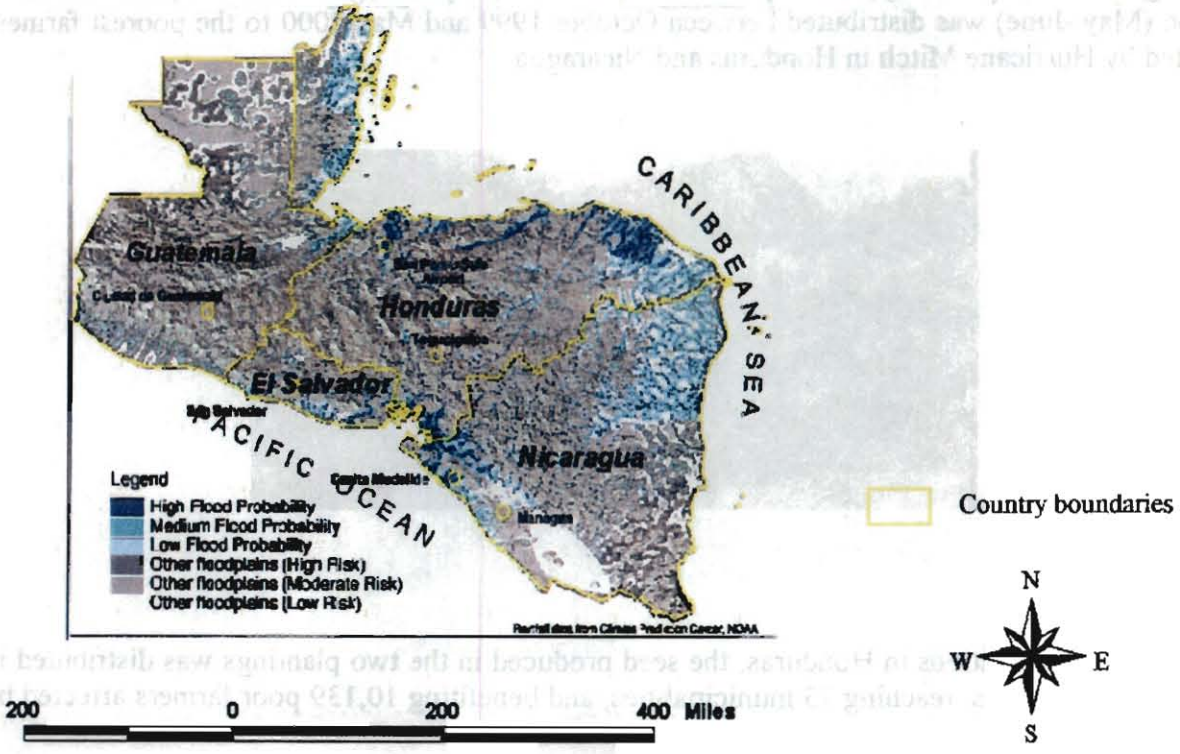


Figure 5. Flooded areas in Central America during Hurricane Mitch.

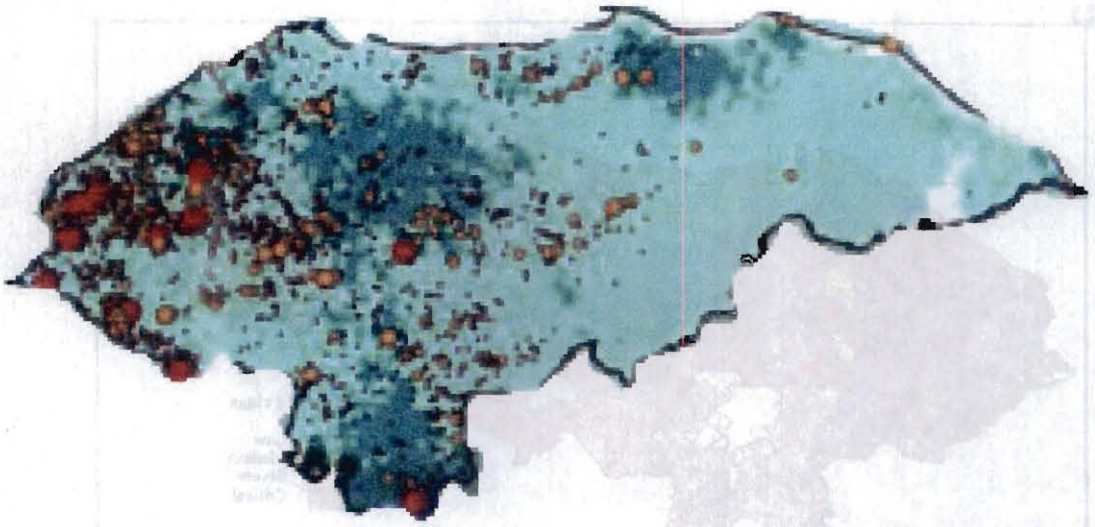


Figure 6. Bean production areas, Honduras, 1999.

Seed Distribution

The seed harvested in the dry season (December–January) was distributed at the start of the first planting season (April–May). Seed produced in the second planting in different plots that same season (May–June) was distributed between October 1999 and May 2000 to the poorest farmers affected by Hurricane Mitch in Honduras and Nicaragua.

Through nine institutions in Honduras, the seed produced in the two plantings was distributed in 14 of 16 departments, reaching 73 municipalities, and benefiting 10,139 poor farmers affected by Mitch (Table 5, Figure 7).

Table 5. Bean seed distribution in Honduras through different collaborating institutions, 1999-2000 (for acronyms, see page 89).

Institution	Department	Municipality (no)	Agricultural beneficiaries (no)
CARE	Lempira	5	
	Intibucá	7	812
	La Paz	3	
RED CROSS	Choluteca	10	5,673
	Paraíso	7	
	Valle	4	
	Fco. Morazán	3	
IPCA - CIAL	Yoro	3	300
	Sta Barbara	2	
	Comayagua	2	
	Atlántida	1	
PDA - Choluteca	Choluteca	4	448
	Valle	2	
	Fco Morazán	2	
CCD	Choluteca	6	300
	Fco Morazán	1	
	Valle	3	
PDA – YORO	Yoro	2	1,200
SERTEDESO	Yoro	3	120
FEPROH	Fco Morazán	2	6
PROLANCHO	Olancho	1	20
PDA – Sn MATIAS	Paraíso	1	120
PMA	Fco Morazán	4	880
Producers	Jamastrán	2	260
TOTAL	13	80	10,139

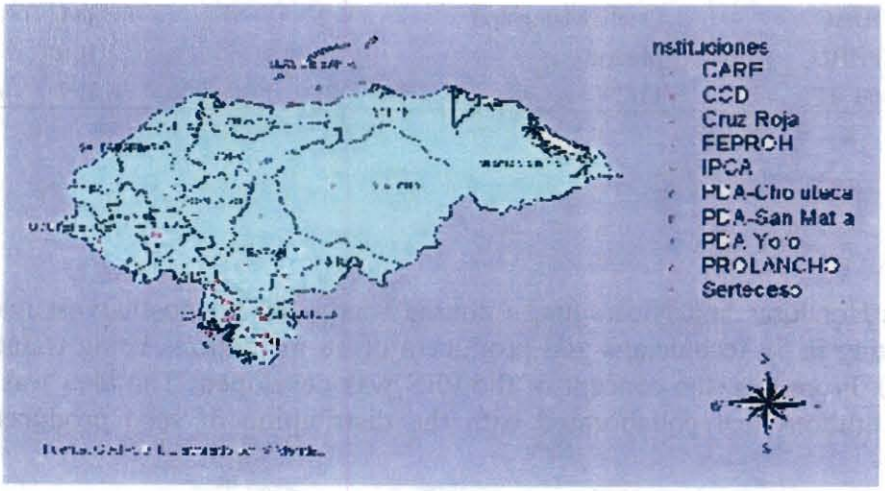


Figure 7. Bean seed distribution in Honduras, 1999-2000 (for acronyms see page 89).

In Nicaragua, the seed of the two plantings was distributed through 11 institutions, reaching 46 municipalities in 11 of 20 departments, and benefiting 6,197 poor farmers affected by Mitch (Table 6, Figure 8).

Table 6. Bean seed distribution in Nicaragua through different collaborating institutions, 1999-2000 (for acronyms see page 89).

Institution	Department	Municipality (no)	Agricultural beneficiaries (no)
CARE	Matagalpa	4	2,780
CRS	Estelí	3	496
	Madriz	3	
	Chinandega	2	
	Matagalpa	1	
CENADE	Managua	2	203
	Boaco	1	
CIEETS	Carazo	1	737
	Managua	2	
	Jinotega	1	
	RAAS	1	
	RAAN	2	
	León	1	
	Chinandega	1	
	Matagalpa	2	
CIPRES	Estelí	1	343
	Chinandega	2	
	León	1	
	Matagalpa	1	
CIALs	Matagalpa	1	120
ACV	Matagalapa	1	300
PASA - DANIDA	Estelí	4	460
CENADE	Chinandega	3	325
CIALs	Matagalpa	2	167
ADDAC	Estelí, Matagalpa	2	161
INPHRU	Madriz	1	105
Total 11	11/20	46	6,197

Training

During 1999, in Honduras and Nicaragua, a course was given on postharvest management of bean seed, resulting in 59 technicians and producers of 18 institutions being trained (Figures 9 and 10, Table 7). From this, the concept of the PES was developed. The idea was presented to some of the institutions that collaborated with the distribution of seed produced in the two plantings.

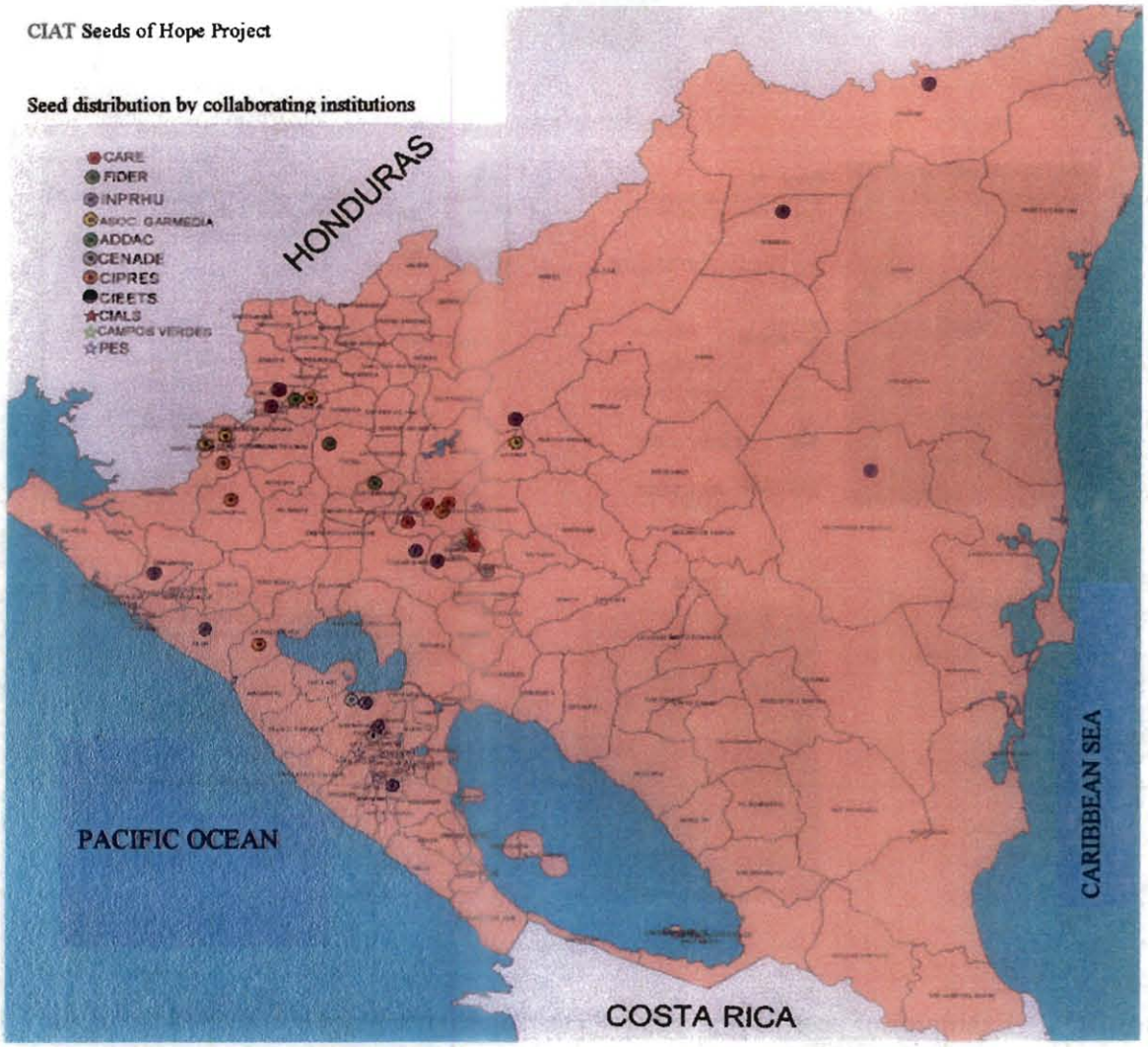


Figure 8. Bean seed distribution in Nicaragua through different collaborating institutions, 1999-2000 (for acronyms see page 89).

Figure 9. Photographs of some of the technicians and producers trained in postharvest management of bean seed in Honduras and Nicaragua, 1999.

Figure 10. Examples of postharvest training course programs and certificates for those completing the courses.

Table 7. Number of participants in postharvest training courses in Honduras and Nicaragua, 1999 (for acronyms see list page 89).

Participants	Honduras		Nicaragua		Total
	No	Institution[a]	No	Institution[a]	
Technicians	16	14	8	4	24
Producers	22	-	13	-	35
Total	38	14	21	4	59

a. Honduran Institutions = CARE, IPCA, PROLESUR, World Vision, PDA-Yoro, CIAT, CCD, SERTDESO, PROLANCHO, FEPROH, EPRODAS, EMAPRAS, El Cajón Project. Nicaraguan Institutions = INTA, CARE, CIEETS, CIALs

Later, some technicians gave a course on postharvest management to the producers they were assisting, and thus another 220 producers of seven institutions were qualified in nine courses (Figure 11, Table 8).

Figure 11. Some of the producers trained by technicians on the postharvest management of seed, Nicaragua, 1999.

Table 8. Number of producers trained in postharvest management of seed, Nicaragua, 1999 (for acronyms, see page 89).

Honduras			Nicaragua		
Institution	Events (no)	Producers trained (no)	Institution	Events (no)	Producers trained (no)
FEPROH	2	33	CIEETS	1	33
CARE	1	54	INTA-Carazo	1	15
CCD	1	30	INTA-Granada	2	40
			INTA-Ticuantepe	1	15
Total 3	4	117	4	5	103
Overall Totals: 7 institutions, 9 events, and 220 producers					

Impact Evaluation

Short- and Medium-Term Effects

As Figure 12 shows, impact was achieved through two products: supply of good quality seed to producers, and training in postharvest management of seed.

Supply of good quality seed to producers

Two hundred and eighty five tons of bean seed, varieties Dorado, Don Silvio, and Tío Canela, were produced in Honduras in the two planting seasons (January and June 1999), in 231 hectares, by 75 producers. With the support of 18 NGOs and CIALs this seed benefited about 20,000 producers and their families in 25 Departments and 107 municipalities of Honduras and Nicaragua.

Training in postharvest management of seed

With the training carried out in 1999 on postharvest management of bean seed, 24 technicians and 35 producers of 18 institutions were directly qualified in Honduras and Nicaragua. These in turn trained a further 189 producers in their work areas. An extension of time was allowed the project until September 2000. Thus in May and June, in Honduras and Nicaragua, these same technicians and producers were trained in postharvest management of maize. In August 2000, nine Honduran technicians of these same institutions were trained in Managerial Administration by means of an inter-institutional agreement between CIAT-SOH and the Pan-American Agricultural School (EAP-Zamorano).

In the same way, technicians from CIAT, DICTA, and the National Service of Agricultural Health (SENASA) trained the 75 producers who participated in the two production periods of the bean seed given to producers. Training was on aspects related with plot establishment, agronomic handling, and opportune harvest time. The three institutions also supported the SOH Project with inspection visits to assure seed quality.

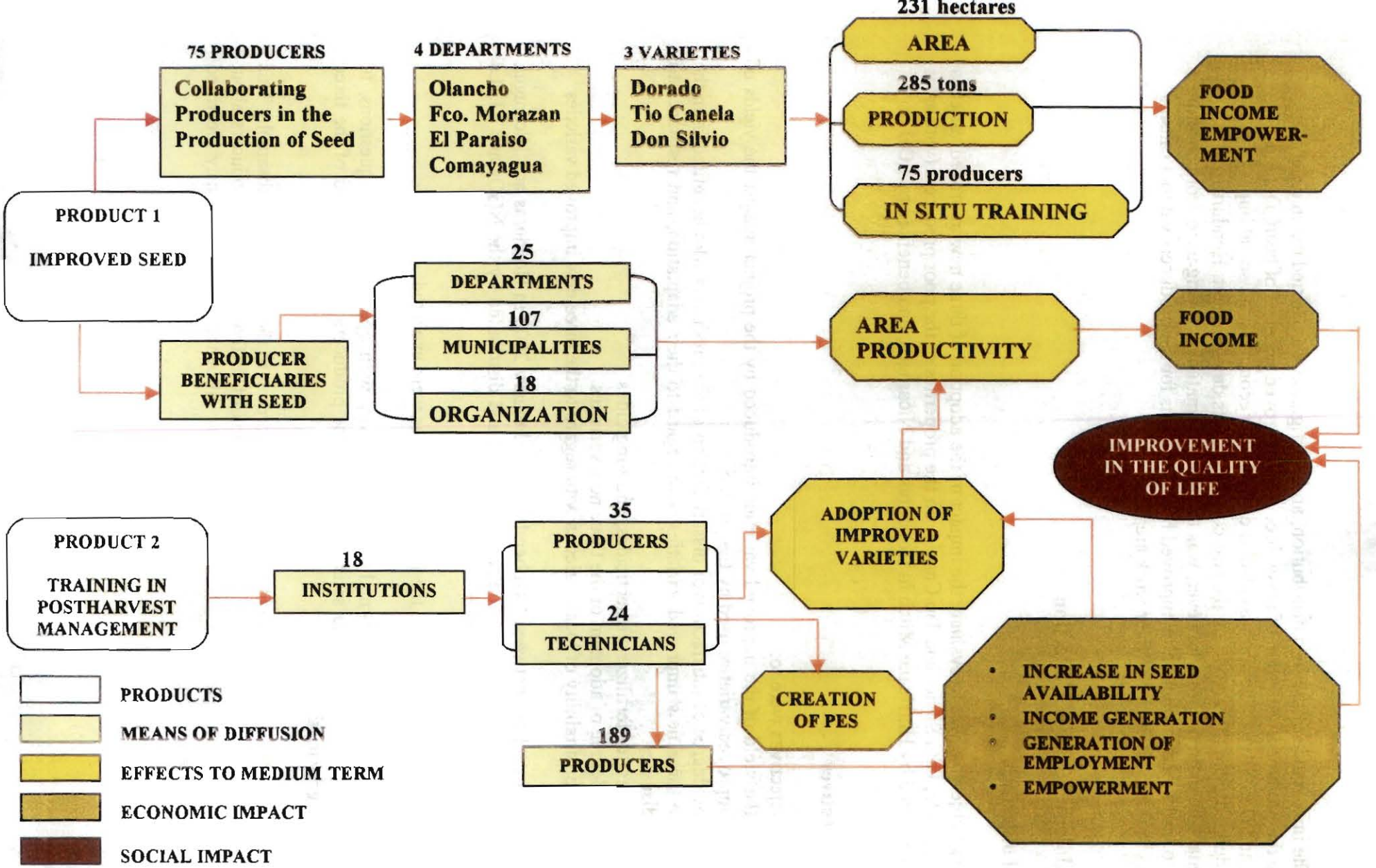


Figure 12. Short- and medium-term impacts of the Seeds of Hope Project. (Adapted from information of MV Gottret and G Giraldo, 1999.)

Given the importance of the seed distribution, an investigation was carried out in order to evaluate the producers' adoption of these three new improved varieties of bean, Dorado, Tío Canela, and Don Silvio. The aim was also to evaluate the economic and social impact that the project derived from this activity in the two countries of its development: Honduras and Nicaragua. The main purpose, however, was to gain information allowing us to reorient future actions to lead to a contribution in improved life conditions for the producers without causing problems in the biodiversity of their work areas.

Methodology for Data Collection

General objective

The overall objective was to evaluate the impact of the adoption of three new improved varieties of bean: Dorado, Don Silvio, and Tío Canela, on the properties of the poor producers (with areas > 3.5 ha) affected by Hurricane Mitch in Honduras and Nicaragua, and benefited by SOH in 1999.

Specific objectives

The specific objectives were to:

- Compare the yield of the improved varieties introduced by the project against the yields of local and improved varieties used by the producer.
- Measure the degree of satisfaction or dissatisfaction of the producers who benefited from the seed of the three new improved varieties with regard to their adaptation, and resistance to pests and diseases.
- Measure the use of fertilizers, insecticides, and fungicides.
- Measure the degree of adoption of the three new varieties.
- Discover the profitability of local varieties with regard to the three new improved varieties.

The study was carried out between October 1999 and January 2000 in Honduras and Nicaragua with producers who benefited from the seed produced and distributed by the NGOs and CIALs that collaborated with the SOH Project.

To fulfill the objectives of the study, the following phases were executed:

1. Design and application of a formal structured survey with open and closed questions, to evaluate levels of adoption and satisfaction of those producers receiving seed of the three new improved varieties.

2. Personalized interviews with producers selected according to the established subsample. This interview was to gain knowledge on the perceptions of different types of producers about access to seed of the new improved varieties and its influence on the previously identified parameters in the survey.

Selection of the sample

From the total of farmers benefited, a sample was taken by each of the NGOs and CIALs involved in the distribution. To obtain the sample size, the Krejcie and Morgan (1970) sampling chart cited in Bernard (1994)[5] was used that allows having an adequate population with an interval of trust of 5%.

The sample was obtained from the total number of farmers benefited by the project with the first seed delivery (10,886). Those benefiting from the second seed delivery were not included in the sample because they did not obtain results until January 2000 when they harvested their plots, by which time the project had already finished. Then with the sampling chart, the number of samples needed was obtained for this population (370).

The size of the sample was determined as follows.

- Percentage of the total that each NGO represents (PNGO) = Number of beneficiaries for each NGO / Total number of beneficiaries

- Number of beneficiaries to be interviewed by each NGO = Total number of survey * PNGO

Type of information

It was determined that to obtain the required data, a survey was needed that with clear questions and easy tabulation would provide the following information:

- Level of schooling,
- Ages of the family nuclei,
- Crops and areas lost because of Hurricane Mitch,
- Use of local varieties,
- Use of improved varieties,
- Application of fertilizers and insecticides,
- Yields,
- Profitability by area,
- Degree of adoption of improved varieties, and
- Family and hired manpower.

