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DIRECTED TECHNOLOGICAL CHANGE AND THE SMALL FARM SUB-SECTOR IN EL SALVADOR

(The Availability of Technical Assistance to Small-Scale Farmers)

A Report
Prepared by

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September 20, 1975

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SECTION I: INTRODUCTION

An intensive review of the technical assistance efforts of the Public Agriculture Sector was carried out over the period, July 5 - September 12, 1975. The purpose of this review was to determine if the availability of technical assistance might be a limiting factor in any program which was destined to help low income farmers.

For the purpose of this review "technical assistance" is defined as directed technological change. This covers all the activities, starting with replicated experiments and progressing through the stages of field testing, demonstration plots, and mass campaigns, which advance the adoption by farmers of improved production practices. The focus of this review is on the production technology employed by small-scale farmers who have access to less than two hectares (3 1/2 manzanas) of tillable land.

These target group farmers are primarily producers of Basic Grain crops. According to Table 1 they accounted for the following percentages of national production of the basic grains in 1971.

Corn	-	as a single crop	-	62%
Corn	-	as an associated crop	-	77%
Beans	-	as a single crop	-	55%
Beans	-	as an associated crop	-	77%
Sorghum	-	as a single crop	-	65%
Sorghum	-	as a companion crop	-	77%
Rice	-		-	34%

Basic grains in turn account for approximately 93% of the target groups income from farming operations. (Table 2)

Table 1

BASIC GRAINS PRODUCTION ON SMALL FARMS
(HECTARES)

	TILLABLE LAND/FARM				NATIONAL TOTAL
Hectares	.42	1.10	1.92	3.20	
Basic Grains	54,190	59,908	66,664	30,664	299,271
Cummulative %	18	38	60	71	100
Corn (Single crop)	21,571	20,024	24,178	11,626	106,000
Cummulative %	20	39	62	73	100
Beans (Single crop)	2,476	3,993	4,653	2,545	31,531
Cummulative %	8	20	35	43	100
Rice	592	1,332	2,899	1,729	14,328
Cummulative %	4	13	34	46	100
Sorghum (single crop)	933	1,474	1,676	985	7,412
Cummulative %	13	32	55	68	100
Associated Crops Corn/beans and Corn/sorghum	28,638	33,085	33,258	13,799	140,000
Cummulative %	21	44	68	77	100

SOURCE: Interpretation of 1970-71 Agricultural Census

Table 2

LAND USE FARMS LESS THAN 10 HECTARES, 1970/71

	SIZE OF FARMS			
	Less than 1 Ha.	1-1.99 Has.	2-4.99 Has.	5-9.99 Has.
Number of Farms	132,907	59,842	44,002	15,730
Total Land	70,568	83,084	134,163	122,590
Tillable Lands	56,183	65,638	84,625	50,332
Tillable Land/Farm	.42	1.10	1.92	3.20
Land in Basic Grains	54,190	59,908	66,664	30,684
% of Tillable Land in Basic Grains	96	91	79	61

SOURCE: 1970-71 Agricultural Census

The only directed technological change which is of any potential consequence to the target group as a whole is the development and extension of imporved production practices in the Basic Grains. Consequently we made a systematic effort to "spotlight" all of the Public Sector activities in applied research and in agricultural extension that were being carried out with the basic grains crops at the time of this review.

Our review concentrated on the Centro Nacional de Tecnología Agropecuaria CENTA, the institution which encompasses the agricultural research and agricultural extension functions of the Ministry of Agriculture (MAG).

Although the technical assistance activities of other MAG agencies and of potential private sources of technical assistance were tabulated, no field evaluation was undertaken of their activities. It became apparent at the outset of this review that the only organization in El Salvador that is structured and equipped to provide technical assistance to large numbers of small farmers is CENTA.

Interviews were held with all of the CENTA investigators and supervisors who are in charge of research or field testing programs in the basic grains. Field contact was established with the Extension Service. Eight Extension Agencies were selected as observational focal points, not only for this study but for the other two studies, The Agricultural Input Marketing System and Farmers Organizations, which were undertaken concurrently by the Básico, Inc., contract group.

- Ahuachapán
- Atiquizaya
- Candelaria de la Frontera
- Texistepeque
- Tenancingo
- Tonacatepeque
- San Martin
- Sensuntepeque

These observational focus points were selected at random from within the three zones where the special corn and bean programs were concentrated. This is a biased sample since three of six zones were purposefully omitted from the sampling universe. All eight agencies were visited and all extension agents and basic grains extension specialists were contacted. Home demonstration and 4-H club agents were not contacted. In seven out of eight visits we were able to accompany the agents on a half to full day of their "rounds". A standard schedule was employed for interviewing the agents and crop specialists.

An inventory was made of all research projects programmed in the basic grains for the current year. When the experiment was located in one of the observational zones, we tried to locate it. An inventory was made of all of the descrete units of work which could be called field test plots or demonstration plots. In the observational areas we visited 48 of such plots out of a total of 88 reported by CENTA for those areas.