Visits were paid to the selected farmers on their respective properties and the purpose of the present study and the methodology to be followed were explained to them in such a way that they would provide truthful information.

The data gathered in the individual interviews were fed into an Excel database, because this allows comparisons to be made among the farmers with regard to the different variables, and at the same time it allows a tabulation in matrix form and the use of more exact and quicker models.

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[5] Bernard HR. 1994. Research methods in anthropology: Qualitative and quantitative approaches. 2nd edn. Sage Publ, CA.

Results

Characterization of Producer Beneficiaries

On analyzing the information, it was observed that in Honduras, 87% of the interviewed producer beneficiaries were men and only 13% women; whereas in Nicaragua, 71% of the producers were men and 29% women. This is explained by the socioeconomic characteristics of the two countries in the rural sector where fieldwork is mostly done by men. Women believe it to be very hard work and that their biggest contribution lies in the care and management of the home and the family market gardens. This does not take into consideration macho attitudes; these are societies characterized by high patriarchies and consequently mostly controlled by men.

The number of people composing each family nucleus of producers that benefited from SOH was evaluated. Figure 13 shows that a high percentage of family groups both in Honduras and Nicaragua include numerous members. Of the total sample, in Honduras 32% and in Nicaragua 39% had between six and nine people per family. In both countries a low percentage (15% in Honduras and 7% in Nicaragua) had more than nine members per family. Family groups composed of four to six people per family made up 29% in Honduras and 30% in Nicaragua, with 24% in both countries for family nuclei with less than four people. The average number of people per family group was 6.7% in Honduras and 6.25% in Nicaragua.

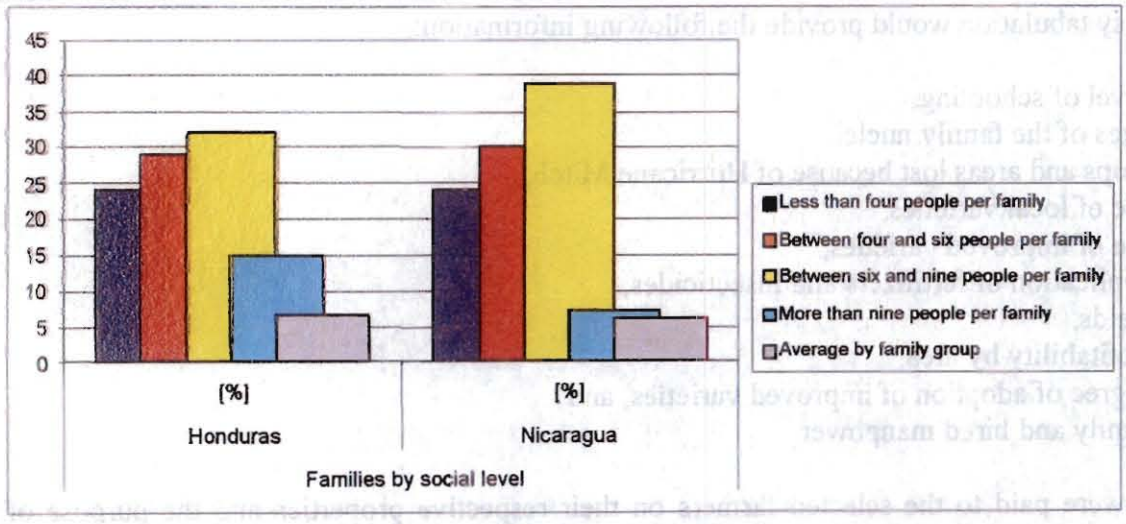

Figure 13. Composition of the family groups of producers benefiting from the Seeds of Hope Project.

Both in Honduras and Nicaragua, among the interviewed producer beneficiaries, the greatest percentage of ages lies in the range of 21 and 60 years of age (Figure 14). In Honduras, the biggest age range is between 41 and 60, with a 40 year-old average; while in Nicaragua the biggest age range is between 21 and 40 years of age, with a 44 year-old average. In both countries the percentages that correspond to the youngest population, under 20 years of age, is

very low; being much lower in Honduras (1%) than in Nicaragua (6%). The same situation occurs with the older population, with a percentage higher than that of youths, but significantly lower than that of the adult population.

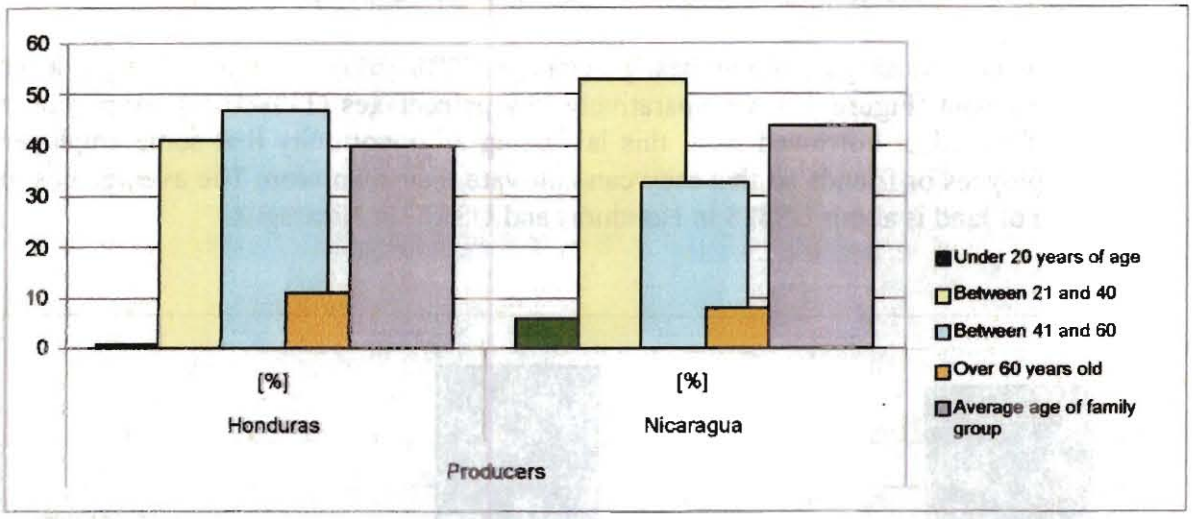

Figure 14. Age average of the producers benefited by the Seeds of Hope Project.

In Honduras, most of the producer beneficiaries have a level of education below that of second grade primary (Table 9), which reflects that a high population (52%) does not know how to read or write. This low level of education is because of where these people live, in marginal and very poor areas. This corroborates that in these places, educational services are few or nonexistent; and usually when they do exist, only one teacher is available for all six levels of schooling. This contrasts with a very low percentage of producers (5%) that do have a degree of education higher than primary level.

Table 9. Percentage level of education of producers benefited by the Seeds of Hope Project, Honduras[a]

Level of education	Producers
Below second grade primary school	52
Between third and sixth grade	43
Above sixth grade	5
Average	Third grade primary school

a. No information is available for Nicaragua.

Land Ownership of Producer Beneficiaries

The term "land ownership" refers to the "useful domain" that producers have over land use; however, most of these producers do not have public title deeds, which limits their right to sell the lands, or to apply for agricultural credit offered by banks or cooperatives.

Both in Honduras and Nicaragua, the highest percentage (72%-76%) corresponds to producers who say they own land (Figure 15). Comparatively low percentages (11%-16%) are producers that make use of rented or borrowed land; this last being an opportunity that some employers give to their employees or friends so that they can cultivate their own crop. The average cost of renting 1 hectare of land is about US$28 in Honduras and US$32 in Nicaragua.

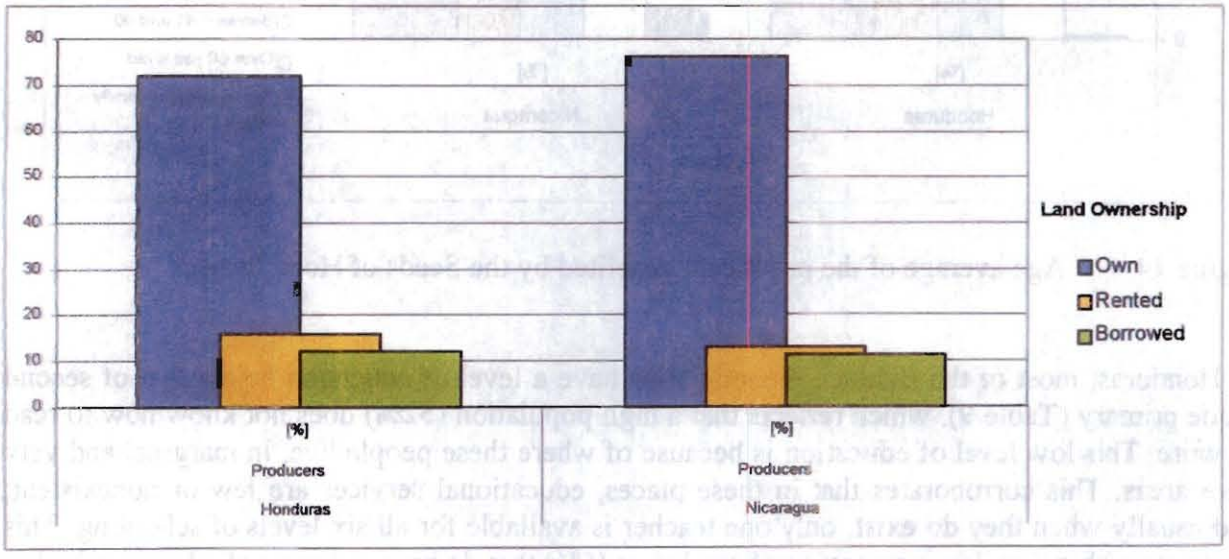

Figure 15. Classification of land ownership of producer beneficiaries (%) of the Seeds of Hope Project.

Figure 16 shows the average of hectares used per producer. It can be seen that in Nicaragua the average both of lands owned and the general average is significantly higher than in Honduras

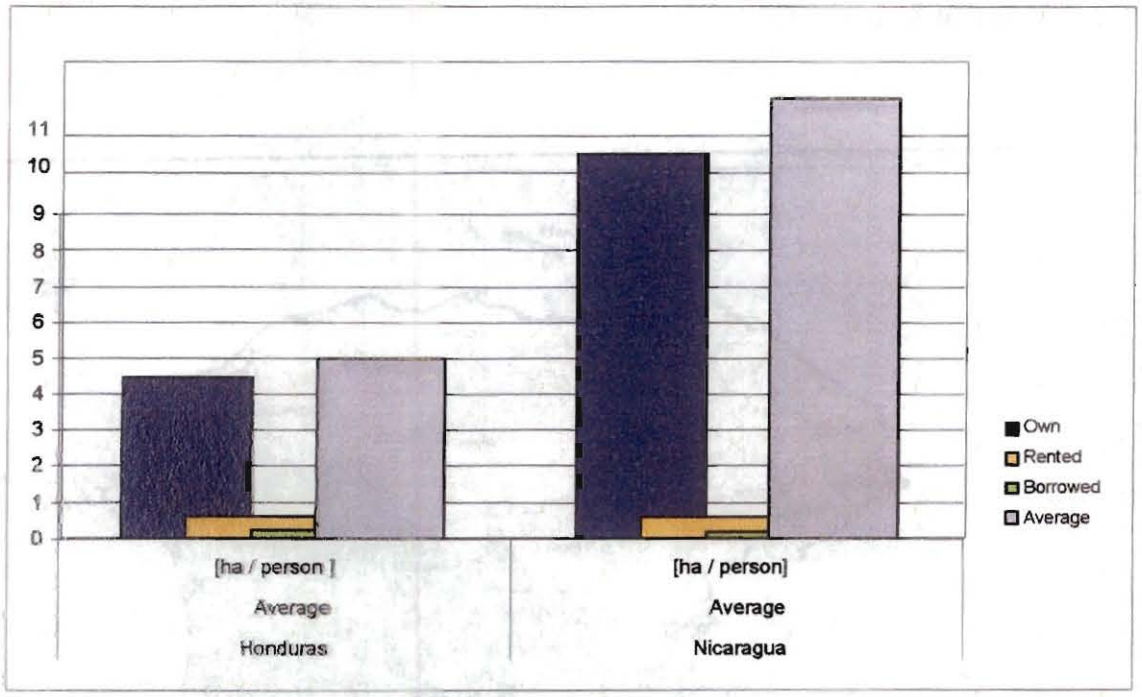

Figure 16. Average of hectares of land used by producer beneficiaries of the Seeds of Hope Project in Honduras and Nicaragua.

Evaluation, among Producer Beneficiaries, of Losses Caused by Hurricane Mitch

Producers in both Honduras and Nicaragua that benefited from the SOH Project, as well as being very poor and living in marginal hillside areas, are also mostly producers of basic grains and suffered huge production losses during and after Hurricane Mitch.

Some producers, such as Samuel Izaguirre from San Francisco de Orica, Orica Municipality, Francisco Morazán Department, Honduras, stated that losses in their bean and maize plots were mainly caused by excessive rain. The downpour caused maize fields, which were close to harvesting, to rot and the bean crops were completely submerged.

The situation worsened because many producers were left without their seed to attempt another planting and recover their losses. Even the minority who were able to rescue something of what they had expected to harvest, in the absence of food had to make use of the seed to alleviate their families' hunger and thus were also left without seed for planting.

Crop losses

Figure 17 shows the base map of Honduras and Nicaragua for comparison with the maps shown in the figures that follow.

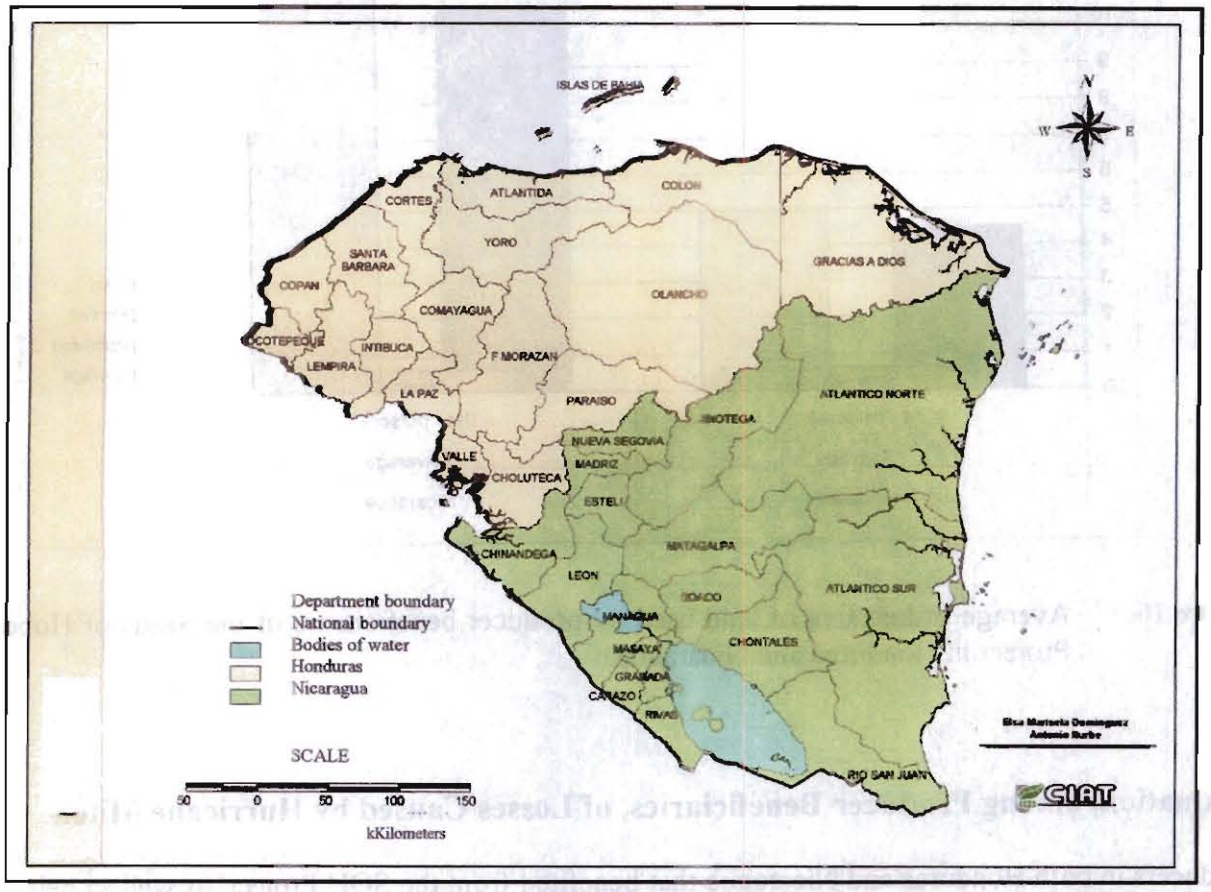

Figure 17. Base map of Honduras and Nicaragua.

Figure 18 shows losses in the maize crop. The national average loss in Honduras was 58%, the highest losses being in the Departments of Choluteca (83%), El Paraíso (83%), and Intibucá (62%). Losses were a little lower in the Departments of Yoro (35%), Francisco Morazán (34%), and Olancho (25%). It can be seen that losses in this crop were significantly higher for Nicaragua, with a national average of 83%. Losses by department ranged from 71% to 93%—Matagalpa (71%), Esteli (80%), Madriz (90%), and Boaco (93%). Losses in the last two departments were almost total.

Figure 19 shows losses in the bean crop. Losses in Honduras present a significantly higher national average (86%) than that for maize. When analyzing by department, it is evident that in the Departments of Intibucá (93%) and Olancho (99%) losses were almost total, followed by

Choluteca with 84% and Francisco Morazán with 74%. The departments presenting the smallest losses were Olancho (56%) and Yoro (65%).

As for maize, the percentage average of bean loss was much higher in Nicaragua (92%) than in Honduras. In Nicaragua, as for Honduras, there were also departments where losses were almost total (Boaco and Madriz with 95%, Matagalpa with 91%, and Estelí with 82%).

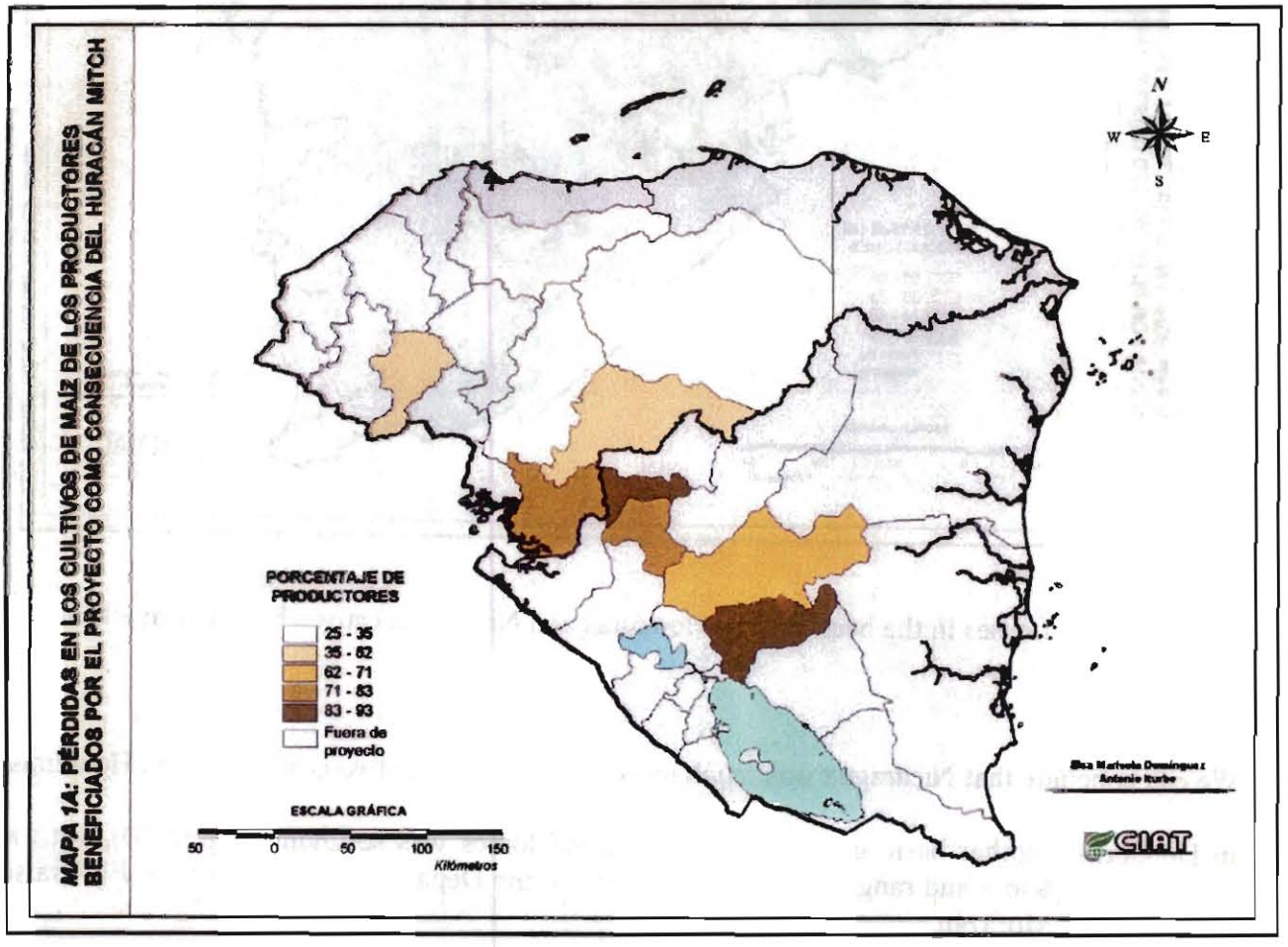

Figure 18. Losses in the maize crop in Honduras and Nicaragua caused by Hurricane Mitch.

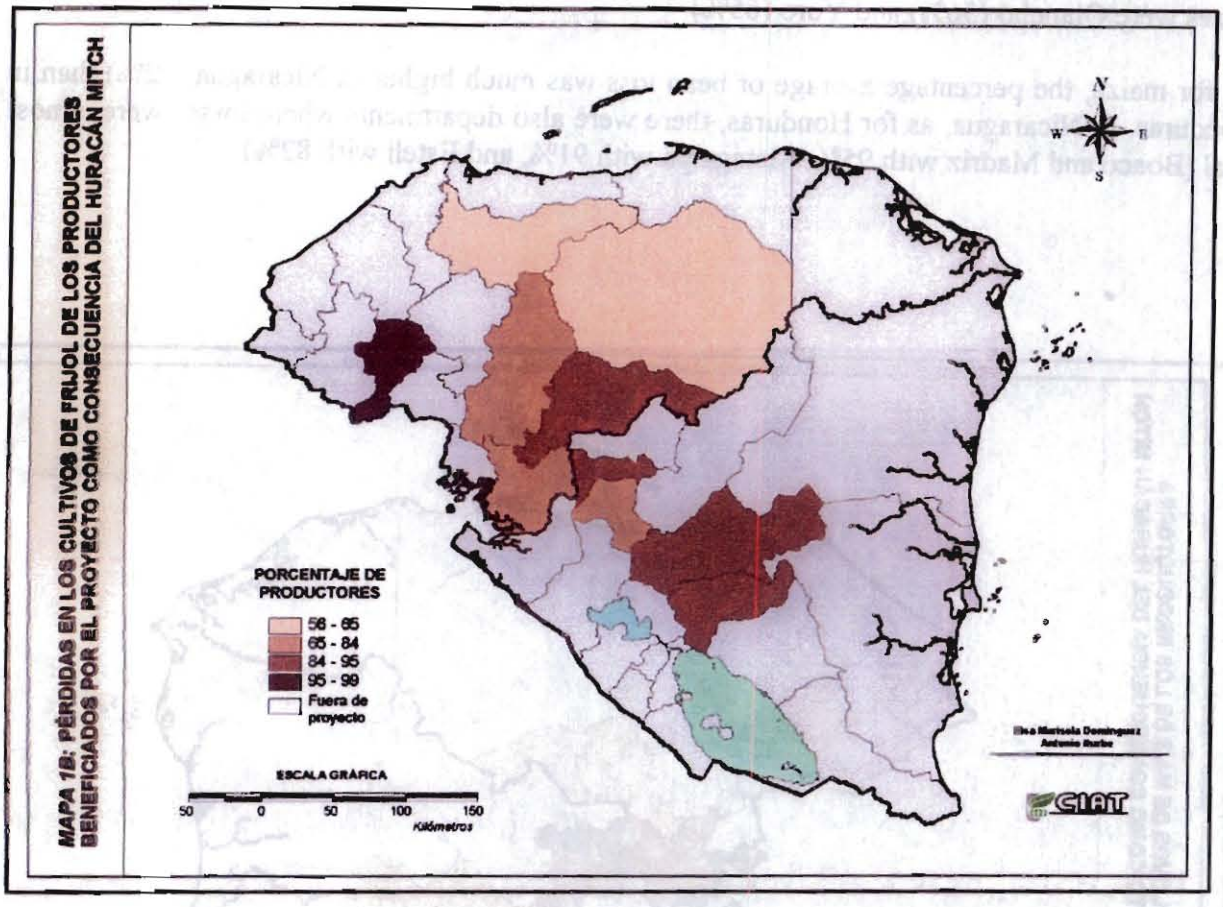

Figure 19. Losses in the bean crop in Honduras and Nicaragua caused by Hurricane Mitch.

We can conclude that Nicaragua was much more affected in these two crops than was Honduras.

In Honduras, another basic grain crop that reported losses was sorghum (Figure 20), with an average of 74% loss and ranges from 56% to 76% for the Departments of Choluteca, El Paraíso, and Francisco Morazán.

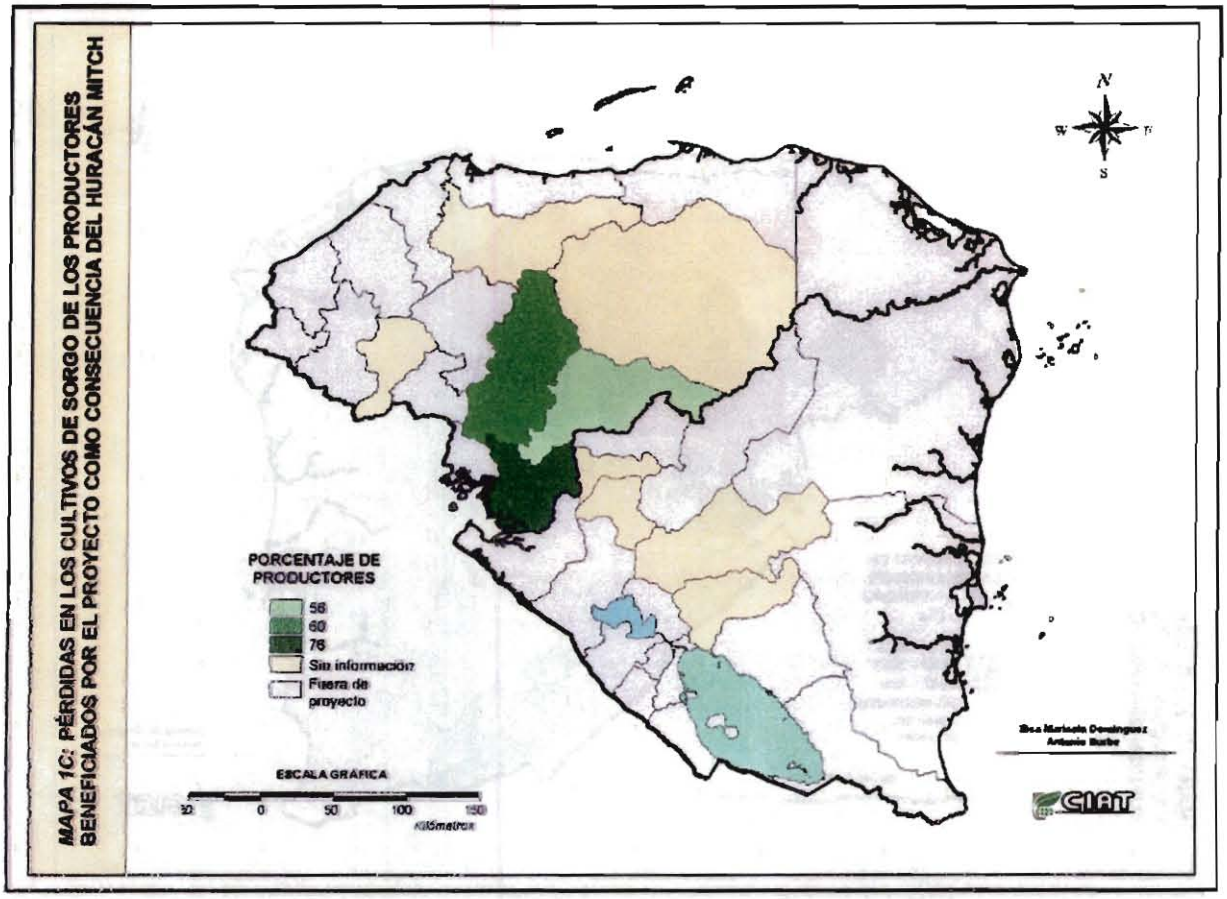

Figure 20. Losses in the sorghum crop in Honduras and Nicaragua caused by Hurricane Mitch.

Soil losses

Some producers had riverside plots, for example, Félix Pedro Zapata, a small-scale Honduran producer of Sertedejas, Municipality of Danlí, Department of El Paraíso, in Honduras. He stated "*Of my plot, only the memory remains, of seeing how the river swallowed it with all the maize that was ready to harvest.*"

As can be seen from Figure 21, producers in Nicaragua that benefited from the SOH Project lost on the average about 1.2% of soil to river flooding or landslides, more than producers in Honduras (0.8%). However, when analyzing the information by department, it can be seen that in Honduras, producers lost almost all of 1 *manzana*[6] in the departments of Choluteca (0.9%), Francisco Morazán (0.7%), and El Paraíso (0.5%). In Nicaragua, in the Department of Matagalpa, producers lost a very high percentage of their lands (about 2.1%), followed by Boaco and Estelí, with 0.71% of 1 mz; and Madriz with 0.86%.

[6] Land in Honduras and Nicaragua is measured in *manzanas* (mz); 1 mz = 0.704 ha)

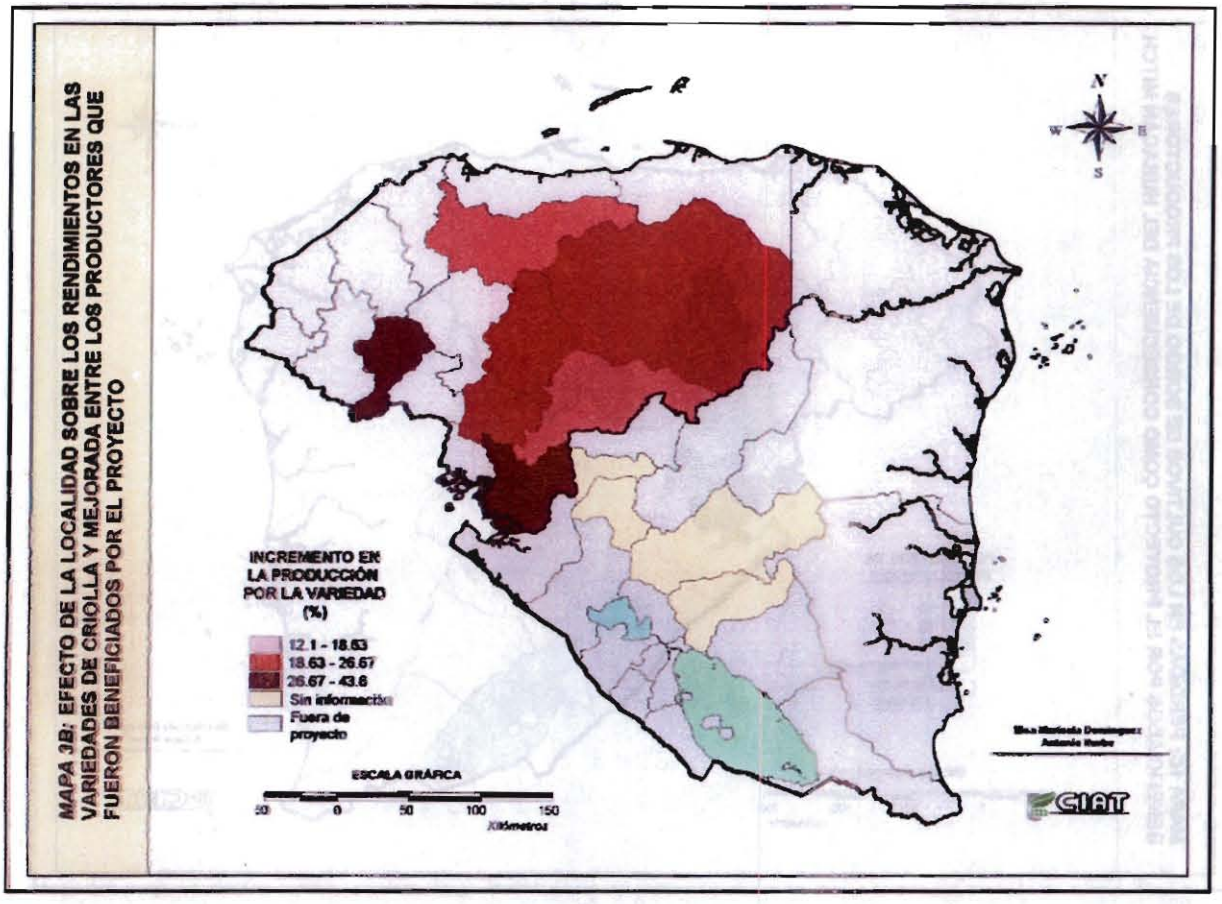

Figure 21. Soil losses of producer beneficiaries of the Seeds of Hope Project caused by Hurricane Mitch.

Producers Sowing Local and Improved Varieties Before and After Hurricane Mitch

Table 10 shows that before Hurricane Mitch a high percentage of the producers that benefited from the SOH Project used local varieties, both in Honduras (76%) and in Nicaragua (81%). This is normal if one considers that they are producers that live in distant areas in the hillsides, where they have little or no access to the seed of the new varieties.

Table 10. Distribution of varieties used traditionally by producers before Hurricane Mitch who later benefited from the Seeds of Hope Project.

Variety	Honduras		Nicaragua	
	Producers (%)	Cultivar	Producers (%)	Cultivar
Local	76	Desarrural, rojo, Paraisito, Concha rosada, Vaina blanca	81	Red bean
Improved	24	Dorado, Zamorano, Tío Canela, Catrachita	19	Dorado, Estelí

The low percentage of Honduran (24%) and Nicaraguan (19%) producers already using improved varieties before Mitch can be seen. However, some of these have already lost their varietal purity, because they were released years ago and they now present problems of varietal mixture, as is the case of the varieties Zamorano and Catrachita in Honduras and Estelí in Nicaragua.

Table 11 shows why local rather than improved varieties are used. The non-use of improved varieties reflects the problem of access to these by the small-scale producers of the marginal areas and hillsides. In Honduras, the main problem is their high price. This is due to the price of transport by distributors established in different departments to those of the companies of seed producers and that is added to the final price of seed, making it even more expensive and inaccessible to the small-scale producers. In Nicaragua, the main problem is the difficulty of obtaining improved seed. Also evident is that producers lack knowledge about them. This slightly reflects the effect of producers' location in relation to production centers, and the little interest of the private companies to reach this margin of producers with seed.

Table 11. Reasons why producer beneficiaries of the Seeds of Hope Project did not use improved varieties before Hurricane Mitch.

Question	Answer	Producers (%)	
		Honduras	Nicaragua
Why do you not use improved varieties?	• Too expensive	55	26
	• Difficult to obtain	25	58
	• Do not know them	16	-
	• Other	4	16
Why do you use local varieties?	• From habit	34	4
	• Adapted to the area	25	7
	• Yield well	11	18
	• They are cheap	8	24
	• Easy to get	6	47
	• Have a good market	7	-
	• Have a good flavor	6	-
	• Other	3	-

In Honduras, producers said they used local varieties from habit and because of their adaptation to the area. In Nicaragua, producers said it was easier to obtain local varieties, they are of low price, and yield well.

Use of Fertilizers and Pesticides by Producers Before and After Mitch

Before Hurricane Mitch, both in Honduras and Nicaragua, most of the producers that benefited from the SOH Project used local varieties, but a small percentage already used the improved varieties. Investigation found that producers applied some fertilizer to the local varieties (in Honduras 17% and in Nicaragua 27%) (Table 12). An average of 68 kg (Honduras) and 72 kg (Nicaragua) was fertilized per producer. However, for improved varieties, the percentage of producers that fertilized was significantly high in both countries, Honduras 68% with an average of about 47 kg per producer and Nicaragua 48% with an average of about 114 kg per producer. This increase was partly because some institutions that helped producers with food, medicine, and clothes, also gave them fertilizer.

Table 12. Fertilizer quantity used by producer beneficiaries of the Seeds of Hope Project before Hurricane Mitch.

Varieties	Honduras			Nicaragua		
	Producers (%) that:		Fertilizer applied (kg per producer)	Producers (%) that:		Fertilizer applied (kg per producer)
	Use variety	Use fertilizer		Use variety	Use fertilizer	
Local	76	17	68	81	27	72
Improved[a]	24	68	47	19	48	79
Both	100	28	64	100	30	74

a. Before Hurricane Mitch, some producers that later benefited from the Project already used improved varieties.

Table 13 shows what occurred when producers received seed from one of the three improved varieties that were distributed by the SOH Project. In Honduras, the quantity of fertilizer applied per producer did not change significantly. The difference was about 5 kg when changing from a local to a new improved variety, 2 kg when changing from an old to a new improved variety, and 9 kg when changing from either a local and/or improved to a new improved variety. In Nicaragua, the same phenomenon is observed—an increase in the number of the producers that fertilized when they passed from local and old improved varieties to new improved varieties. As in Honduras, there was no significant increase in the fertilizer dose per producer.

Table 13. Quantity of fertilizer used according to variety by producer beneficiaries of the Seeds of Hope Project before and after Hurricane Mitch[a].

	Honduras		Nicaragua	
	Before Mitch	After Mitch	Before Mitch	After Mitch
Producers (%) that planted:				
Local varieties	76	-	81	-
Improved varieties	24	-	19	-
Both	100	-	100	-
Producers (%) using fertilizer on:				
Local varieties	17	73	27	44
Improved varieties	68	96	48	30
Both	28	59	30	43
Fertilizer applied (kg per producer)				
Local varieties	68	73	72	56
Improved varieties	47	45	79	74
Both	64	55	74	59
Increase in use of fertilizer (% of producers):				
Local varieties	-	56	-	17
Improved varieties	-	28	-	18
Both	-	31	-	13

a. Before Mitch, some producers already used some improved varieties and others used only local varieties. After Mitch all producers replaced their varieties with one of the three improved varieties produced by the Project.

Table 14 shows the effect of pesticide use by the producers that planted local and improved varieties before Hurricane Mitch compared with after they received seed from one of the three improved varieties that were distributed by the SOH Project.

Contrary to the case of fertilizers, in Honduras, the number of producers that applied pesticides when using a local variety diminished significantly when receiving seed of a new improved variety (from 61% down to 27%). The same situation is observed for producers that sowed a local or an old improved variety; their percentage also diminishes significantly from 67% to 37%. However, when changing from an old improved variety to a new one, the percentage of producers applying pesticides did not change significantly (86% before and 83% after Mitch). On the contrary, the number continued being significantly higher than both the previous cases. This shows that the producers' concept that seed of a new variety require the best conditions. Thus, an entire education campaign should be developed toward producers who, besides receiving seed and inputs, should also be trained in the benefits of the new improved varieties.

In Nicaragua (Table 14), the same phenomenon is observed as in Honduras. Fewer producers applied pesticides when they changed from local and old improved varieties to new improved varieties. However, in Nicaragua there was a significant decrease in the number of producers that applied pesticides when they changed from an old improved variety to a new one (from 83% to 48%).

Table 14. Use of pesticides[a] before and after Hurricane Mitch by producer beneficiaries of the Seeds of Hope Project.

	Honduras		Nicaragua	
	Before Mitch	After Mitch	Before Mitch	After Mitch
Producers (%) that planted[b]:				
Local varieties	76	-	81	-
Improved varieties	24	-	19	-
Both	100	-	100	-
Producers (%) applying pesticides on:				
Local varieties	61	27	89	70
Improved varieties	86	83	83	48
Both	67	37	88	68
No. of applications per producer:				
Local varieties	2.3	2.2	3.2	2.8
Improved varieties	5.0	3.4	2.4	2.0
Both	2.9	2.8	3.0	2.6
Decrease in use of pesticides (% of producers):				
New improved variety #1	-	34	-	19
#2	-	3	-	35
#3	-	30	-	20
Difference (no. of applications):				
New improved variety #1	-	7	-	11
#2	-	31	-	17
#3	-	5	-	14

a. The word "pesticides" here refers to a mixture of insecticides with fungicides.
b. Before Mitch, some producers already used some improved varieties and others used only local varieties. After Mitch all producers replaced their varieties with one of the three improved varieties produced by the Project.

The decrease in pesticide use, as represented in the number of applications, shows a significant reduction both in Honduras and Nicaragua. We believe that this reduced number of applications in the established crops established with the new improved varieties, is partly because some extensionists informed the producers that they assist.

Figure 22 shows that producers in Honduras and Nicaragua apply pesticides indiscriminately, especially for insect control. In the case of the whitefly (*Bemisia tabaci*), there was no significant reduction in the number of producers that applied pesticide when they sowed a local variety than when they changed to a new improved variety, 56% down to 34% for Honduras; and 58% down to 48% for Nicaragua.

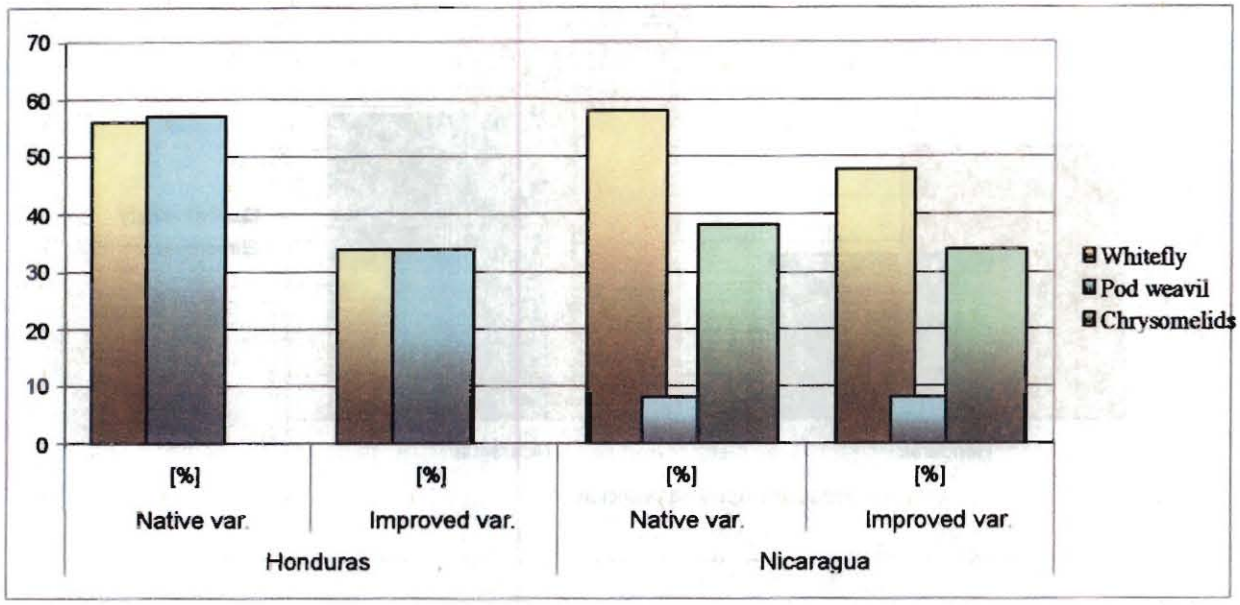

Figure 22. Percentage of producers benefited by the Seeds of Hope Project that applied insecticides, according to bean variety, before and after Hurricane Mitch.

Also the number of producers using pesticide to control the bean pod weevil (*Apion godmani*) did not decrease significantly when changing from a local to a new improved variety, in Honduras from 57% to 34% and in Nicaragua remaining at 8%. But there was a highly significant difference between the countries and the number of producers making applications against *Apion* (Figure 23).

In the case of Nicaragua, 38% of producers reported applying pesticide against the chrysomelids (*Diabrotica* sp. and *Cerotoma* sp.) when they planted local varieties, and this percentage did not significantly decrease when seed was received of a new improved variety (34%).

This again shows producers' lack of knowledge regarding the benefits of the improved varieties, and particularly of the three distributed by the Project—Dorado, Tío Canela, and Don Silvio. These have incorporated resistance to BGMV, which is caused by the whitefly, and thus control is not needed.

As can be seen from Figure 23, the number of producers applying pesticides is significantly reduced when they change from a local variety to a new improved variety (61% down to 37% for Honduras and 88% down to 68% for Nicaragua). The same does not occur with relation to the average number of applications per producer (Figure 24). On the contrary, in Honduras producers increased the number of applications when they sowed seed of the new improved variety (2.8 as against 2.4 applications on the local variety). However, in Nicaragua the opposite occurred; producers decreased the number of applications for the local variety (3.0) to 2.6 for the new improved variety.