Approximately 120 small farmers were contacted through the three studies conducted concurrently by the contractors' group. The most prosperous of these produce a marketable surplus. At the other extreme were campesinos whose production is at subsistance deficit level.

The principal objectives of this work were to:

1. Available Technology: Establish the parameters (Input Use/Yields) for currently recommended production practices with respect to the basic grain crops.

2. Developing Technology: Estimate the gains in productivity that can be anticipated in the immediate future (2-5 years) on the basis of current research in the basic grain crops.

3. Evaluate the acceptance of currently recommended production practices by the target group of farmers.

4. Make a prognosis of the target groups' capacity to accept and absorbe advanced agricultural production technology.

5. Identify the strengths and weaknesses in the CENTA technical assistance system as it is directed to the target group.

SECTION II: STATE OF TECHNOLOGY SMALL FARM SECTOR

A. Production Practices Employed and Yields Obtained by the Target Group in Basic Grains

Small farmers in El Salvador use their land intensively and employ relatively high rates of outside inputs, including certified hibred seed in the case of corn. Thei fields are very clean, demostrating a very intensive use of labor. Traditional systems of interplanting permit them to take two crops per year from the same field, corn/beans or corn/sorghum. Yields are high by Central American standards.

Production technology is very advanced in corn and rice production. With respect to these two crops, reports written about El Salvador should cease to employ the terms traditional practices or traditional technology. In a year when moisture conditions have not been optimal we observed many small farmers corn fields which will yield in the range of 50 to 80 quintales/manzana (see Annex A). We observed one small field under irrigation that yielded in excess of 100 quintales/manzana.

In corn production there is no lag between the technology employed by commercial farmers and that employed by small farmers. In the areas visited by the contractors; given the same quality of land resource, small farmers corn fields were observed to be in as good or better condition than commercial scale plantings. In rice production, where production is dominated by medium scale commercial farmers and where very advanced technology is employed, small farmers yields compare favorably with the commercial sector.

In bean and sorghum production relatively low levels of outside inputs are employed and yields are correspondingly low. This is due primarily to an applied research lag.

B. Receptivity to Technological Change

The target group is at a relatively advanced stage in its acceptance of modern technology in agriculture. The almost universal acceptance of advanced practices in corn production by smaller farmers who occupy class I, II and the better class III lands is the best test of this assumption. All the elements of a complete package of advanced corn production technology have been available in El Salvador for ten years; locally adopted disease resistant high yielding varieties, a positive economic response to moderately heavy applications of fertilizer, and effective systems for controlling major insect pests.

Based on their acceptance of advanced corn technology we would classify the target group as follows:

Condition	Est. % of Target Group
1. No significant use of modern inputs, a condition normally associated with occupation of marginal lands.	20
2. Employing modern inputs at the level of minimum risks.	25
3. Goals are maximum yields. Relatively high rates of use of modern inputs, a condition normally associated with access to good land.	35
4. Waiting for the research-extension system to catch up to them. Will respond immediately to any new tested technology.	15

In our field contacts, which tended to be with small farmers in categories 3 and 4 (above), we were impressed with the wide range of agricultural chemicals that they could identify by brand name and use. It should be noted here that there is a transfer of knowledge out of the commercial or export farming sector into the small farm sector. Many small farmers both till their own land in the wet-season and migrate in the dry season to work in the export crop sector. We also were impressed by the dialogues that we witnessed between these advanced small farmers and Extension Agents in which the farmer assumed the role of the "investigator" and reported that "I found this product worked better than that product" (that product being the one currently being recommended by Extension), "that mix was too expensive so I substituted this mix", "etc.".

C. Constraints: Acceptance of Advanced Technology

1. Factors which are contraints:

a. Land Class is a constraint.

No yield data is available which is segregated by land classes. However, it is clear from the contractor's observations and from talking to farmers and extensionists that there is a strong correlation between land quality and the amount of risk a farmer is willing to assume in employing non-traditional inputs. The small farmers who are not using hibred seed corn, who use very low levels of fertilizers, and who have yet to try fertilizers on beans are those who cultivate the steep slopes.

b. Land Tenure Status is a constraint.

There is obviously a higher incentive for land owners and cash renters to invest in outside inputs than there is for sharecroppers. One of the intentions of the Ley de Arrendamientos which took effect in 1973 was to remove this constraint.

c. Purchasing Power at Seeding Time is a constraint.

The following table summarizes the amount of cash which would be required to employ the full package of CENTA recommendations for corn and beans.

Table 3

COST/MANZANA, AUGUST 1973 PRICES
FINANCING CENTA RECOMMENDATIONS

CROP	TOTAL COST PER MANZANA
Corn	₡ 197.00
Beans	135.00

Source: See Table 4

d. State of Technology: For Beans and Sorghum it is a constraint.