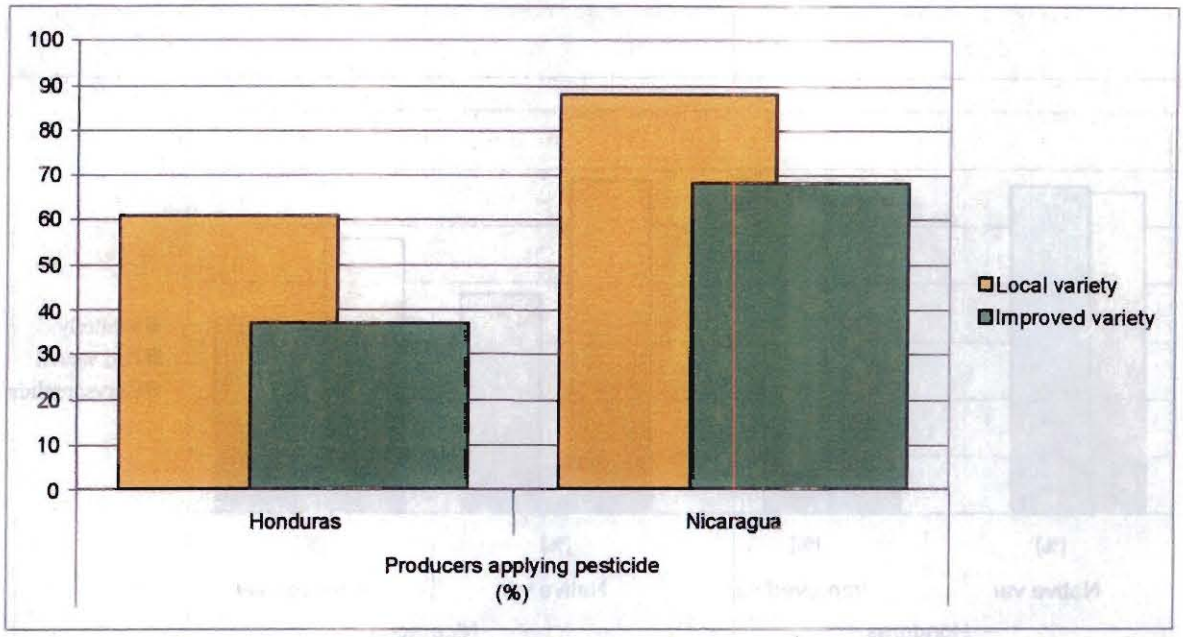

Figure 23. Average number of producers benefited from Seeds of Hope Project applying pesticides (mixture of insecticides with fungicides) according to local and improved bean varieties.

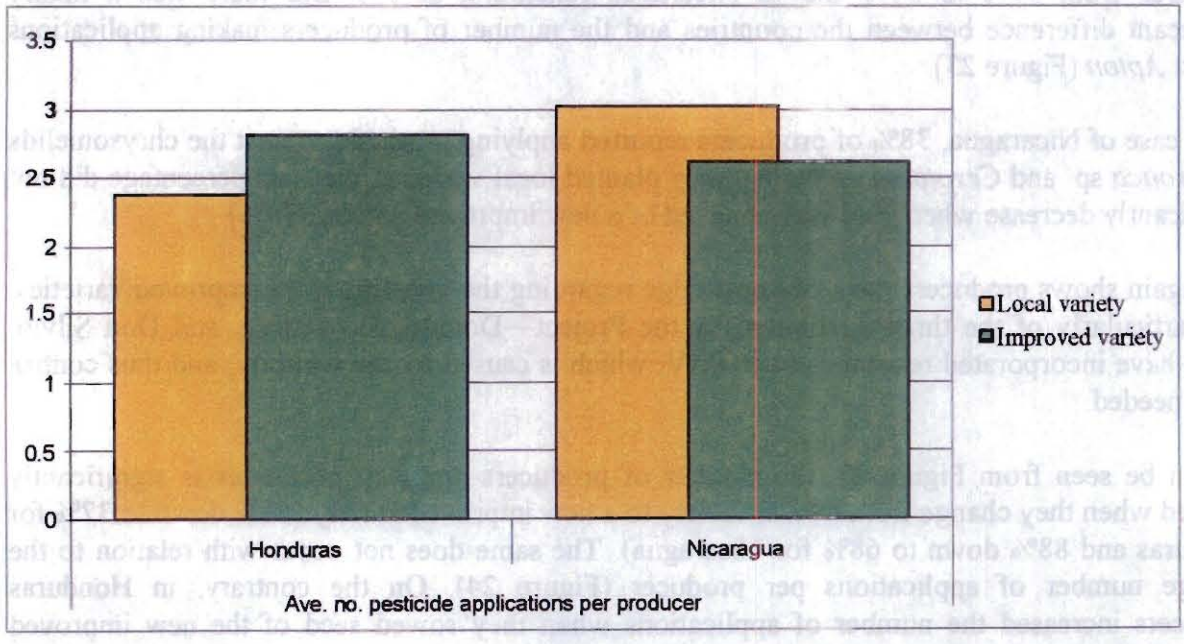

Figure 24. Average number of pesticide applications (mixture of insecticides and fungicides) per producer benefited by the Seeds of Hope Project according to bean variety.

Table 15 shows the effect of the interaction of the fertilizer plus pesticide application with relation to varieties. Both in Honduras and Nicaragua, the number of producers that applied pesticides and fertilizer increases significantly when changing from a local variety to a new improved variety—from 11% up to 26% for Honduras, and from 19% up to 33% for Nicaragua. This is explained by the concept that the producer has of a new improved variety: that it must be given the best conditions.

Table 15. The pesticide[a] - fertilizer interaction and its effect on yields in local and improved bean varieties among producers that were benefited by the Seeds of Hope Project.

Varieties	Honduras				Nicaragua			
	Farmers using pesticides and fertilizers (%)	Yield average[b] (kg ha^{-1})		Differences for effect of pesticide and fertilizer (%)	Farmers using pesticides and fertilizers (%)	Yield average[b] (kg ha^{-1})		Differences for effect of pesticide and fertilizer (%)
		Without	With			Without	With	
Local	11	416	691	66	19	621	723	16
Improved	26	616	731	19	33	709	782	10
Differences for effect of variety (%)	15	48	6	-	14	14	8	-

a. The word "pesticides" here refers to a mixture of insecticides with fungicides.
b. Without and with pesticide and fertilizer.

In Honduras, the local variety had a highly significant increase (66%) in the yield average as a result of the application of fertilizer and pesticides. This is because a bigger dose of fertilizer was applied to local varieties (73 kg per producer, Table 13). Another aspect influencing this increase was the producers' control of whitefly, which is the vector of BGMV, for which the local varieties do not have the resistance gene. With the new improved varieties, the increase in the yield was less significant, only 19%, and can be partly explained because the dose of applied fertilizer was smaller than for the local varieties—45 kg per producer (Table 13).

In Nicaragua, the increase in the yield of local (16%) and new improved (10%) varieties was not significant. This is comparatively much less than in Honduras and may be because in both the local and improved varieties there was no significant increase in yields when pesticide plus fertilizer was applied or not.

Table 16 shows the interaction of variety with fertilizer and its effect on bean yields. Producers in Honduras and Nicaragua significantly increased their number of fertilizer applications when changing from a local to a new improved variety; from 17% up to 59% for Honduran producers, and from 27% up to 43%, for those in Nicaragua.

In Honduras, the local varieties had a significant increase in their yields because of fertilizer use (40%). The new improved varieties did not show a significant increase (10%). This situation is largely because producers used a bigger fertilizer dose on local than on improved varieties and control of the whitefly was effective. However, when analyzing the effect of the varieties with and without fertilizer, it can be seen that the new improved varieties yielded more without fertilizer (312 kg ha^{-1}) than did the local varieties (231 kg ha^{-1}).

Table 16. Variety-fertilizer interaction and its effect on bean yields in local and improved varieties among the producers that were benefited by the Seeds of Hope Project.

Varieties	Honduras				Nicaragua			
	Farmers using fertilizers (%)	Yield average[a] (kg ha^{-1})		Differences for effect of fertilizer (%)	Farmers using fertilizers (%)	Yield average[a] (kg ha^{-1})		Differences for effect of fertilizer (%)
		Without	With			Without	With	
Local	17	466	654	40	27	663	612	(-7.6)
Improved	59	629	692	10	43	763	805	5.4
Differences for effect of variety (%)	42	26	6	-	16	15	31	-

a. Without and with fertilizer.

In Nicaragua, the local varieties did not respond to fertilizer application because in contrast to Honduran producers, the Nicaraguans applied less fertilizer to the local varieties (72 kg per producer) than to the improved (79 kg per producer). Both in Nicaragua and Honduras, the improved varieties yielded better than the local varieties without the application of fertilizer (in Nicaragua, 763 kg ha^{-1} as against 663 kg ha^{-1}) and with the application of fertilizer (in Nicaragua 805 kg ha^{-1} as against 612 kg ha^{-1}).

When comparing the effect of the pesticide applications on yields, Table 17 clearly shows a difference in yields because of the effect of pesticides in favor of local varieties against the new improved varieties; 18% as against 14% for Honduras, and 27% as against 3% for Nicaragua.

Table 17. Effect of pesticide[a] application on yields in local and improved varieties among the producers that were benefited by the Seeds of Hope Project.

Varieties	Honduras				Nicaragua			
	Farmers using pesticides (%)	Yield average[b] (kg ha^{-1})		Differences for effect of pesticide (%)	Farmers using pesticides (%)	Yield average[b] (kg ha^{-1})		Differences for effect of pesticide (%)
		Without	With			Without	With	
Local	61	443	543	18	89	587	744	27
Improved	37	640	874	14	68	759	770	3
Differences for effect of variety (%)	24	44	34	-	21	29	5	-

a. The word "pesticide" here refers to a mixture of insecticide with fungicide.
b. Without and with fertilizer.

But, when comparing yields with and without pesticides, in Honduras the new improved varieties had a more highly significant yield with (34%) and without (44%) pesticide application than did the local varieties. The same situation occurred in Nicaragua; the yield of the new improved varieties exceeded that of the local varieties by 29% when pesticide was not applied; and only by 5% when pesticide was applied. This confirms that the yields in the local varieties are more seriously affected by whitefly than by the effect of fertilizer use.

Figure 25 shows the effect of locality on the yields of local bean varieties and Figure 26 the effect of locality on new improved bean varieties.

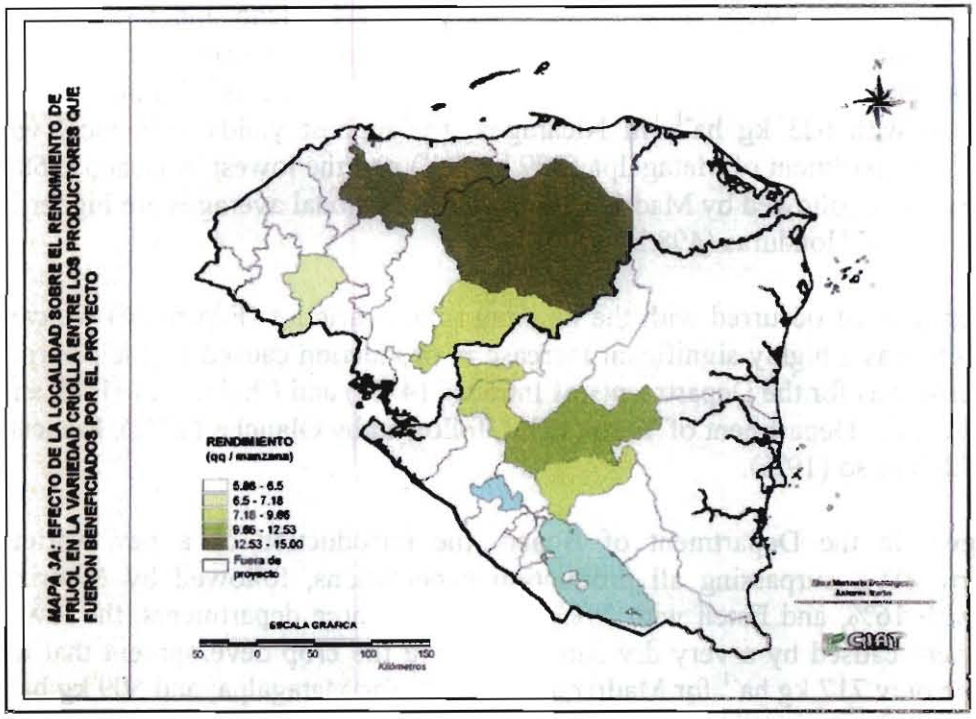

Figure 25. Effect of locality on the yields of local bean varieties amongst the producers benefited by the Seeds of Hope Project.

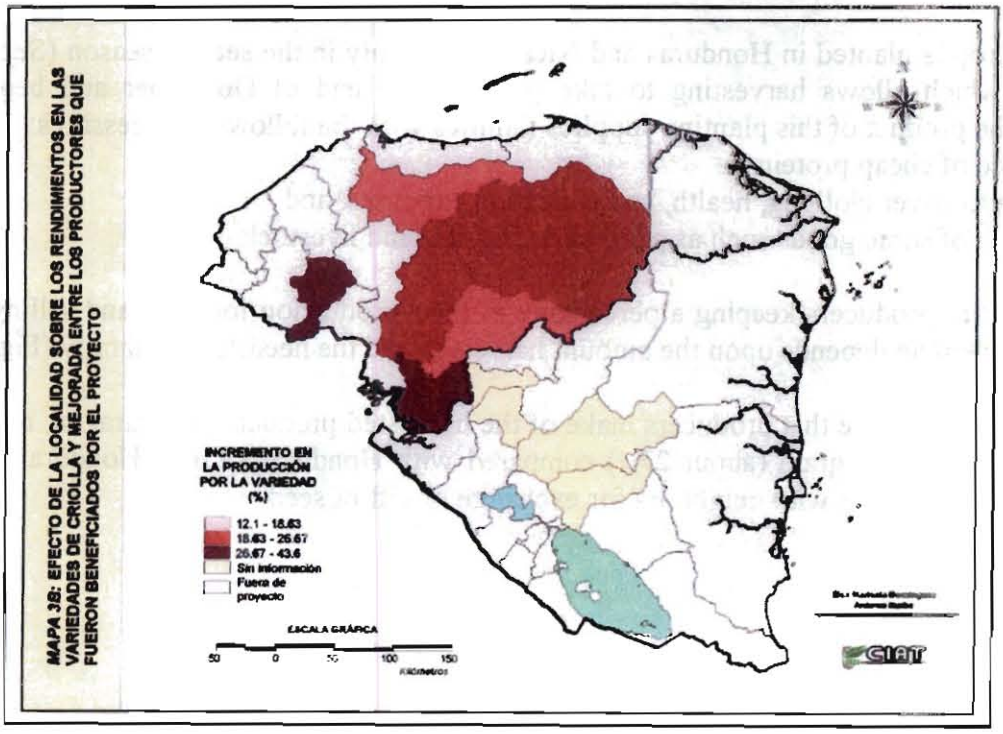

Figure 26. Effect of locality on the yields of new improved bean varieties amongst the producers benefited by the Seeds of Hope Project.

Both in Honduras and in Nicaragua, the area had a marked effect on the local varieties. For example, in Honduras in the Departments of Olancho and Yoro, which are high producers of bean, the highest yields were obtained (968 kg ha^{-1} in Olancho and 938 kg ha^{-1} in Yoro). Whereas in the Department of Choluteca, a very poor and dry department, the yields were the lowest (379 kg ha^{-1}), followed by Francisco Morazán with 419 kg ha^{-1}, Intibucá with 463 kg ha^{-1}, and El Paraíso with 623 kg ha^{-1}. In Nicaragua, the highest yields with local varieties were obtained in the Department of Matagalpa (809 kg ha^{-1}) and the lowest in Boaco (568 kg ha^{-1}) and Estelí (549 kg ha^{-1}), followed by Madriz (596 kg ha^{-1}). National averages are higher in Nicaragua (645 kg ha^{-1}) than in Honduras (498 kg ha^{-1})

When analyzing what occurred with the new improved varieties (Figure 26) we can see that in Honduras there was a highly significant increase in production caused by their introduction. The highest increase was for the Departments of Intibucá (44%) and Choluteca (41%), and the lowest increase was for the Department of Yoro (12%), followed by Olancho (27%), Francisco Morazán (23%), and El Paraíso (19%).

For Nicaragua, in the Department of Boaco, the introduction of a new variety increased production by 88%, surpassing all production expectations, followed by Madriz with 20%, Matagalpa with 16%, and Estelí with 7%. In these last three departments, the low increases in production were caused by a very dry summer during the crop development that caused yields obtained to be only 717 kg ha^{-1} for Madriz, 676 kg ha^{-1} for Matagalpa, and 509 kg ha^{-1} for Estelí.

Commercialization of Production

The bean crop is planted in Honduras and Nicaragua mainly in the second season (September to October), which allows harvesting to take place at the end of December and beginning of January. The product of this planting supplies families with the following necessities:

- A source of cheap protein,
- Income to cover clothing, health, and education expenses, and
- Purchase of some goods such as pigs, birds, horses, and livestock.

This has led to producers keeping a percentage of their production for food and selling the rest, but this percentage depends upon the amount harvested and the needs of the family (Figure 27).

Table 18 shows the use that producers make of the harvested product. In Nicaragua, more seed is sold in the market as grain (about 27 t) compared with Honduras (4.6 t). Honduran producers show more interactions with neighbors for exchange or gift of seed.

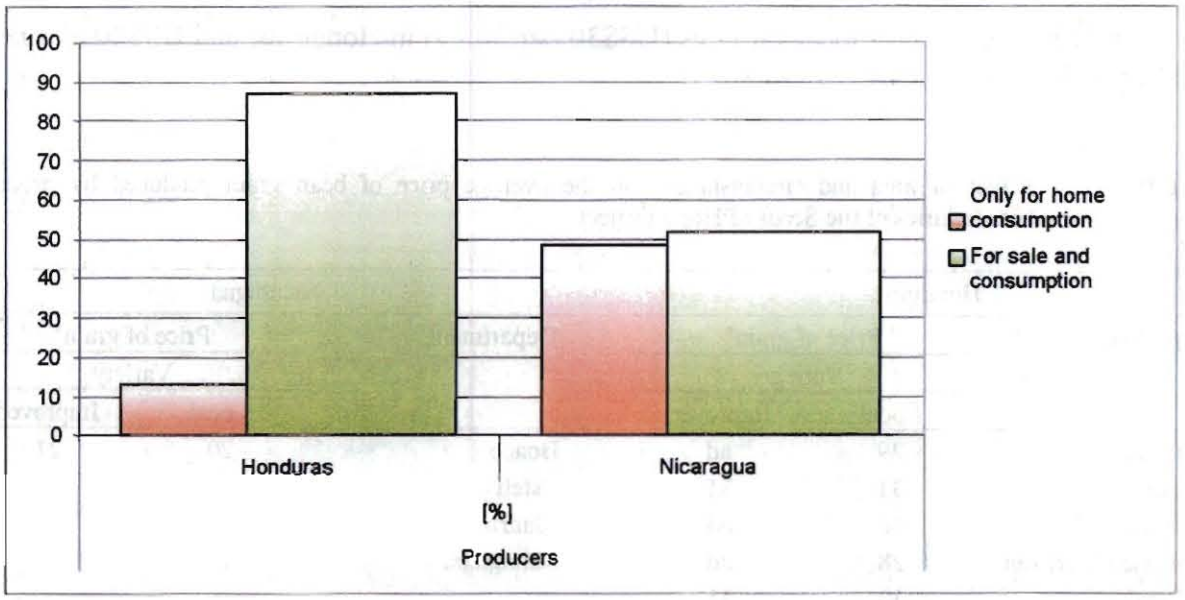

Figure 27. Use of the bean production among producers in Honduras and Nicaragua before Hurricane Mitch

Table 18. Use of production of bean grain produced after Hurricane Mitch by producer beneficiaries of the Seeds of Hope Project

Production use	Honduras			Nicaragua		
	Producers of the sample			Producers of the sample		
	Use of total harvested grain (kg)	Average use by producer of the total harvested grain		Use of total harvested grain (kg)	Average use by producer of the total harvested grain	
		(kg)	(%)		(kg)	(%)
Home consumption	18,129	91.82	57.0	18,559	150.91	34.3
Planting in the next season	6,877	35.00	21.6	7,382	60.00	13.7
Sale in the market as grain	4,564	23.18	14.3	27,280	221.82	50.8
Sale to the neighbor as seed	1,873	9.54	5.9	364	3.18	0.7
Exchange with neighbors as seed	204	0.91	0.6	27	0.23	0.1
Given for seed	114	0.45	0.4	102	0.09	0.2
Other	35	0.04	0.2	-	-	-
Total production	31,796			53,714		

Traditionally, in Honduras and Nicaragua, producers have preferred grain of a pale red color, and this been one of the biggest limitations in the adoption of new varieties and has greatly influenced the market price of grain. Local regional varieties are pale red and therefore enjoy a better price from the middlemen or "coyotes", but the three new improved varieties delivered to producers have dark red or wine red grains, which fetch a lower price. However, in the present study, in both countries the price of grain of the new improved varieties (about US$31 per 50 kg)

was slightly higher than for local varieties (US$30 per 50 kg) in Honduras, and US$20 as against US$18 per 50 kg for Nicaragua (Table19).

Table 19. Effect of area and circumstances on the average price of bean grain produced by producer beneficiaries of the Seeds of Hope Project.

Honduras			Nicaragua		
Department	Price of grain[a]		Department	Price of grain[a]	
	Variety			Variety	
	Local	Improved		Local	Improved
Intibucá	29	nd	Boaco	20	21
Choluteca	31	31	Estelí	20	21
Olancho	30	nd	Madriz	15	20
Francisco Morazán	28	nd	Matagalpa	18	19
El Paraíso	30	31			
Yoro	28	30			
National average	30	31		18	20

a. Price is in US$ per 50 kg of grain. Figures are rounded. nd = no data available.

Also at the level of some departments, the price of grain of the new improved varieties was slightly above that of the local varieties. In Nicaragua, in all departments, the price of the new improved varieties in some cases was significantly above the price of grain of local varieties.

The figures reflect that in the emergency situation faced by the two countries the price of grain did not differ significantly between local and new improved varieties. On the contrary, the middleman or "coyote" had to recognize that the consumer in the market has gradually become accustomed to the wine color of the new improved varieties. This is a great advantage for the producer who can increase income with bigger yields using less pesticide.

Table 20 shows where and how the producer beneficiaries of the SOH Project sell their surplus beans. Nicaraguan producers sell mostly in the nearest market a little at a time, while Honduran producers sell mostly from home and in a single session.

Table 20. Place and form of commercialization of the surplus grain of produced bean after Hurricane Mitch by producer beneficiaries of the Seeds of Hope Project.

Questions	Answers	Honduras (%)	Nicaragua (%)
Where do you sell your bean production?	▪ From home	82.0	34.0
	▪ In the nearest market	14.5	59.0
	▪ Elsewhere	3.5	7.0
How do you sell your bean production?	▪ In a single session	87.0	11.0
	▪ Little by little	6.0	87.0
	▪ Other	7.0	2.0

CHAPTER II

ACHIEVEMENTS

DECEMBER 1999 TO SEPTEMBER 2000

CHAPTER 1

ACHIEVEMENT

Reference to Be Determined

Training

Training in Postharvest Management of Maize Seed

Continuing the training of technicians and producers of the institutions interested in establishing the PES, in May and August a course was given on postharvest management of maize seed. In Honduras the course was supported by DICTA and SAG and in Nicaragua by MAGFOR, INTA, and the Seed Improvement Project (PROMESA). Fourteen technicians and 24 producers of 18 Institutions that had received training in postharvest management of bean the previous year were now qualified for maize.

Training in Managerial Administration

This was given by EAP-Zamorano through an agreement of inter-institutional support between EAP-Zamorano and CIAT-SOH. The nine technicians of institutions that were qualified in postharvest management of seed were trained in Introduction to Administration, Organization, Finances, Marketing, and Budget Preparation.

Development of the Small Seed Companies - PES

As a result of the training given to the 24 technicians and 35 producers, and the distribution of seed, producers in marginal areas of the hillsides in Honduras and Nicaragua asked CIAT to develop a mechanism to help rural communities become self-sufficient in production and seed commercialization. This initiative gave birth to the idea of developing the PES. This was presented to the NGOs supporting the technicians and producers because these institutions believe that this would be a way for small-scale producers of the marginal and hillside areas in Honduras and Nicaragua to have access to a reliable, economic, and opportune source of seed.

The concept is based on inter-institutional collaboration, identification and organization of groups, and strengthening of these as illustrated in Figure 28.

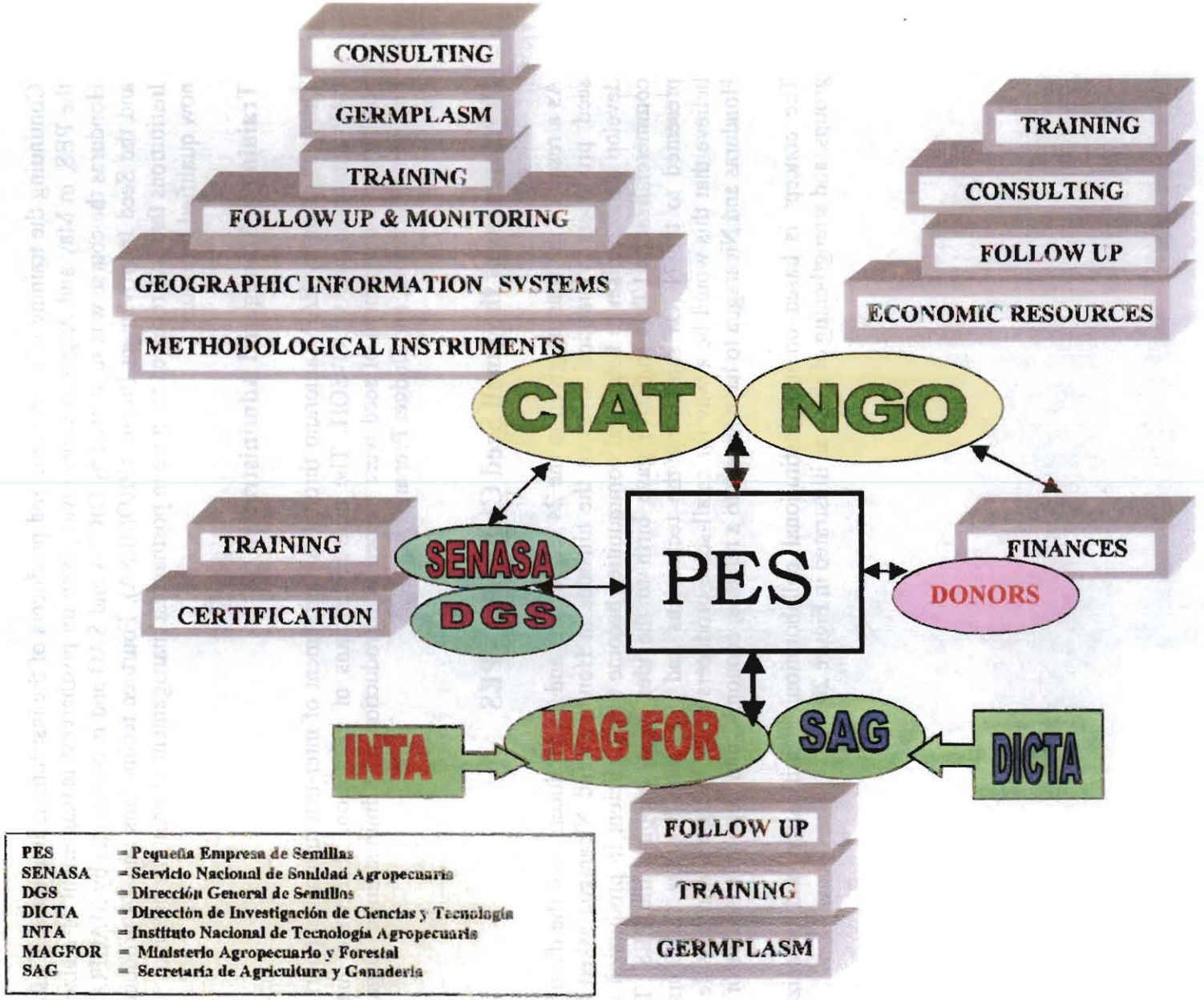

Figure 28 Seeds of Hope Project interinstitutional collaborations, and identification and organization of groups.

Strategies for Developing the PES

Identifying an appropriate area to produce, dry, and store seed is of great importance in systems of seed production because it is known that hillsides producers lose all their efforts in the field during production when they reach the point of drying and storing their seed. This is because without the appropriate conditions of relative humidity (RH), and appropriate drying method, their physiologic quality (germination and vigor) and their condition are drastically affected during storage until the new planting, producing economic losses at planting time. Therefore, with the support of the Atlas for Honduras generated by CIAT-GIS in Honduras, we proposed to generate maps with information that allowed the SOH Project to make correct decisions in identifying the appropriate areas for establishing the PES both in Honduras and Nicaragua.

Figure 29 shows a series of maps illustrating the hydrological balance in Honduras. It can be seen that in January and April, these hydrological levels are deficient by 100 to more than 200 mm, being the lowest in the year. This indicates that, to produce seed in these months, irrigation equipment is necessary to guarantee success in production and, from a weakness of the system, we would make a strength for the PES because we would be producing seed in a very difficult time for the rest of the producers.

Also, we can select the areas with the best hydrological level, 0-250 mm, and supplement with irrigation the levels from 0–100mm. We can likewise avoid those areas where precipitation is very high, more than 250mm, which would be a problem in field production because of diseases. It would also be a problem because of the high relative humidity, which would make it difficult, if not impossible, to reach an RH content in the seed of 11% to12%, which is safe for their storage.

Thus, a methodological tool was developed for training in the organization of a PES. This will allow the national institutions and NGOs to implement the PES with groups of producers from hillside and marginal areas. In this way, seed production can be decentralized and thus allow these producers to have access to a source of good quality seed at fair prices and in quantities adapted to the times at which they are needed.

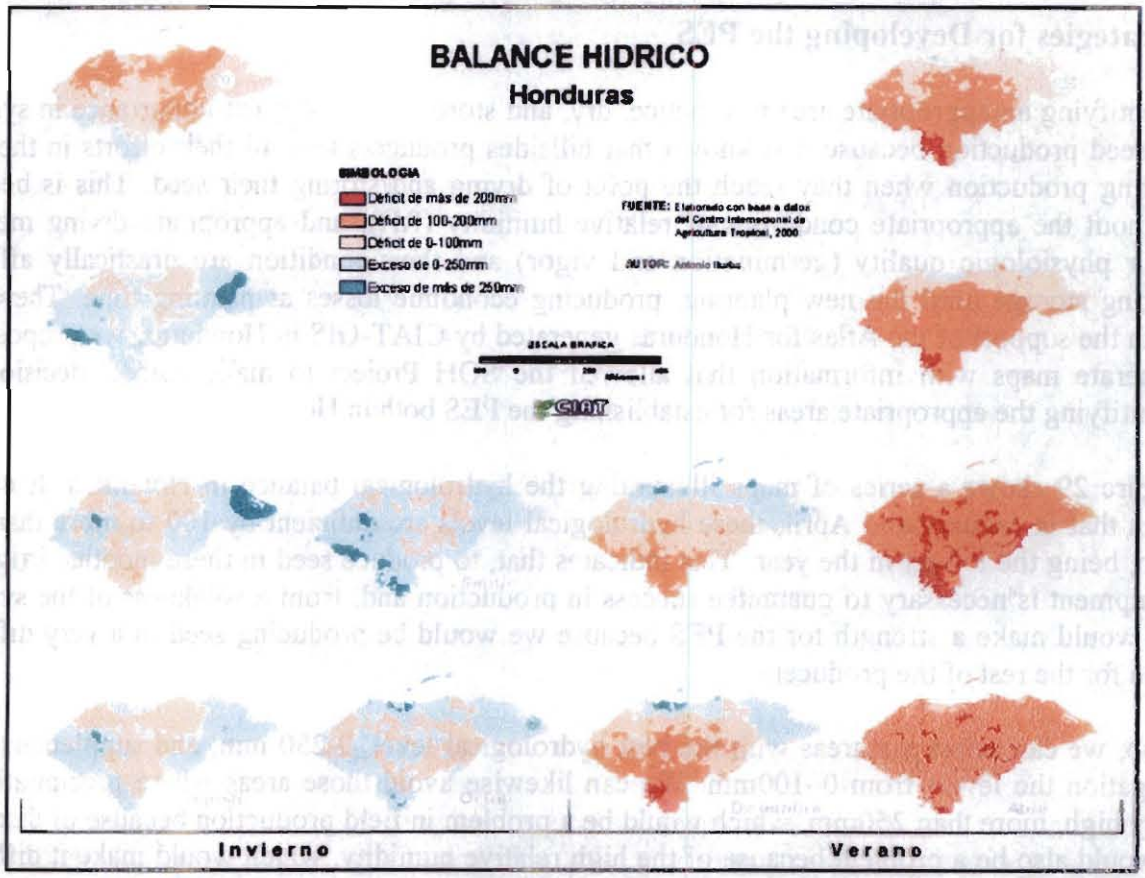

Figure 29. Maps of the hydrological balance of Honduras according to the month and season (dry – summer, or wet - winter)

Results

Between March and July, four sections of the methodological Guide were produced. Section 1 is entitled "Identifying the appropriate zone and organizing the interest group". This section emphasizes the alternatives that institutions have in identifying the appropriate zone to establish the PES, for example, using GIS, the physical and agroclimatic profile, and the psychometer. Different aspects related with the strategies are analyzed for identifying and organizing within a community the group of producers most appropriate for the PES. This is based on organization, planning, execution, monitoring and evaluation (M&E), and on the strengths and weaknesses of being associated to a PES.

Section 2 is entitled "Seed commercialization and managerial administration". This section puts forward some mechanisms for commercializing the seed produced by the PES, based on the socioeconomic profile, the studies and evaluation of markets in the PES's zone of influence, and the distribution channels and publicity. Also relevant aspects related with accounting systems are presented as mechanisms for the economic control of the PES.

Section 3 is entitled "Pre- and postharvest management of the seed". This section presents all aspects related with seed quality, appropriate harvest time, and their influence on seed deterioration. Rules are also established for the seed drying and storage, as well as some tests for evaluating seed quality.

In Section 4, aspects related with the internal quality control in the PES are presented. This is managed through M&E in all production processes: field, cleaning, drying, storage, commercialization, and administration. This internal quality control is also compared with the official control carried out by the institutions of seed certification.

This Guide will also have a set of prototypes of the equipment used for producing better seed, such as: an air ventilator, a chute for manual selection of seed, and a stationary dryer. These prototypes will allow qualified technicians to carry out some exercises related with the postharvest handling of seed.

A PES Case Study

As a result of the training given, a group of producers developed a PES, and in November 1999 had their first experience as producers of maize seed.

The San Francisco de Orica Associative Company of Producers

This company was founded in 1956 and obtained legal recognition in 1976. It is located in the village of San Francisco de Orica, Orica Municipality, Department of Francisco Morazán in Honduras. It comprises 54 members, with an area of 70.4 ha of agricultural land, of which about 42 ha are communally worked with crops such as beans, tomato, chili, maize, and papaya, and the rest is made up of small individual plots.

It has an irrigation system consisting of a 100-HP diesel pump, PVC pipes and sprinklers to water the 70.4 ha that are collectively worked. Members have a tractor with all its agricultural implements, a big storeroom, a drier for grains, and work tools such as hoes, machetes, and backpack sprays.

The first contact with this group was in 1999 when the project increased the seed of the three bean varieties to be distributed to producers affected by Hurricane Mitch. The group was contracted for the multiplication of about 32 ha in the two planting seasons (called *primera* or first and *postera* or second). Later, the technician and a producer participated in the training activities in bean and maize postharvest management, and with this base the development of a PES began.

On the 25th of November 1999 in the second season the group planted about 2.1 ha of the maize variety DICTA Guayape. In March, a Field Day was held to which were invited producers of the area, and NGOs that work in other areas of the country such as the:

- Evangelic Promotion of Progress in Honduras (FEPROH),
- Area Development Project (PDA)-Yoro,
- Technological Services for Sustainable Development (SERTEDESO), and

- Project Center of Small-Scale Producers (CPDECAP).

Also, the Seed Certification Program was invited to evaluate management, isolation of the plot, and quality of the seed. The local producers and representatives of invited institutions, showed their satisfaction when saying how important it was that a group of producers could produce good quality seed. Producers then have access to the seed at a price fixed at 48 US cents per kg. This is double the value of grain on the market from which they habitually take their seed (20 US cents per kg), but 54% cheaper than the price of certified seed (90 US cents per kg).

Later, the seed was harvested, threshed, treated, and packed in 25-lb bags. Table 21 presents the activities carried out and the sale of seed produced.

Table 21. Activities of the San Francisco de Orica Associative Company of Producers and sale of maize seed[a].

Activity	Quantity	Price (US$ per 50 kg)	Total value (US$)	Number of producer beneficiaries with seed
Total work days (no)	573		1128	
Total inputs			942	
Total cost of production			2070	
Harvested seed (t)	5.8			
Sale producers (t)	1.2	28	735	105
Sale PDA-Yoro (t)	3.2	24	1727	282
Sale SERTEDESO (t)	1.3	28	805	115
Sale to the group (t)	0.1	28	84	12
Total sale of seed			3351	
Total no producers benefited				514
Grain produced (t)	4.5[b]	10	1050	
Total revenue			4401	
Total net income			2331	

a. All figures are rounded. Maize seed harvested from the 25-11-1999 planting. Two hectares were planted for a total production of 10 tons. For acronyms, see page 89.

b. The high relationship between seed and produced grain was because producers were very strict about seed quality, and a portion was discarded as grain that might well have been sold as seed, further increasing their revenues.

Another relevant aspect during this activity, was the generation of employment (573 workdays at about US$2 per day) among the members of the Associative Company and the community who participated in the different production work in the field and in the postharvest management of seed. The latter included activities such as husking, threshing, drying, selecting, treating, and packing. Women and children mostly did the postharvest work. The seed produced benefited 514 producers of the Departments of Yoro and Francisco Morazán.

MSc Theses

In February 2000, two Norwegian students from the University of Agriculture of Norway were linked to the CIAT-SOH Project to complete their MSc theses.

Thesis 1: "Study of Decision Processes for the Supply and Distribution of Seed in Emergency Situations–Case of Honduras " by Sigrid de Barbentane

This first study dealt with "The strategies of international, national, and local institutions that worked in the emergency to restore agriculture after Hurricane Mitch". A "normal" year was defined as one when no major disaster occurred such as a hurricane, drought, war, etc.

The work was carried out between February and May 2000 and had as objectives to:

1. Know the weaknesses and the positive points of the emergency programs that worked with the distribution of seed to small-scale farmers,
2. Develop strategies that might assure restoration of the "stocks" of farmers' seed in cases of emergency,
3. Improve the process of distribution of seed to those that need it, and
4. Improve both intra- and inter-institutional decision-making processes.

As a result of this research, some preliminary aspects follow under three main groupings. The first proposes an outline illustrating formal and informal seed systems and the way in which both function in a "normal" year and in a period of emergency. The second presents the strategies used by the institutions and the problems that were faced. The third proposes some preliminary recommendations to keep in mind for projects to restore the agricultural system during an emergency.

Institutional links relating to agricultural projects and the distribution of seed to small-scale farmers

Formal and informal seed systems can be illustrated as in Figure 30 (adapted from Almekinder and de Boef 1999)[7].

In "normal" years, few links exist among the formal and informal seed systems, and the two systems work almost independently without exchange of information or knowledge.

[7] Almekinders C, de Boef W. 1999. The challenge of collaboration in the management of crop genetic diversity. December Newsletter.

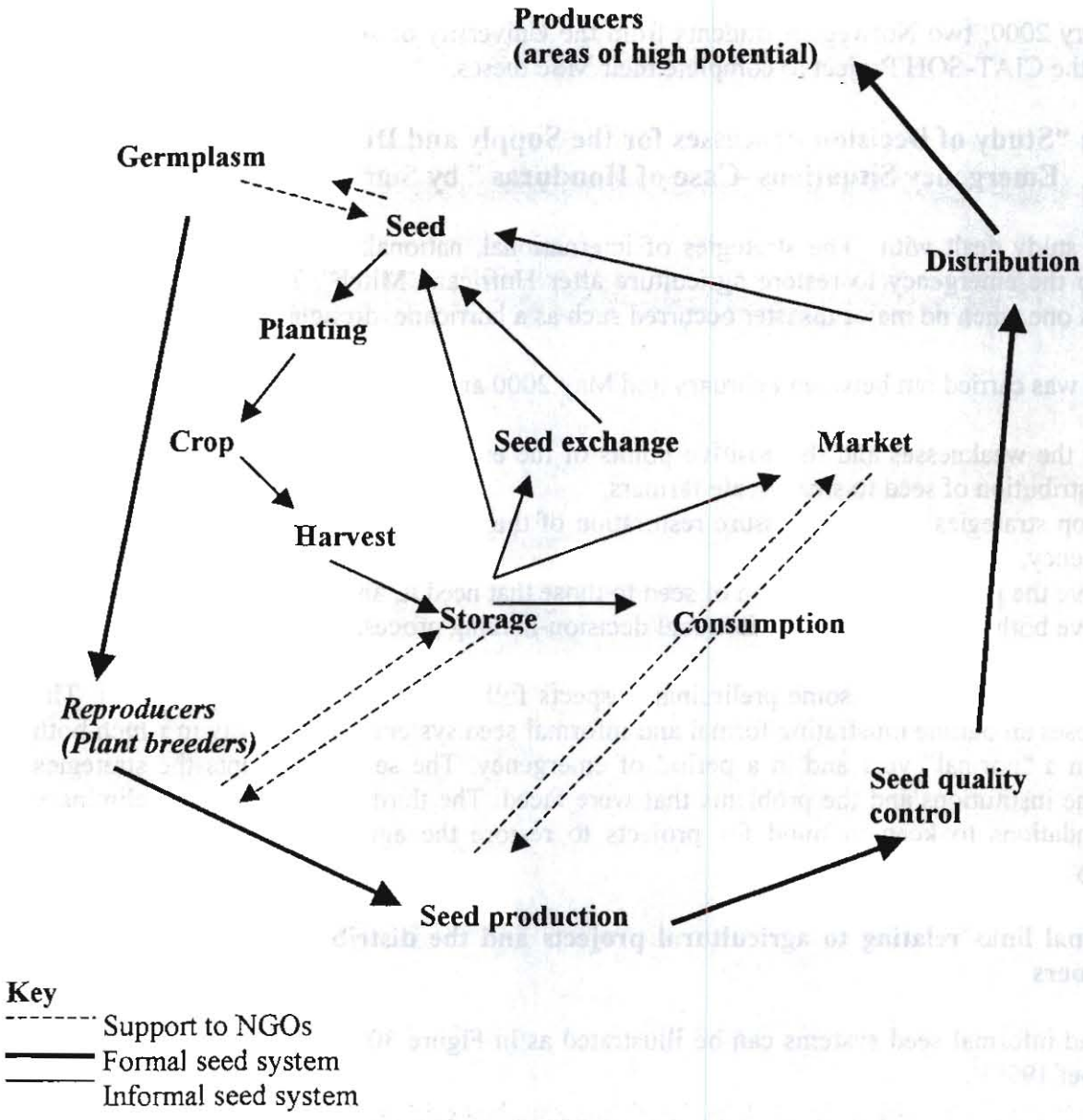

Figure 30. Links between formal and informal seed systems (adapted from Almekinder and de Boef 1999).

In cases of emergency, the NGOs play the part of middlemen between the two systems and they apply known techniques from formal to informal systems. In some cases this can result in the non-adaptation of modern technology to a local agricultural system, generally located in the most marginal and poorest areas.

Strategies

Identifying beneficiaries. Various options were found for choosing the beneficiaries in emergency situations, for example:

- The institutions that work at local level such as the NGOs, and
- Through the municipalities, but taking into consideration that they worked very little in seed distribution to small-scale farmers because of lack of economic resources and agricultural knowledge.

Choosing beneficiaries. A CD-ROM on the impacts of Hurricane Mitch in Central America was released by CIAT. It was a very important and indispensable tool for determining the places where the small-scale farmers with needs were to be found.

During the emergency, the Honduran government also had information services at a national level such as the Permanent Contingency Committee (COPECO), and at a regional level, the Regional Development Committee (CODER). Several NGOs used this information to choose intervention sites.

The interviewed NGOs presented different strategies for choosing beneficiaries, through:

- A house by house census in the communities such as, for example, the case of the Red Cross that sent voluntary relief workers into the countryside to determine what were the necessities;
- Leaders of the communities;
- The municipalities;
- The knowledge of the NGOs obtained thanks to past projects in some communities; and
- Cases where the NGOs did not take a census, because of lack of time and the need to help people quickly.

Ways of distributing seed to the beneficiaries. Distribution was carried out through:

- Farmers' groups, a system that increased after Hurricane Mitch because many NGOs experimented with stimulating the creation of farmers' groups within communities because of the need to work together;
- House by house;
- Municipalities (in very few cases); and
- Community leaders.

Seed sources

During the study, two seed sources were found to be available for the distribution to small-scale farmers, local or improved seeds. An important question in the fieldwork was, "Which varieties did your organization distribute and why?" The answers were according to the concept that the organizations have of the programs for restoring the agricultural system and also the knowledge that the organizations have of the local agricultural system and the local agroecological and socioeconomic conditions.

Through the fieldwork we found that most of the interviewed institutions distributed improved seed that came from big national producers, for the following reasons.

- The local seed existed in small quantity, which hindered their acquisition.
- It was easier to obtain the improved seed through big institutions that produce certified seed and in big quantities.
- They wanted to improve local production, replacing local seed with "pure" seed of good quality.
- They lacked knowledge on where to acquire the local varieties and on the local agricultural system.

We also found that hybrid seed were promoted by private companies who sold seed to the NGOs or to farmers with better resources. Some NGOs also distributed hybrid seed to small-scale farmers, their reasons for doing so being because:

- Hybrid seeds yield better, or
- It was easier to obtain the varieties of free pollination in the last phases of the emergency (i.e., some months after the disaster) because the "stocks" of free pollination seeds were quickly finished.

Some NGOs tried to make use of the local seed that existed in small quantities in the field, to respect farmers' local varieties, and to diminish the risk of distributing seeds not adapted to the local conditions, that is, the agroecological and socioeconomic conditions of each community. The distribution of local varieties allows the foreseeing of the risk of phytogenetic erosion such as the loss of local varieties and it also promotes the work of local producers in the local market.

Seed distribution

Seed distribution is usually necessary in cases of emergency, after a disaster, when farmers do not have seeds for planting. Seed distribution also reduces the risk of an increase in the seed prices in the national and local markets. During Hurricane Mitch, international and national institutions usually distributed seed through the NGOs and these distributed to the beneficiaries in different ways. The two most popular ways of seed distribution used by the NGOs during the field study were by donation and by credit.

Donation. According to the interviewed NGOs, there are two main reasons for distributing seeds as a donation. The first is linked to a moral principle that considers it inappropriate to sell seed (as credits, or directly) to people that suffered great losses because of Hurricane Mitch. The second is attributed to the technical capacity and logistics of the NGO, and also to the importance of acting very quickly during an emergency. Many NGOs do not have the time or capacity to distribute seeds through credit, because one needs to know the economic state of people before and after the disaster.

In most cases, donations were made once, at the start of the first season (May-June) because the institutions considered that farmers already had the multiplied seed from the first planting (in cases of good yield). However, a few NGOs made a second distribution in the second season (September-October).

Credit. Institutions or NGOs that were generally well established in the communities, and that had medium- to long-term programs of about 3 years, used this system. They could also offer credit in the distribution. These NGOs justified this action of distributing seed for credit because it reduces the risk of dependence and gives to producers the possibility of setting up seed or grain banks in the communities. The problem with this process is the difficulty of giving follow-up to each beneficiary so that they return the seeds. Much more work is needed and more technical and logistic capacity on the part of the NGOs to follow a monitoring of the project.

Two main ways of distributing seeds through credit were found to exist:

1. The beneficiary has to repay the credit in cash (this credit type was used by the government).
2. The beneficiary has to repay the credit in grain.

During the fieldwork, an interesting case was presented where an NGO distributed improved seed to producers and they put their local seed in seed banks during the first months of the emergency. The goal was to protect the local seed from phytogenetic erosion in case of a distribution of improved seed of free pollination. The local seed was returned to the producers after the first crop.

Project sustainability. An emergency project is, by definition, a project that should respond to the population's first needs after a disaster such as Hurricane Mitch in Central America. However, emergency projects always have long-term consequences, especially in the case of projects to restore the agricultural system. During fieldwork, both types of project were encountered. The short-term projects were generally characterized by distribution of seed through donation, without monitoring and evaluation. Institutions were also encountered that followed the first phase of the emergency program with restoration projects of the agricultural system to medium and long term.

The long-term projects were involved mostly in some activities through training of leaders or of farmer groups such as:

- Farmer training,
- Grain/seed selection,
- Creation of microenterprises with production and seed multiplication (improved seed in most cases),
- Creation of rotating community funds,
- Soil conservation (agroforestry, live barriers, etc.),
- Maintenance of fields (cleaning, etc.),
- Creation of seed/grain banks, family and communal,
- Training people in cases of emergency, and
- Participation of ordinary people, that is, projects that integrate the participation of beneficiaries in the project elaboration. The idea is to stimulate the project by the demand of producers and not so much with the decisions of the NGOs.

Seed source and producer taste. After this emergency, it was essential to provide producers with seed for the next planting. In the case of Hurricane Mitch the disaster happened at the end of October, the time of the second planting, thus it was important that institutions distribute seed to the farmers for the following first planting, before the month of May.

Programs like CIAT-SOH produced seeds on two opportunities: January-February, using irrigation, and May–June. This allowed them to have seed ready for the two planting seasons. About 20,000 producers and their families were thus benefited. Another institution that distributed seed for the first planting was the EAP-Zamorano in Honduras. Nevertheless, seed demand was so great that the quantity of seed produced in January - February was not enough, and several institutions had difficulties in getting seed in March - April. In some cases, seed arrived 1 month after the planting time, too late to plant.

Farmers have various criteria for judging seed quality, such as color, form, cooking time (also important for minimizing the amount of firewood used), plant growth time, quantity of fertilizer to add, and adaptation in marginal areas. These criteria are sometimes more important for small-scale farmers than a maximum yield, and big national producers need to take into account these criteria when working with small-scale farmers.

Unfortunately, in cases of emergency, these approaches are often neglected by institutions that can more easily obtain certified improved seeds with good yield, but less approval in the local markets.

Sufficient quantity. It is almost impossible to have an idea of what were the necessities and how many tons of seeds were distributed in Honduras during the emergency. Although demand was higher than supply, it seems that the informal system of seed exchange within the communities achieved that a great part of the affected producers received seeds.

Different options. To the question of whether institutions had other options for helping the small-scale farmers, few responded in an affirmative way. It seems that the alternative of distributing seed, and usually improved seed, was one of the only answers with which institutions responded to the damage caused by Hurricane Mitch on the agricultural system.

Dependence. The problem of dependence often appears in communities for two main reasons:

1. Donations – the habit of receiving donations can discourage in some producers the need to build their own production system.
2. Another problem that can appear when there are "unjustified" donations is that relationships that exist between the local producers and the local buyers can be changed. This is linked to a destabilization of the local agricultural system.

The distribution of seeds not well adapted to the agroecological and socioeconomic conditions of the area (causing low yield) forced farmers to buy new seed or to wait for new external support because most did not have the necessary economic resources. There were some examples of seed adapted to humid areas that were distributed in arid areas during the emergency in Honduras; and cases of distribution of hybrids, sometimes not well adapted to some local agricultural systems. Many small-scale farmers did not have the possibility of buying new seed for each planting, which made them more vulnerable in the event of lack of seed in their own stocks.

Loss of phytogenetic resources. The emergency programs in seed distribution considerably promoted the distribution of two main varieties of bean, Tío Canela and Dorado varieties, and two main maize varieties, DICTA Guayape and HB104. These are all known to have a long scale of ecological adaptation. However, phytogenetic erosion can occur when an important distribution of a few types of varieties occurs that diminishes the biodiversity of the country in the agricultural sector. The loss of local varieties is linked for example with the loss of important specific properties that can be necessary in the agricultural system of small-scale farmers, such as short growing time, high quantity of proteins, or little need for fertilizer.

Also, in the first phases of the emergency, the Ministry of Agriculture decided to facilitate the admission of imported seeds, resulting in a weak control of imports at the frontiers. Results were quite negative because of the introduction of all types of seed, sometimes very little adapted to the specific conditions of the country and that could be crossed with national varieties of free pollination giving rise to possible phytogenetic erosion.

Therefore, it may be that the seed distribution during the emergency increased the problem of phytogenetic erosion that has long-term consequences and can quickly destabilize the food security of a country and/or of an entire region like the countries affected by Hurricane Mitch.

Reduction of the local price. An important distribution of improved seeds can be linked to the reduced price of local seed in the markets, which in turn reduces the incentives of local producers to produce or sell their seed because they do not want to sell at a low price. This problem can also happen with food donations because people will buy little in the markets if they receive food at lower price or for free.

Bad coordination. The lack of coordination among institutions that worked in the emergency programs and in the restoration of the agricultural system was obvious during the development of this study's fieldwork. In a small municipality in the south of Honduras, six NGOs were encountered that did not coordinate activities and that mixed their beneficiaries during their programs. All affirmed that "perhaps" duplication of work occurred because of a very weak coordination among the six organizations. The main reasons that they presented were:

- Different or opposed strategies such as credit and donation. The NGOs that work with credit find it hard to develop their own development programs to stimulate the local agricultural system if other NGOs are distributing seed as donation in the same communities. With some exceptions, farmers are more willing to receive seed as donation than to re-stimulate their own production to repay credit.
- Different political ideas, which were sometimes found between NGOs and municipalities, or among several municipalities.
- Competition to obtain funds, and although this reason was not presented by the interviewed institutions, it seems evident that the difficulty of getting funds results from the lack of transparency in the programs and in the interinstitutional coordination.

Lack of monitoring and evaluation. During the field study it was common to find projects that had neither monitoring nor evaluation. Few institutions took the time to follow up the project and to evaluate the effects on the population.

Although the lack of M&E can be explained by a lack of time and/or NGO technical capacity and logistics, it does appear necessary that enough resources should be assigned to carry out the M&E of the emergency programs. On this point, it was very difficult to get reports, because this lack of transparency results in the difficulty of clearly analyzing the strategies in the distribution of seed to the small-scale farmers in the event of emergency.

Also, lack of food during an emergency can increase the effects of a seed distribution without follow-up. Some people, if they have nothing else to eat, will eat their seeds. The problem is doubled, first because if they do not plant the seed they will have none for the next planting, and second because the seed contains a substance that can, if not well washed, poison those who eat it. An important role of the field technicians should be that of controlling that people plant the seed received. In this case, and to minimize the possible consumption of the distributed seed, donations of food are important, for example, the World Food Program (WFP) that distributed food during the first months of the emergency.

Lack of knowledge. After Hurricane Mitch, many NGOs wanted to support needy people, but many of them did not have a precise knowledge of the agricultural systems of Honduras, or of the country's needs and capacity to restore its resources. Some NGOs chose the strategy of donating certified improved seeds to limit the risk of distributing seeds of bad quality. To eliminate risks arising from lack of knowledge, the project of restoring the agricultural system must be begun with the population's active participation.

Lack of information. The lack of information in the delivery of seed to producers can be analyzed as the lack of time and/or of logistical and technological capacity of the NGOs to reach them. In other cases, the lack of information given to farmers can also be assimilated with the lack of knowledge that the NGOs had of the seed they distributed. An example of this is the hybrids that were distributed to farmers for the first time without their receiving information on the main characteristics of the hybrid (i.e., reduced yield of following crops, need to apply a good quantity of fertilizer, and generally the special management that they need). These farmers were left once again with almost nothing, even 18 months after the hurricane.

Observations

Defining the country's and population's needs "Seed acute stress" and "Seed chronic stress" in relation to the type of disaster (e.g., drought, hurricane, or war). Clearly strategies were not always chosen based on a clear knowledge of the state of the Honduran agricultural system before and after Hurricane Mitch; or with relation to the seed requirements, and of the capacity that the country and its population had to restore its seed "stock".

Also, it seems that most of institutions did not make a difference between "seed acute stress" and "seed chronic stress", which must be defined before beginning a recovery process. It is important to evaluate seed loss at national level and then determine individual needs in the event of emergency. This requires a detailed knowledge of the area and of its communities before each intervention.

Time of intervention. Although a large quantity of seed was produced on time (i.e., before the first planting) in the case of maize the "stock" of varieties of free pollination was insufficient in face of the important demand that arose in March-April. Certainly many NGOs did not respond directly after the disaster to the restoration of the agricultural system and the distribution of seed, because many had other priorities, such as rehabilitation of the infrastructure and the sanitary problems.

The delay of many NGOs in beginning a project to restore the "stock" of small-scale farmers' seed is important in explaining the imbalance between the very high demand and the lowest offer of free-pollinating seed 4 months after the disaster. It was too late for the big producers to have ready seed of good quality for the first planting.

Organization of institutional links and of the understanding of the national seed policies. The low level of coordination among institutions during the emergency worsened the system of seed exchange in the country. This brought about, in some cases, a delay in seed distribution to small-scale farmers. It also favored the distribution of seed not well adapted to the agroecological and socioeconomic conditions of the intervention areas.

On the other hand, the NGOs did not have to report their activities to a national institution in Honduras, and the fact that nobody supervised what these organizations were doing in the country made matters more confusing.

Preliminary recommendations

This thesis suggests that the responsibilities of the institutions working in seed production and distribution must be clarified, especially in a period of emergency.

- A government organization should be responsible for coordinating the projects to restore the agricultural system at national level in the event of an emergency.
- Institutions must be organized before a disaster occurs, considering that it is almost impossible to coordinate activities during an emergency.
- Seed banks should have a clear emergency program and the possibility to produce sufficient quantity of seed, both commercial and local.
- The role of the NGOs that work with agricultural projects at local and national level must be clarified.
- The different available technological and logistical support of the government institutions must be determined.
- The distinctions between germplasm bank, seed bank, seed storage strategies, and seed enterprises at local level must be clarified.

- An understanding is needed of the basic technologies related with the organization and development of seed programs in the field with the population's active participation.

- The greatest use must be made of the production of local seed, to avoid logistic and technological problems that arise with seed introduction and transport; also to avoid negative effects at local and national level of the loss of the country's phytogenetic resources.

- The training of beneficiaries must be emphasized in the seed production and distribution programs.

- The monitoring and evaluation of projects needs to be systematized allowing learning from past experiences; also a follow-up must be assured of the projects and of information over the following years.

- Places of production and multiplication of seed at national level should be diversified. In the case of Hurricane Mitch, the area designated by the government for seed production was badly damaged, which hindered its use by the government and its production to support farmers. Fortunately, some institutions had production areas outside the disaster area, allowing seed production in great quantity during the emergency.

- Advantage must be taken of the institutions that are in the country to reinforce existing interinstitutional links that will allow better use of time during an emergency and a direct answer to the needs of the country and its population.

Thesis 2: "The Seed Systems of Small-Scale Producers and their Importance in Disaster Intervention" by Jon Magnar

This second study dealt with "The seed systems of small-scale producers and their role in seed recovery during the disaster of Hurricane Mitch in Honduras." The work was carried out between February and May 2000. The objectives were to:

- Study the effects of Hurricane Mitch on agrobiodiversity and the seed systems;
- Study the impact on the food security of external support programs in relief and restoration after Mitch; and how these indicators can be used to evaluate impact on food security for such programs;
- Study the changes that occurred in agrobiodiversity and the impact on seed systems and social systems; and
- Find out if the differences in such factors as distribution scale or intervention type lead to different effects in agrobiodiversity in production systems, food security, or the socio-cultural context.

The thesis emphasizes the genetic resources of small-scale producers in Honduras and how these are related to local production and social systems. It discusses the seed production systems of these producers with a primary focus on seed exchange and acquisition. It brings together experiences with these mechanisms and their consequences with Hurricane Mitch; and emphasis is given to the vulnerability and capacity of producers affected by natural disasters.

The document also presents a short analysis of the interventions actually made after Hurricane Mitch, and considers if the producers' systems were sensitive to local conditions, capacities, and vulnerability.

The study was carried out in two different regions. The first is Yorito in the country's interior, with an altitude from 700 to 1600 mm, and a relatively long rainy season. The second is Choluteca, located in the southern region of the country, bordered by Nicaragua and the Pacific, with an altitude from 300 to 700 mm, and a short rainy season.

Predominant crops

In Yorito the main crops are bean and maize. Maize is cultivated once a year, in the first season that begins in May - June, with the rains. Bean is cultivated in both the first and second seasons (October and November, also with the rains).

In Choluteca, almost the whole area is planted to maize, but usually less so in the lowest areas, where sorghum and cowpea (*Bigna unguiculata* [L]) are more widely planted. Beans are only planted in the highest areas, where the climate is colder.

During the field work, between 10 and 15 different varieties of bean were identified, and producers showed a high degree of knowledge on how the different varieties adapt, and how agroecological conditions affect their agronomic qualities. Most producers could mention between five and 10 different characteristics of the varieties that they use. The characteristics that were perceived as important were production, market acceptance, adaptation to the area, adaptation to the production system, time to maturation, flavor, nutritious value, and resistance toward biotic and abiotic factors.

The visual characteristics of the grains and pods/cobs, as well as the types of plant growth are important to distinguish among different varieties. The common names of the bean varieties could be *el blanco* (white), *el negro* (black), *el chingo* (for the upright bush type of bean), *el blanco de la vaina pero de grano negro* (white pods, black seeds). Although many characteristics are valued by producers, the process of seed selection is based on visual characteristics such as form, size, and color of grains and pods/cobs, and varieties are always planted as pure lines (seeds of one color only) to maintain the characteristics.

Seed systems

In their discussion of seed systems, Richards and Ruivenkamp (1997, p 20)[8] include not only seeds, storage, and cultivation practices, but also the knowledge and social relationships that producers have to promote the utility of their genetic resources (see also Longley and Richards 1999, p 123)[9].

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[8] Richards R, Ruivenkamp G. 1997. Seeds and survival: Crop genetic resources in war and reconstruction in Africa. International Plant Genetics Research Institute (IPGRI), Rome.

[9] Longley K, Richards P. 1999. Farmer seed systems and disaster. In: Restoring farmers' seed systems in disaster situations. Procs of the International Workshop on Developing Agreements and Capacity to Assist Farmers in Disaster Situations to Restore Agricultural Systems and Seed Security Activities. Food and Agriculture Organization (FAO), Rome.

In Yorito Municipality, the second planting is the main bean season in which beans are planted between the maize that is left standing in the field after the January harvest, or even later. In the first planting, bean is usually cultivated as a monocrop.

Conversely, in Choluteca Department, maize and sorghum are usually intercropped in the first season, and beans are quite commonly later planted in relay among these cereals and harvested in August. The sorghum planted in the second season is harvested together with the maize and beans in November. This system of intercrop/relay plantings possibly reflects that for some crops (maize, beans), the agroecological conditions in the region are sub-optimal. Cowpea and sorghum adapt more, but for consumption are seen as inferior to beans and maize. Sorghum is highly resistant to drought, but very susceptible to the wind that prevails in higher areas; and cowpea is more resistant than bean, but is often attacked by aphids and ants. This shows that these diversified planting systems can consequently be an adaptation to the security of optimizing food and diet in an area with high biotic and abiotic pressure.

The biggest producers use more than five different bean varieties. However, only two or three varieties are more commonly planted because in doing so use is made of their comparative advantages. Some reach maturity quickly; red grain beans are more popular in the market; some can be more resistant to problems of pests, diseases, and water; others have a bigger nutritious value; or are used in certain dishes and drinks. In Yorito, for example, black grain varieties that are not appreciated in the market, are popular in the higher areas, because they adapt more to the agroecological conditions there and are seen as being of good taste and nutritious.

In Choluteca, most producers have to trust in their second and first plantings to obtain food until August, but between May and August, when production of basic grains is low, these can be replaced with fruit and tubers.

Land ownership

Usually, the household head is responsible for the land management and therefore for the crop. While the family kitchen garden, where some smaller quantities of special varieties of bean, maize, and cowpea are planted, is often the women's responsibility. The crops cultivated in a kitchen garden have quite a high level of survival (this is often the most interesting from an agrobiodiversity perspective, even subject to disasters like Mitch), because they are easier to manage for their proximity to the house. In this way, women can play a very important part in conserving genetic resources, because they are often the most avid and conservative experimenters, trying out small quantities of seed they receive from friends and family, but also continuing with the planting of small quantities of the traditional varieties.

Domestic production is the dominant source of seed, but the low level of stability in bean production has made, at least in some regions, external sources the most important for obtaining seed. However, in bad years, producers try to obtain seed from domestic production. This may be because it is the best way to guarantee that their planting will be carried out on time, and thus producers have the greatest trust in their own product, and these seeds are the cheapest. On the other hand, it seems that they are also interested in maintaining their genetic resources.

In Yorito, access to land is very insecure, and producers may have problems when cultivating areas with different agroecological conditions each year. This discourages producers from saving seed, especially because most of the tenants in Yorito are young, and the renting of land in this municipality does not have a long tradition. In Choluteca, tenants commonly rent the same lot year after year or, at least, can cultivate areas with more or less the same agroecological conditions. This creates an incentive for these producers who can behave like proprietors and keep their seed every year.

Producers can be classified into four categories according to access to seed.

1. Self-sufficient producers, usually have seed security (dominant strategy among producers in Honduras).
2. Producers that obtain seed regularly from a secure source, usually the market (not very common among small-scale producers in Honduras).
3. Seed-secure producers that obtain seed normally from local sources (quite common among tenants in Honduras).
4. Seed-insecure producers (can be of some, but not all, seed production systems).

Exchange and distribution of seed

Some producers, even when belonging to the self-sufficient category, can use external sources from time to time to obtain seed. Their motivations in doing so may be:

- Too low a harvest,
- Too poor crop quality, or
- A desire to try out new varieties.

Also, these producers can try to re-obtain the seed of a variety that they had previously produced, but could not keep seed from its harvest. However, they are willing to try out new varieties that neighbors plant or technicians introduce. Producers of the other categories can also often change from one variety to another each year, depending which are available.

Seed acquisition strategies

If a producer has seed or grain, but wants access to seed of others, then exchange is very common. But a producer that does not have any seed to exchange, because of crop failure or non-adaptation of the variety, will acquire seed in several ways:

- Buy local seed (at the relatively low prices obtainable in the market),
- Seed loans,
- Seed exchange,
- Seed as payment for work,
- Gifts (only small quantities),
- As payment for a contract of land partnership, and
- Buy in the market–this is more common in Choluteca where the distance to the town is less than in Yorito.

Success in acquiring seed will then depend on good social relationships with relatives and friends. Also, as an important source of seed, producers received seed through the organizations that collaborated in the disaster efforts after Hurricane Mitch.

Large-scale producers. Private members of the community can be seed sources, and these are generally the large-scale producers. Even in disaster situations, these may have seed and can be an important element in the survival of some varieties. They often save enough quantity of grain for their own consumption, and provided that the disaster does not happen when their stores are empty, this grain can be used as seed. This, however, indicates that seed quality will be lower, first, because the grain is stored for a long time, and second, because it is not selected particularly for use as seed. In some communities, the most important sources of seed are the purchase of a crop of other producers who have sold it as seed; or seed as exchange for some work that will be carried out in the following planting season.

Other communities. Some areas may have comparative advantages over others in the production of different crops because of the differences in their agroecological conditions. In Choluteca, for example, in the highest area where communities have a more stable bean production, the export of bean seed to the lowest areas can be significant, especially after crop failures in those areas. This can occur to the point that producers from the lower areas visit the higher areas to gain access to seed of better quality and in enough quantities. Thus some communities can secure sources of genetic resource for others that have lost them.

The market. In Yorito, the market is used mainly for buying maize seed. In the Choluteca market, seeds are sold that are produced in distant regions and they can ultimately become a seed source. However, it must be clarified that some of these varieties cannot adapt to other regions.

Organizations. Different organizations have been distributing seed regularly through the years as an answer to crop failures.

Changes in the use and distribution of varieties

According to Richards and Ruivenkamp (1997, p 23), changes in the use of the different varieties can be attributed to three factors:

1. Involuntary changes, where varieties have been accidentally lost or their consumption was necessary.
2. Voluntary changes caused by conditions altered in the agroecological factors of the production systems or by the degeneration of their seed.
3. Changes resulting from successful trials with new materials.

Voluntary changes. The increasingly high use of silos for keeping seed and grain has led to a change in the use of varieties, because new varieties that are resistant to loss during storage are showing their advantages. Another important aspect is how changes in the production systems can have important impacts on the preferences for some varieties, because some are more important than are others when factors such as population density, crop technologies, and market integration changes are present.

Changes resulting from successful trials. Producers in Honduras seem to be conservative, but also curious. Even before Mitch, communities were in a process of adopting new bean varieties, reducing the demand for local ones. At that time, they were accepting new broadly adapted varieties of the bush type, mainly because of their resistance to certain diseases such as bean common mosaic virus, BGMV, and angular leaf spot. The new improved varieties have been quickly diffused in the communities, a tendency that began before Hurricane Mitch, but that was further promoted by the massive distribution of seed after the disaster. The diffusion has been promoted beyond an open seed system where information and seed move freely, facing the adverse situation of growing levels of disease stress. This has made many producers want to experiment with new varieties.

In the fieldwork many examples were encountered of involuntary changes in the use of varieties, but no evidence is available about which variety was lost completely in an area in recent years. Producers could probably recover the varieties that were lost because of Mitch.

Sources for new genetic resources of small-scale producers

Other communities. In different regions, a high degree of contact is usually maintained between communities and producers, merely by regularly bringing with them new genetic resources to try out in their plots.

Rich producers. Often a producer, usually one of the richest ones, buys seed of improved varieties in the market and these are distributed to other producers after the first crop.

Organizations. The presence of different organizations has led to the introduction of varieties through field trials, where new varieties have been tested. This has allowed producers to take with them small quantities of seeds of the varieties that they like.

Effects of Mitch

Crop losses. In Yorito, Hurricane Mitch hit the fields in the first weeks of the second planting, affecting the bean crop. In the highest areas, where the wind hit harder, many producers had not planted their beans because the rain caused a delay that later made the crops vulnerable to the summer drought. Also during the drought, maize was seriously affected because only a very small percentage of producers had been able to harvest the first planting.

In Choluteca, the few producers that had some grain had difficulty in keeping part as seed for the first planting, but a few producers managed to do so. Although maize, sorghum, and bean are planted together, in Choluteca Mitch seems to have had a much more severe impact on bean that on sorghum. The explanation found during fieldwork is that beans are more susceptible to disease, and even when it was possible to harvest some plots, the bean quality was not good enough for use as seed.

Vulnerability – food security. In situations of high tension such as Hurricane Mitch, biotic and abiotic factors caused the production systems of the small-scale producers of Honduras to be the most vulnerable. The traditional germplasm showed high susceptibility toward pests and

diseases, and they yielded much less because soil nutrients were washed away. These factors were becoming more marked even before Mitch. Further, the pressure of poverty and population meant that big areas were very sensitive to any disaster.

Preventive strategies

Copying strategies can in some cases be a way of increasing poverty (see a discussion on this point in the case of Africa in Buchanan-Smith and Maxwell (1994, p 4)[10]. However, a well-developed system based on social and organizational relationships and with access to a wide range of strategies seems to maintain a high elasticity after panic situations.

- Relative crop diversification, reflected as a preventive measure for the Honduran producers, is the planting of two important crops in the two planting seasons.

- Variety diversification presented as varietal mixtures to reduce the risk of crop losses caused by biotic and abiotic factors in catastrophe situations, in contrast with Honduras, where producers have tried to keep their varieties pure.

Models and strategies

It can be said that in Honduras, few models of the strategies encountered after Mitch were directly erosive, but some producers had to stop cultivating for 1 year and were forced into deeper poverty. The main models after the crop failures are seasonal migration and finding work outside the property. Some deploy such strategies every year, adapting them and partly abandoning their working of the land. Some models are:

- Use of bad-quality seed,
- Changes in planting patterns,
- Dietary adjustments (reducing the number of meals, eating fewer beans and more plantain, combined with saving more in storage),
- Livestock sales,
- Food obtained through social relationships, and
- Food for work (the WFP has many activities in the region).

In Choluteca, where maize and sorghum are the basic sources of carbohydrates, the first planting season after Mitch was with these crops, while the bean production was low. This involuntary model altered the availability of bean seed, but it may also have been voluntary in that bean seed was needed because bean is considered a "luxury" crop much more than maize and sorghum.

Observations

A natural disaster will affect the seed systems and food security differently than will a war or social conflict. An important difference between a hurricane and a situation of tension, such as social conflict, is the dimension of time. According to the Buchanan-Smith and Maxwell (1994,

[10] Buchanan-Smith M, Maxwell S. 1994. Linking relief and development: An introduction and overview. Institute for Development Studies (IDS) Bulletin 25:2-16.

p 9) categorization, Hurricane Mitch was an emergency situation, and after such emergencies restoration should be begun immediately.

As regards vulnerability, in an emergency of this nature, damage is caused mainly in natural capital, that is, in the productive resources (e.g., soil, genetic resources) while social and human capital are not much affected. In these cases, it is improbable that the socio-cultural traditions of the seed systems, such as exchange and selection, will cease to function. A natural emergency can also affect the socio-cultural dimension, but in an indirect way. For example, having lost their productive resources, people may stop cultivating, or cultivate with inadequate resources. But, if material help is given before social and cultural capital is eroded, such help can be sufficient protection.

In emergency situations, the time that a disaster lasts can be crucial to the magnitude of crop losses. In Choluteca, where the hurricane hit late in the production period, we might expect that people would have used up most of their stores. Thus it was difficult for them to cover at the same time both their food and the saving of seed from the crop to use the following season. In Yorito, the hurricane hit before the harvesting of the coffee crop, so the possibilities for employment outside of the property were big, creating an alternative source of work for producers that had had failure in their crops.

In Choluteca, the seed distribution that took place in June arrived too late to help producers in the first planting. The loss of crops caused by Mitch put many producers in a difficult situation, to such a point that some that could not obtain seed in other ways could not cultivate bean in the first planting of 1999. This leads instinctively to the conclusion that informal security systems cannot cover crop losses. However, a common answer was to cultivate more maize and sorghum, an effective and non-erosive strategy. From this one could conclude that interventions should be made based only on the observation of the changes in models.

Seed price in Honduras seems to have continued stable after the hurricane, probably partly because of the entry of seed donations. Although most producers had been able to harvest a little, it is debatable whether they could have access to their own seed, because from the short-term point of view of food security it was not crucial to provide seed, so much as food. However, many interventions of seed systems seem to have benefited the rural population of Honduras. The short-term protection of food security was facilitated through having available seed ready for producers, and the introduction of genetic material may have contributed to the long-term promotion of food security.

The objective of seed distribution in emergencies is generally to protect producers with this source in a short time. However, the motivation behind many interventions of seed distribution in Honduras after Mitch was often related more to the promotion of long-term food security than to the protection of the status quo. For example, the Red Cross distributed bean seed to families that did not have the tradition of cultivating bean, to promote a more diverse production in the diet. One variety that was introduced has a high tolerance of drought and heat and consequently could have been introduced in Choluteca where climate has limited the cultivation of bean.

The international center, CIAT, saw help as a possibility for producers to have access to the seed of improved varieties with potentially higher yields, promoting a right to the highest level of food. Conventional seed systems have, can, and should contribute a lot to reduce these tensions allowing these appropriate materials to be made available. But the objective of the promotion made by the project in Central America was something totally different from SOH in Rwanda, and the CGIAR may need to think through what they want this concept to mean for donors, the public, etc.

Seed interventions where new varieties and crops are introduced imply that the seed systems can change as much as they can. In this way, the introduction of new seeds as a promotion gives origin to the right that goes beyond the consequences of other events related with production. The culture of exchanging seed in times of production failure and the combined knowledge about how varieties and crops can be eroded is important when considering the processes of planning interventions. Therefore, vulnerability just like capacities should be identified and any effort should be directed to where needs are most urgent.

With seed interventions it is highly dangerous to create dependence on organizations, replacing the existent local social relationships, and reducing the sustainability of the production systems. A case in Nicaragua showed that an agency financed by the United States Agency for International Development (USAID) with the objective of promoting the use of certified seed emphasized the use of maize hybrids. These were strongly promoted, which could have harmed both the trust and the production systems of the small-scale producers.

Evaluating the sustainability of the organizations' activities in the study areas in Honduras is very difficult because some are locally established and could strengthen the seed systems. Others were external and had a short commitment and made the distribution with poor local knowledge, and damage occurred to the seed source counted on by producers.

Different projects working in Yorito are facilitating the transformation of the seed production systems in the direction of the informal to formal systems of seed selection (see Richards and Ruivenkamp 1997, p 39). The traditional systems are based on high diversity, native varieties, and local changes, while the formal system can provide a more uniform production with improved varieties whose accessibility can be guaranteed through local productions, and whose quality can be guaranteed by methods of seed production. A combination can guarantee the innovative changes of the producers who try to adapt to a situation of high levels of biotic and abiotic factors.

Lessons learned from Hurricane Mitch - How to execute interventions

Which varieties? Sperling (1997, p 28)[11] suggests that if germplasm is introduced it should, as far as possible, resemble that which producers were using before the emergency situation, but, she adds, this is an assumption in which the agroecological context should be stable and viable. In Honduras, before Mitch, the extensive levels of pressure from pathogens and soil nutrient leaching meant beforehand that the traditional germplasm would be vulnerable.

[11] Sperling L, ed. 1997. War and crop diversity. Overseas Development Institute (ODI), Agricultural Research and Extension Network Paper no. 75. ODI, UK.

Only a few improved varieties were used in the seed distribution after Mitch and these had a wide adaptation, which allowed them to generally adapt well in an atmosphere of pressure. However, it is still doubtful if there should have been more sensitivity toward the local differences in the different production systems. In high areas, the introduced varieties were vulnerable to the strongest environmental conditions; in these areas, the distribution of local varieties could be a more appropriate intervention.

A quick crop in the first production season following the disaster can shorten the duration of any severe food shortage after a crop failure. In Honduras, the bean varieties extensively used in the distribution of the seed arrived late.

Which seed sources? The experiences in Honduras and in Rwanda (Sperling 1997) show that production systems are very dynamic and this implies that information on the use of varieties should not be outdated because this would make more complex a restoration strategy focused on germplasm reintroduction.

In some cases, the local sources of seed can be quickly available after a crop failure if the producers were not to sell it to replace other needs. This was the case in certain communities in Honduras and Nicaragua after Mitch (see Richards and Ruivenkamp 1997).

However, the general experience of Honduras is that the external interventions focussing on seed distribution were not crucial. External seed sources were available, although not always ...essible; thus interventions could be focused on strengthening the capacities of the producers' ...ss to seed sources.

...ality seed. After Mitch, prices of bean and maize fell; however, this can only be applied to grains, because the price of seed rose. In Choluteca, the high difference in prices could have led people to use grain as seed; and many producers bought their seed in the market. The distribution of seed allowed some producers access to seed of better quality, although in some places the seed arrived too late.

Which producers to help? In Yorito, seed distribution did not benefit all the affected producers, and it was presented in the form of seed loans, a similar method to that of exchange of traditional seed inside the communities. A free distribution of seeds could have lateral negative effects, such as jealousies, because not all producers benefited. The high level of germplasm diffusion among the families allowed that many of them in a short time were able to access improved germplasm, and to access any variety lost involuntarily.

In the highest areas, where the improved varieties adapt poorly, most beans of the local varieties of black grain produced were only for domestic consumption. The distribution of local black seed could have created a mechanism of self-selection to distribute seed; and those that could sell some part of the production could as a consequence access seed of varieties that adapt to the market. A second form of supply took place in Choluteca, where seed was distributed in the town offices, causing a cost for the producers because they had to travel a distance to gain access.

Help should be given to producers that have experienced the highest losses in the different forms of capital, that is, to producers that have the greatest needs. The help given can vary in each case: capital losses should be reintroduced; for erosion loss that different strategies cover help should be focused on the right to protect them; and in the case of those in need, an initiative of long-term development should be undertaken.

CHAPTER III

SUPPORT FROM PARTNER CENTERS OF THE CGIAR

Answering a call to collaborate with SOH, the three International Centers of the CGIAR involved in the proposal, CIMMYT, CIP, and IPGRI, carried out activities aimed at evaluating and repairing damage both in physical structures and in biodiversity of the crops affected by Hurricane Mitch in Honduras and Nicaragua.

Next, we present a summary of the activities carried out by each of them and their recommendations for support to the producers affected by the hurricane, as well as some suggestions to keep in mind in future situations of catastrophe.

International Potato Center (CIP)

Project: Evaluation of the performance and impact of international help to alleviate, through the distribution of improved seed, the damage caused by Hurricane Mitch

This project was carried out with the support of Dr Noel Pallais (ex-leader of CIP's Seed Unit), and Daniel Reynoso and Ciro Barrera (both of CIP). The CIP proposal was to support the governments and institutions of Honduras and Nicaragua in provisioning, management, and production of high-quality seed of potato and yam. Between 1998 and 1999 CIP sent 1.5 kg of sexual potato seed (true potato seed [TPS]) to Honduras and about 2.9 kg to Nicaragua.

This seed was all distributed among farmers affected by Hurricane Mitch for the production of mini-tubers, which in turn were used as seed in the production fields: 50 ha in Honduras (1.3% of potato crop area) and 70 ha in Nicaragua (4% of potato crop area). Also, CIP transferred to Nicaragua 30 kg of TPS donated by the National Agricultural Research Institute (INIA) of Chile.

Between 1998 and 1999 CIP also sent seed (prebasic cuttings) of 13 yam varieties to Honduras and Nicaragua. Five of these were selected in a first stage and remain under evaluation, with the collaboration of NGOs and local institutions. Another eight varieties were sent to Honduras in August 2000 and are being propagated. These same varieties were sent to Nicaragua at the end of September, and will be evaluated in CIAT's Supermarket of Technology Options for Hillsides (SOL) sites in the two countries, with the purpose of identifying appropriate materials as cover, and human and animal food.

Also, in 1999 CIP sent to Honduras sexual seed of 20 yam families that were incorporated in the improvement program of the present agricultural campaign. Finally, this project has trained and motivated 56 professionals and technicians to use a technology of effective and efficient seed production in the face of disaster situations, and has rehabilitated and built five greenhouses for the production of prebasic seed potato and yam.

Perspectives

The supply of potato seed in appropriate quantity and quality before an eventual disaster as well as competitiveness in normal times will greatly depend on improving the evaluation systems of varieties and current seed production. The integration of government institutions, NGOs, and

private companies around this objective of food security will have particular characteristics in each country.

In this sense, some advances can be glimpsed in the short and medium term both in Honduras and Nicaragua.

Honduras

The equipment and reagents for in vitro propagation that have been in the Santa Cruz Experiment Station of Opatoro for over 3 years should be transferred to an institution that has a tissue culture laboratory, guarantees seedling production, and offers them at a competitive price. These institutions could be the Honduran Foundation of Agricultural Investigation (FHIA), and the National Institute of Professional Formation (INFOP), among others. The Opatoro Experiment Station lacks the minimum facilities indispensable for operating a tissue culture laboratory. If continuing there, the material runs the risk of deteriorating even further and will be useless in a short time.

Apparently, the NGOs and private companies could play a stronger part in the production chain of potato seed in Honduras. The government is very concerned about the long-term (2005) competitiveness of potato produced locally, considering the growing opening of the markets. The Research Office, DICTA, has oriented toward crops generated from wealth and, in the case of potato, the strategy is that of increasing yields with the purpose of reducing unitary costs. The diffusion of the production technology using TPS could be in the charge of NGOs that work in marginal areas.

The seed potato production area of basic and following categories could be made in an appropriate place that has not been used for the production of potato or other solanaceous plants in view of the infestation of current areas with bacterial blight (*Pseudomonas solanacearum*). The area of Yarula, adjacent to El Salvador, could become an important production area of potato seed.

Nicaragua

The production of prebasic potato seed for the National Center of Agricultural Investigation (CNIA)/INTA could improve with the contribution of the present project, but it will not be enough. There are two NGOs interested in dedicatedly supporting seed production projects, and since the area to cover is relatively small, the facilities can easily be improved and there are qualified personnel. These NGOs are the Program of Support to the Agricultural Sector of the Danish International Development Agency (PASA-DANIDA) and ARAP-CHEMONICS. Another could be PROMESA; and CIAT could be involved with the PES. Contrary to Honduras, the process of privatization of research works and technology transfer is smaller. However, they do coincide in that diffusion of the technology of traditional production and using TPS will be directed to different producers.

The selection of a potato variety with regional adaptation starting from the trial promoted by PRECODEPA could facilitate the trade of the seed-tuber at regional level and its supply in cases

of disaster. The adoption of potato production technology using TPS at subsistence level farming will depend significantly on the availability of early, homogeneous families, resistant to late blight (caused by *Phytophthora infestans*), and with less glyco-alkaloid content.

The adoption of yam in current production systems, especially in the marginal ones, and its consumption in certain urban sectors, has interesting potential in terms of food security, quality of diet, development of new products, and sustainability of the agriculture-ecosystem. Nevertheless, this process requires more research and promotion. The NGOs PASS-DANIDA and ARAP-CHEMONICS of Nicaragua have shown interest in supporting projects of yam promotion for human and animal consumption in marginal production areas. In Honduras, the diffusion of yam could be significant in the Atlantic area. Also, those youths about to finish army service, and presently trained by the Center of Training in Agricultural Development and Environmental Conservation (CEDACE), could also promote this crop in the rural area when they are reinstated to civil society.

In view of the genetic erosion of yam as a consequence of Hurricane Mitch, CIP could help reintroduce to Honduras and Nicaragua the native varieties of those countries that are maintained in the world bank of germplasm. In the same way, at the request of those interested, a lot of yam families could be sent to Nicaragua so that they serve as base for a program of long-term genetic improvement.

International Plant Genetic Resources Institute (IPGRI)

Project: "Study of farmers' perception about the losses of agrobiodiversity caused by Hurricane Mitch in Honduras and Nicaragua"

This project was carried out with the support of Dr Priscila Enríquez, Regional Coordinator of REMERFI.

The genetic diversity maintained in farmers' traditional systems is extensively threatened worldwide. It is recognized that the substitution of local by improved or exotic varieties is the main cause of genetic erosion. It has also been reported that natural disasters (e.g., the floods in Bangladesh and the hurricanes of the South Pacific) have produced genetic erosion (FAO 1998)[12]. This is possibly the case of Mesoamerica, a region of much ecological fragility where phenomena like hurricanes are able to cause important losses. First occur floods, which raze the crops, and then epidemics of fungal diseases and pests are set loose on fragile crops.

The present study was quite thorough in the areas of interest affected by Mitch in Honduras and Nicaragua because it was possible to interview a high number of farmers to detect if these considered that varieties had been lost, whether "landraces" or improved, or of specific crops. It offers interesting results regarding farmer perceptions about crop changes following Hurricane Mitch in both countries. Some problems of seed availability of the local planted varieties, especially in Nicaragua, seem to indicate a substitution of varieties occurred after the hurricane.

[12] FAO (Food and Agriculture Organization). 1998. The state of the world's plant genetic resources for food and agriculture. FAO, Rome. 510 p.

The study was carried out using participatory methods with perception surveys of farmers in several departments of Honduras (Choluteca, El Paraíso, and Francisco Morazán) and in Nicaragua (Matagalpa, Estelí, and Madríz).

In Honduras, 436 surveys were carried out and in Nicaragua, 380. Of those interviewed, 89% were men and 11% women. In Nicaragua, most of those interviewed had a range of ages from 31 to 50; while in Honduras, except for Francisco Morazán Department, most of those interviewed were over 50 years of age.

The average size of properties in Honduras varied from 2.5 to 4.1 hectares; and in Nicaragua from 5.2 to 7.0 hectares. Most of those interviewed were owners of their plots, although in Nicaragua it was found that in the Municipalities of Sébaco and New Town a high percentage reported land ownership as "handed down."

In Honduras the topography of the municipalities where the study was carried out (Valle de Sébaco and San Ramón) was largely flat. Conversely in Nicaragua, in San Dionisio and San Ramón, the topography had a combination of plains and hillsides.

An inventory of the traditional crops was made in the area where 80 crops are reported. In Nicaragua, the system of maize, bean, and sorghum predominates in all the areas interviewed except for the Municipality of Sébaco that, being a highly productive valley with irrigation, is dedicated to the production of vegetables.

Results

Despite the severe losses suffered, especially in Honduras, farmers planted in the agricultural cycle 1999-2000. The crops planted are the same as those traditionally planted in the respective areas, showing farmer preference for well-known materials, scarce though they were. Most of the seed used came from their own reserves or from exchange with other farmers. In Nicaragua, Municipality of La Sabana, the presence of NGOs that also facilitated access to seeds is particularly noticeable.

Comparison of data reported before and after Mitch in Nicaragua shows a decrease in the plantings of the three basic grains; that of most diffusion for maize was the improved variety NB6. It could be seen that the farmers had difficulties finding local material kept from before the disaster. For example, in Nicaragua, a decrease is noticed in the number of farmers that sowed the *chile claro*, *guaniseño*, and *mono* varieties of bean; and in at least 10 cases the variety *chile claro* was reported locally as exhausted because of Mitch for its susceptibility to disease.

Similar results were obtained with the variety *millon* of sorghum, which was reported in lesser degree in relation to the situation before the hurricane. Several farmers reported the loss of materials that only they possessed in the area, as in the case of an introduced bean variety from Brazil. The level of genetic erosion of these materials could only be elucidated with more advanced studies in the areas.

The study also made known that among those interviewed, the women are interested in recovering the diversity of crops traditionally maintained on the properties as "backyard" or kitchen garden crops, in which the planting of medicinal plants and grafted fruit trees, introduced and local, is evidenced.

The introduction of new varieties of cassava, coffee, banana, and some vegetables such as the "chayote" (*Sechium edule*), "pipián" (*Cucurbita* sp.), and tomato was reported, also some fruit-bearing varieties such as the "maracuyá", and some forest ones.

Perspectives

As is common in local systems, the farmers reuse their seed and have an exchange system that allows them to obtain the seed wanted. Thus it is important to reinforce the local seed production systems that favor the in situ maintenance of traditional varieties. This was palpable during the interviews carried out, because many farmers requested more support with programs of distribution of local materials of their preference and with training in their management.

Similarly, they requested more support with training and access to seeds of good quality and of the varieties that they prefer in the areas, for which reason they recommended the realization of programs in both countries for such an effect.

It was also obvious that this study provides the base on which a study of genetic erosion in the areas affected by the hurricane Mitch could be carried out in both countries. This study should as complete as possible for the three basic crops (maize, bean, and sorghum) but should also extend to other crops of local importance, such as local vegetables in the Municipality of Sébaco, and other underemployed crops such as the "quequishque" and the "malanga."

To go to greater depth it would be necessary to make collections of materials and their respective documentation. It was recommended to study variability using morphological technologies, isoenzyme analysis, and molecular techniques, including materials from the banks of local germplasm.

It is also suggested that farmer knowledge should be explored in ethnobotanic studies that contemplate a gender focus, because women can give more information about the variability of the crops maintained on the property and their uses.

Also evident was the urgency to reinforce the capacity of the countries to conserve their local materials in situ and ex situ, because in emergencies like the one faced during Mitch, the programs of seed distribution should be able to provide farmers with traditional materials of the area. This would avoid in the long term the extensive introduction of other materials that may displace the farmers' traditional crops and be the cause of loss of valuable genes and their combinations.

Finally, as already recommended in several forums (The Crucible II Group, 2000), we need to facilitate the integrated participation of innovative farmers and their communities and the

scientific community to conserve germplasm and for varietal improvement. This is a key factor in any process that involves the conservation and rational use of phytogenetic resources.

International Maize and Wheat Improvement Center (CIMMYT)

Project: ***"Evaluation of the performance and impact of international aid to alleviate the damage caused by Hurricane Mitch through the distribution of improved seed"***

Introduction

The main objective of this work was framed in analyzing the performance and impact of the international aid "Seeds of Hope" at property level with the purpose of extracting policy measures that allow us to improve the performance of future programs of the same type.

The work had two specific objectives, which were to:

1. Analyze and evaluate farmer perceptions on the performance of the international aid programs on improved seed, and
2. Analyze the change at property level related with the international aid in seed, particularly on five indicators:
    i. Cultivated area,
    ii. Seed use and management,
    iii. Levels of productivity and total production,
    iv. Patterns and consumption habits, and
    v. Methodology and sources of data.

Work Hypothesis

The postulated hypotheses are closely related with the specific objectives proposed above. In particular it was proposed:

- ***Hypothesis 1.*** The final users (small-scale farmers) perceive the aid in seed as useful and effective.
- ***Hypothesis 2.*** As a consequence of aid program, the use and management of maize and bean seed is, at least, the same as that which existed before the hurricane.
- ***Hypothesis 3.*** The restoration of the seed inventories at farmer level allowed the quick recovery of the planted surface, productivity, and production at the levels previous to the disaster.
- ***Hypothesis 4.*** As a consequence of the aid program, the patterns of consumption of the affected families have recovered to the levels existent before the disaster.

To prove the established hypotheses information was collected in each selected work area on two groups of farmers: those that received aid, and those that did not participate in the aid program.

In turn, the information on the variables of interest was gathered over two periods: before Hurricane Mitch, and after the hurricane (present).

Sources of Data and Geographical Localization

Three stages were followed to gather the necessary information. First, the Departments of Choluteca in the south and Olancho in the center-west of Honduras were selected as bases for the study. They were selected because both had been subject to seed aid and, at the same time, they presented a structure of differentiated maize production, which allowed an evaluation under contrasting conditions. In the second stage, interviews were carried out with representatives of the International Agencies involved in the aid program and with representatives of the civil society affected by the hurricane. Finally, the third stage executed a formal survey.

The information gathered through the interviews carried out with representatives of the agencies allowed us to obtain a listing of the communities that received aid mainly through the different agencies that participated in seed distribution, mainly the Red Cross (in Choluteca) and the Catholic Church (in Olancho). Also it allowed us to obtain general information on the way in which seed distribution was carried out and some general impressions about its effectiveness.

The general information gathered in the interviews served as a base for designing a formal survey for putting together detailed information on:

- The general characteristics of the properties,
- Past and present land use,
- Damage caused and type of aid received because of Hurricane Mitch,
- Characteristic of the aid in maize and bean seed, and
- Rural evaluation of the aid.

For the formal survey we first selected, from the lists given by the institutions, those municipalities that had received aid. Then, in each of the selected municipalities, we randomly selected the communities, and within these, the farmers that were interviewed. Of the 150 surveys carried out, 45% (68) were executed in Choluteca and 55% (82) in Olancho, reflecting the difference in size of both regions. (According to the National Census of 1993, the total plots of maize in both departments amount to 44,271, of which 45% is in Choluteca and 55% in Olancho). In Choluteca, 11 communities were covered, located in four municipalities; while in Olancho 18 communities were covered in eight municipalities.

The two departments selected for the study are contrasting in many aspects, but, at the same time, they represent the dual structure that exists in the production of basic grains in Central America. In Olancho Department, a modern commercial agriculture prevails with most farmers inserted in the market, which is reflected in that almost all farmers either use improved materials of maize, hybrid materials, or free pollination varieties (FPV). In Choluteca, the size of the exploitations is less with an agriculture that is more subsistence with most of the farmers in a pre-commercial stage producing mainly for internal consumption.

Important differences also exist regarding the environment in which production takes place and in some structural aspects and the resources available. Perhaps one of the most important

characteristics in Choluteca is the poor distribution of rain that causes the department to be characterized as having a long period of drought from the start of December to the end of March. In that period, 26.7 mm of rain falls with a monthly average of 6.7 mm. Conversely, in the northeastern region of the country, where Olancho Department is situated, the rains are better distributed. In that same period of the year, precipitation totals 86.5 mm for a monthly average of 21.6 mm (data from rain stations in each region over 10 years).

Another structural factor that differentiates both regions is the distance to the source of provision of inputs. This characteristic is an important factor in determining transaction costs associated with the acquisition of inputs, including information and seed. On the average, farmers of Choluteca must cover a distance significantly greater by almost 7 km to the distance covered by those of Olancho to buy the necessary inputs for production.

With regard to property size of the sample, size average for the two areas was not significantly different, however, Choluteca shows a wider dispersion with a greater concentration in the strata smaller than 2.1 ha and a greater proportion of properties with areas greater than 10.6 ha.

Another important factor concerning maize consumption requirements is the number of people on the property. Both departments showed significant differences regarding this factor; Choluteca showed a bigger average and type than Olancho. The distribution also showed that cases of properties with nine or more people living there are much more frequent in Choluteca.

Given the disparity in structure, and in the form in which the hurricane affected both departments, the analysis of the effects of the seed aid was carried out in separate form, considering both departments as two separate populations.

Hurricane Mitch and the Damage Reported by Farmers

The crop cycles during 1998–2000, the time of Hurricane Mitch, and the time when farmers in Olancho and Choluteca received most of the maize and bean seed aid, were analyzed. It could be seen that in Choluteca the aid concentrated on the first planting of both maize and bean, while in Olancho it centered on the first maize planting and the second bean planting of 1999.

The type and gravity of damage reported by the farmers interviewed, reflects the difference in the impact of the hurricane in both departments. In Olancho the biggest losses were reported in damage to the maize and bean crops: 76% of the farmers reported having had some damage in the maize crop, a percentage that increased to 82% for bean. Although in both crops the percentage of farmers reported to have suffered damages superior to 50% was similar (45% in maize and 55% in bean) the gravity of the damage in bean is reflected in the fact that 16% of the farmers reported to have had total loss.

In Choluteca, the reported damage was greater and more diverse. In the maize crop, 88% of those interviewed reported to have suffered some damage in maize, 41% reported total losses, with 69% losses of more than half the crop. In the case of bean, the reported losses were smaller in proportion (46% reported some degree of damage), however, total losses were also high (34%). As in Olancho, the damage done by floods was also important, but in Choluteca the

damage was increased by landslides (72%) that were not important in Olancho, probably because a bigger part of the population and of the crop areas are in areas with more slopes that in Olancho.

Results

Institutions involved and their method of work

Results of the interviews carried out in the areas of interest showed that the office of the Red Cross was the main distributor of maize and bean seed in the region of Choluteca. However, other organizations such as CARE International, World Vision, PDA-Choluteca, and International Plan were also involved in the effort of seed distribution although in a more localized effort because they distributed seed in the areas of influence that they managed previous to the emergency. Contrary to the case of Choluteca, the Red Cross did not distribute seed in Olancho because the requested seed was not received. In this case almost all the seed was distributed through the Roman Catholic Church organization, CARITAS. Other institutions involved in the seed distribution in Olancho were, CARE, DICTA, and the Prolancho Project through the Municipal Agricultural Project (PAM).

The information from the formal survey supplements the information from interviews. In Olancho, almost 100% of farmers that received some type of help reported that they had received seed from CARITAS, while in the case of food aid, 10% of farmers reported having received help from the Red Cross. In Choluteca, institutional participation was more complex, although in the case of seed aid, the two institutions that participated in the distribution of maize and bean seed were CARITAS (maize seed) and the Red Cross (bean seed and other inputs).

The type and the level of help reported by the farmers interviewed agree with the magnitude of damage to properties in each region. Thus, the greatest levels of aid in both departments concentrated on providing maize and bean seed and continued with food aid. In the case of Olancho, however, almost 70% of the farmers interviewed reported having received aid in the form of other inputs, such as fertilizers and pesticides.

These results show the wide coverage of seed aid in the interviewed departments. Of the farmers interviewed, 67% in Olancho and 88% in Choluteca reported having received aid in maize or bean seed. Given the magnitude and gravity of the losses reported in Choluteca compared to Olancho, it makes sense that aid levels in terms of seeds are superior in Choluteca, particularly in the case of maize.

As to the means of operation, in Choluteca, the Red Cross made a survey in February and March 1999 to evaluate what damage Hurricane Mitch had caused, particularly in terms of which varieties of maize and bean were being used and what area planted. For its part, CARE until December 1999 executed a project called "Project of Municipal Watersheds" (PCM) within which the agricultural components are framed. The project's area of influence included seven communities in different municipalities of Choluteca. As part of the aid program following the hurricane, the project distributed maize and bean seed for the first planting of 1999; while for the second planting of 1999 distribution was practically zero.

The CARE form of operation was that each farmer received all the maize and bean seed needed for the area planted, but bean seed had an upper limit of 10 kg. In addition to the seed, CARE distributed other inputs such as fertilizers (mixture of 12-24-12 and urea) and pesticides. Through the program of Committees of Community Development (CDC), CARE promoted the maintenance of seed banks to be used in the event of emergencies.

With CARE's support, the community leaders are thinking of establishing a seed bank to confront future events. Additionally, establishing some areas under irrigation to plant different varieties of maize and bean is being considered with the purpose of establishing future improvement programs. In Olancho, CARE distributed the seed through a plan of reactivation of agricultural production, and they mainly covered the municipalities of Juticalpa, Catacamas, San Fransisco de Becerra, San Francisco de la Paz, Guarizama, Mantel, Guayape, and Jano.

After the hurricane, DICTA also organized an emergency plan in the area to extend their program of maize and bean seed distribution through authorizing soft credit for the purchase of inputs. DICTA worked together with the municipalities of Silca, Juticalpa, San Francisco de Becerra, Santa María, Catacamas, San Francisco de la Paz, Mantel, Guarizama, Campamento, Orica, and Guaymaca (Department of Francisco Morazán). In these towns, the extension agents (now private) were responsible for channeling the farmers' credit applications in inputs (seed and other); DICTA then authorized the credit, and suppliers gave the seed and other inputs to the farmers. Credit was authorized for US$ 469,000. Farmers should begin to pay back the credit after 6 months. At present, June 2000, only 32% of the loans have been completely repaid.

The CARITAS organization coordinated help through the parishes and their respective influence areas. Among these were:

- Salamá (municipalities of Salamá, Silca, Guata, and Jano),
- La Unión (municipalities of La Unión, Esquipulas del Norte, El Rosario, Yocón, and Mangulile), Campamento (municipalities of Concordia, Campamento, and Guayape), and
- Juticalpa (the department capital covering its own municipality of Juticalpa and the municipalities of San Francisco de la Paz, Guarizama, and San Francisco de Becerra, among others).

Through this group was mounted a wide net of distribution of maize and bean seed and other vegetables. Although the CARITAS projects do not usually promote fertilizer use, they did so on this occasion because of the emergency and the need to guarantee a good crop. Aid was granted to the identified needier families with a list of beneficiaries obtained through the consensus of the community. The objective was to help farmers plant 0.7 ha with maize and/or bean so as to maximize the number of beneficiaries and guarantee a minimum level of production that would serve to satisfy the immediate consumption needs of the family. CARITAS is trying to promote the installation of seed banks at community level. Some farmers have begun to donate small quantities of seed (2-5 kg) of bean. In the case of maize, the fund is carried out in cash because the donated seed was mainly of hybrid materials.

Received varieties, quantities, and times

Before information about received varieties is analyzed, we need to note that in general the farmers of both areas have a low level of discrimination regarding the varieties of maize and

bean planted. Thus, in Olancho, farmers group varieties according to their commercial origin. The most common are Cristiani, which includes materials distributed by the firm Cristiani Burkhard (generally hybrids produced in Guatemala or El Salvador), and Cargill, which includes the different hybrids of that commercial signature. In Choluteca, differentiation is even less. Farmers in the area refer to maize in general as "thick maize" or simply "maize", and "maicillo" to refer to sorghum (usually local). The most common name given to maize traditionally used in the area is "maicito" although it is also called "criolla", "del país," or "indio." The only clear differentiation among these materials is for color: white *maicito* and yellow *maicito*. Improved maize (FPV or hybrid) is known as "maizon" or "mejorado." It is very uncommon for farmers to differentiate between varieties of free pollination and hybrid materials or for them to recognize the different varieties. Another problem is that the name "Planta Baja" is frequently used as a synonym for *maizón.* The fact that a farmer mentions that he is planting or has received seed of *Planta Baja* does not necessarily mean that he is using seed of that Honduran variety, but simply improved maize improved with a generic name. (According to information received from the entities that distributed seed it is highly improbable that the donated seed corresponded to this variety).

In accordance with the information collected in the interviews, the Red Cross proceeded to distribute seed and fertilizers in Choluteca during April and May 1999. Each family with less than 4.2 ha that planted maize or bean or both received 12.5 kg of maize seed, 12.5 kg of bean seed, 100 kg of 12-24-12 and 50 kg of urea.

The maize seed distributed by the Red Cross was mostly of the variety Guayape or *maizón* although HB104 marketed by EAP-Zamorano and by Hondugenet was also distributed. The main variety of bean distributed was Tío Canela. The seed was bought from EAP-Zamorano (undetermined quantity) and CIAT-SOH, from which about 258 tons were bought. CIAT also sold seed to PDA-Choluteca (about 7 tons) and to CCD (about 14 tons).

The maize and bean seed distributed by CARE in Choluteca was also bought from EAP-Zamorano. Two main bean varieties were distributed: Tío Canela and El Dorado.

In Olancho, CARE distributed the seed through a plan of reactivating agricultural production. Those farmers that had lost their crop to the hurricane, did not have the resources to buy new seed, and showed interest received about 25 kg of maize seed 12.5 kg of bean seed in June 1999 (first planting). Occasionally they might receive fertilizers and other inputs. The main distributed varieties were El Dorado in the case of bean, and Cargill hybrid materials in the case of maize.

Most of the maize varieties distributed by CARITAS in Olancho were materials of the Cristiani - Burkhard firm and in the case of bean it distributed Tío Canela and Don Silvio. The quality of the distributed seed was satisfactory. Some farmers planted in January, and others in May-June (first planting). However, the crop was poor because of drought problems that affected the area during 1999.

The survey information coincides with that of the interviewed institutions where it was found that in Olancho 75% of the distributed maize seed was of hybrid materials of the Cristiani –

Burkhard firm, while in Choluteca the improved materials of free pollination prevailed, mainly *Planta Baja*.

The overall view of bean varieties is similar, 90% of the seed distributed in Olancho belonged to the varieties El Dorado and Tío Canela, while in Choluteca, 60% of the farmers reported receiving *dorado* and *rojo* bean seed (with their variations) with the *chile* variety in second place.

The analysis of the quantities of seed received also corroborates the interview information about the institutions' ways of operating. In Olancho the delivery of 25-kg bags of maize and bean seed prevailed, while in Choluteca the most frequent size was of 12.5 kg, which matches the largest size used in the properties and plots that characterize Olancho compared to Choluteca.

Given the magnitude and nature of the damage experienced and the farmers' needs, the speed and timeliness of seed aid are an important element in analyzing the performance of aid programs (CIAT).

The distribution of aid in maize seed was more concentrated in time in Olancho; 88% of the seed was distributed during the months of May and June. In Choluteca, the aid distribution was carried out a little later, with 71% of the seed distributed during the months of June and July. The relation is inverted for bean; in Choluteca the aid distribution concentrated in June and July (64%), while in Olancho 26% was distributed for the first planting in June and 60% in September and October for the second planting of 1999.

If we compare the times of seed distribution reported by the interviewed institutions with those that farmers report, we can affirm that the systems of seed distribution implemented by the involved institutions worked effectively because stages moved smoothly between the two seasons.

Perspectives

According to the information received through the initial interviews in the Department of Choluteca, the distributed maize and bean seed was well accepted and performed well. For example, the farmers interviewed in the areas of San Luis Anach received bean seed of good quality and had good yields. In the area of Los Colorados, the farmers said they received maize (*maizon*) and bean seed, both of good quality and with good results. Farmers of distant areas such as El Cerrito and El Triunfo said that although they had not received seed aid, despite having had big losses because of the hurricane, farmers in bordering areas had done so and said bean seed was of good quality and they obtained good yields. However, this was not so with maize seed, with which germination problems occurred when the same seed was kept and planted in the second season. (It is unclear if the problem was the seed or the management because in other cases the rate of seed germination was reported as very bad, and in still others that the plant grew but not the cob).

Agricultural leaders that were interviewed in the area of San Juan Arriba and El Corpus said that maize and bean losses caused by the hurricane were as much as 90%, mainly because of excessive rain and some washing away. They received improved maize varieties (Guayape,

Planta Baja, and HB104) from CARE. Although considered good varieties, the farmers judged that they were less tolerant to pest attack than *Maicito*. Another perceived inconvenience was that the improved varieties required more fertilizer, input difficult to obtain for many of the small-scale farmers of the area. Also, the tamales and *atole* made from maize were bitterer with the new varieties. They did not notice differences in the tortillas.

For some farmers the seed delivery was too late for the first planting of 1999 and when keeping it for the second planting they had the same problem as farmers from El Cerrito because seed had poor germination.

Consulted on the desirable characteristics in maize varieties, farmers said that the most important in the area of Choluteca, is that of early maturity given the shortage and bad distribution of rains in the area. For example, *Maicito* arrives at maturity in 75 days, while the improved varieties need a further 15 days. However, the yield is smaller because in a good year *Maicito* yields about 1.3 tons per hectare.

Some farmers differentiated the behavior of the bean varieties Tío Canela and El Dorado; while the first showed good behavior and continues being used, El Dorado was not accepted by the farmers and they stopped planting it.

In summary, the international aid program in maize and bean seed, known as the Seeds of Hope, was useful in reestablishing production of both crops in the Departments of Olancho and Choluteca. Aid was shown to have been effective and adapted in terms of reaching the group at which it was directed, and it respected the farmers' characteristic circumstances. However, its efficiency could be improved if the institutions that distribute this type of aid take inventory of the areas considered susceptible or in greater danger, of their populations and their customs. In particular, an inventory should be taken of the varieties that are cultivated and of the management that farmers give to the seed, in such a way that allows a better discrimination of seed type for farmers' type. The design of seed distribution mechanisms in the communities would also be of great use to assure the appropriate supply of seed for the planting time.

Acronyms and Abbreviations Used

Acronyms

ACV	Asociación Campos Verdes, Nicaragua
ADDAC	Asociación para la Diversificación y Desarrollo Agrícola Comunal, Matagalpa, Nicaragua
ARAP-CHEMONICS	An NGO, Managua, Nicaragua
CARE	Cooperative for American Remittances Everywhere
CARITAS	an organization of the Roman Catholic Church
CCD	Comisión Cristiana de Desarrollo, Honduras
CDC	Comités de Desarrollo Comunitarios, Honduras
CEDA	Centro Experimental de Desarrollo Agrícola, Honduras
CEDACE	Centro de Adiestramiento en Desarrollo Agrícola y Conservación Ambiental, Honduras
CENADE	Centro de acción y de Apoyo al Desarrollo Rural, Nicaragua
CGIAR	Consultative Group on International Agricultural Research
CIALs	Comités de Investigación Agricola Local
CIAT	Centro Internacional de Agricultura Tropical, Colombia
CIDA	Canadian International Development Agency
CIEETS	Centro Intereclesial de Estudios Teológicos y Sociales, Nicaragua
CIMMYT	Centro Internacional de Mejoramiento de Maíz y Trigo, Mexico
CIP	Centro Internacional de la Papa, Peru
CIPRES	Centro de Investigación y Promoción para el desarrollo Rural y Social, Managua, Nicaragua
CNIA	Centro Nacional de Investigación Agropcuaria, Nicaragua
CODER	Comité de Desarrollo Regional, Honduras
COPECO	Comité Permanente de Contingencias, Honduras
CPDECAP	Centro de Proyecto de Campesinos Parceleros, Honduras
CRS	Catholic Relief Service, Honduras
DANIDA	Danish International Development Agency
DGS	Dirección General de Semillas
DICTA	Dirección de Investigación de Ciencias y Tecnología Agrícola, Honduras
EAP-Zamorano	Escuela Agrícola Panamericana, Zamorano, Honduras
EMAPRAS	Empresa de Asesoría en Producción Agropecuaria Sostenible, Honduras
EPRODAS	Empresa de Professionales en Producción Agropecuaria Sostenible, Honduras
FEPROH	Fomento Evnagélico para el Progreso de Honduras
FHIA	Fundación Hondureña de Investigación Agrícola
IDS	Institute for Development Studies, UK
INFOP	Instituto Nacional de Formación Profesional, Honduras
INIA	Instituto Nacional de Investigación Agraria, Chile
INPHRU	Instituto de Promoción Humana, Honduras
INTA	Instituto Nacional de Tecnología Agropecuaria, Nicaragua
IPCA	Investigación Participativa para Centro América
IPGRI	International Plant Genetics Research Institute, Italy

MAG	Ministerio de Agricultura, Honduras
MAGFOR	Ministerio Agropecuario y Forestal, Nicaragua
PAM	Proyecto Agrícola Municipal, Honduras
PASA	Programa de Apoyo al Sector Agrícola, Nicaragua
PCM	Proyecto de Cuencas Municipales of CARE
PDA	Proyecto de Desarrollo de Area, Yoro, Honduras
PES	Productores Empresarios de Semillas Artesanales
PMA	Programa Mundial de Alimentos, Nicaragua
PRECODEPA	Programa Cooperativo de Papa
PROLANCHO	Proyecto de Desarrollo de Olancho, Honduras
PROLESUR	Proyecto Lempira Sur, Honduras
PROMESA	Proyecto Mejoramiento de Semilla, Nicaragua
RAAN	Region Autonoma Atlantico Norte, Nicaragua
RAAS	Region Autonoma Atlantico Sur, Nicaragua
REMERFI	MesoAmerican Network for Plant Genetic Resources
SAG	Secretaría de Agricultura y Ganadería, Honduras
SENASA	Servicio Nacional de Sanidad Agropecuaria
SERTEDESO	Servicios Técnicos para el Desarrollo Sostenido, Honduras
SOH	Seeds of Hope Project
SOL	Supermercado de Opciones para Ladera (CIAT-Hillsides)
USAID	United States Agency for International Development, WA
WFP	World Food Program

Abbreviations

BGMV	bean golden mosaic virus
FPV	free pollination varieties
GIS	geographic information systems
GOs	government organizations
M&E	monitoring and evaluation
NGOs	nongovernmental organizations
PNGO	percentage of the total that each NGO represents
RH	relative humidity
TPS	true potato seed