Level of acceptance of use of outside inputs and subsequent yield expectations are much higher for corn and rice production than they are for the other two basic grains. The principal technological constraint in bean production is the isolation or introduction of varieties which are disease resistant. The principal technological constraint in sorghum production is the replacement of criollo varieties with improved open-pollinated varieties.

e. Acceptance of Second Stage Improvements could be a constraint.

The benefits of such first stage improved practices as the introduction of hibred seed corn, the new fertilizer responsive and disease resistent rice varieties, and the use of nitrogen and phosphate fertilizers have been so obvious that they have been rapidly accepted and adopted by the target group. On the other hand, the benefits of such practices as timely fertilizer application, the adjustment of plant population to soil fertility conditions, timeliness of insect and disease control programs, etc., are not as dramatically apparent. More sophisticated extension education methods than those currently employed are required to prove these second stage advanced practices to most of the target group.

2. Factors which are not constraints:

a. Farm Size is not a constraint.

Farm size is an obvious constraint to raising the income of the target group. But farm size should not be considered a constraint to effectively employing advanced technology. Where the land resource is good (Classes I, II and III) and where there was no credit constraint to obtaining certified seed and fertilizers, yields on mini-plots were observed to be potentially as high or higher as those on larger exploitations. We observed as a general rule of thumb that the smaller the plot, the more cleanly it was cultivated (manicured might be a better word).

b. Availability of Critical Inputs is not a constraint.

This topic is covered at length in a separate companion report 1/. The most important conclusion to that report was that neither the availability, quality, or the price of agricultural inputs (outside inputs) should be considered constraints to the adoption by small farmers of high yield technology.

c. Current Prices of Basic Grains is not a constraint.

Current ratios between the prices guaranteed by IRA (Instituto Regulador de Abastecimientos) for the basic grains and the cash input package are favorable. (Table 4)

1/ The Agricultural Input Marketing System in El Salvador.

Table 4

ESTIMATES OF RETURNS TO LAND AND LABOR; CORN AND BEANS

	CORN/MANZANA	BEANS/MANZANA
Estimated Total Returns CENTA Recommendations	60qqX¢18 1/ = ¢1080	15qqX¢62 2/ = ¢930
Estimated Total Returns Zero use Cash Inputs	30qqX¢18 = ¢ 540	10qqX¢62 = ¢620
Extra Returns Due to Cash Inputs 3/	¢ 510	¢290
Seed Cost 4/	¢ 22	NA
Fertilizer Cost 5/	¢ 145	¢ 75
Insecticide Cost	¢ 30	¢ 20
Total Cost Cash Inputs	¢ 197	¢135
Benefit Cost Ratio	¢510/¢197	¢290/¢135

1/ IRA guarantee price less ¢1.00

2/ IRA guarantee price less ¢2.00

3/ Less cost of harvesting increased yield.

4/ Value Hibred Seed less value non-hibred seed saved.

5/ Current BFA prices, 20-20-0 at ¢55.00/100 kilos
16-20-0 at ¢50.00/100 kilos
Ammonium Sulphate at ¢35.00/100 kilos.

One potential constraint is that there is a high probability that basic grains prices will drop while the cost of the package of inputs moves higher. If current prices for fertilizer hold our estimate is that the basic grain prices would have to drop to ¢16 for corn and ¢56 for beans before small farmers would restrict their use of outside inputs.

d. Sources of Technical Assistance Available to the Target Group

1. From the Private Sector

The major import-wholesale houses in the agricultural input marketing system employ approximately sixty agronomists who in most cases work both as salesmen and technicians. They represent the best (but biased) sources of information with respect to the use of the particular products which they represent. They provide direct technical assistance to large farmer customers, but not to small farmers. The only source of private sector technical assistance available to small farmers is at the retail farm supply stores, agro-servicios. Farmers in the target group have direct access to the storeowners who in turn are advised by the agronomist-salesmen as to the most effective use of their respective products. The local farm store is a more accessible source of information about uses of agricultural chemicals and dosage rates than is the extension service because they are open on weekends.

2. From Farmers Organizations

A companion study 1/ of farmers organizations in El Salvador indicates that this sector is not a significant source of technical assistance to the target group.

3. From the Public Sector, Direct Technical Assistance

There are a total of 317 technicians 2/ within the various dependencies of the Ministry of Agriculture (MAG) whose primary responsibility is to provide direct technical, economic, or social assistance to farm families. They are backed up by approximately 120 administrative and clerical personnel.

A total of 262 field technicians are working in programs directed towards improving the condition of low income farmers. Of these, 252 reside in CENTA and ten in Recursos Naturales which has Extensionists assigned to Irrigation Districts. Ninety technicians, home demonstration and 4-C club educators, are assigned to social development programs, leaving a balance of 172 field technicians who are available to provide direct technical assistance to the target group.

1/ Farmers Organizations Serving Low Income Farmers in El Salvador, Básico, Inc., September 20, 1975.

2/ Source MAG Plan Operativo 1975

SECTION III:

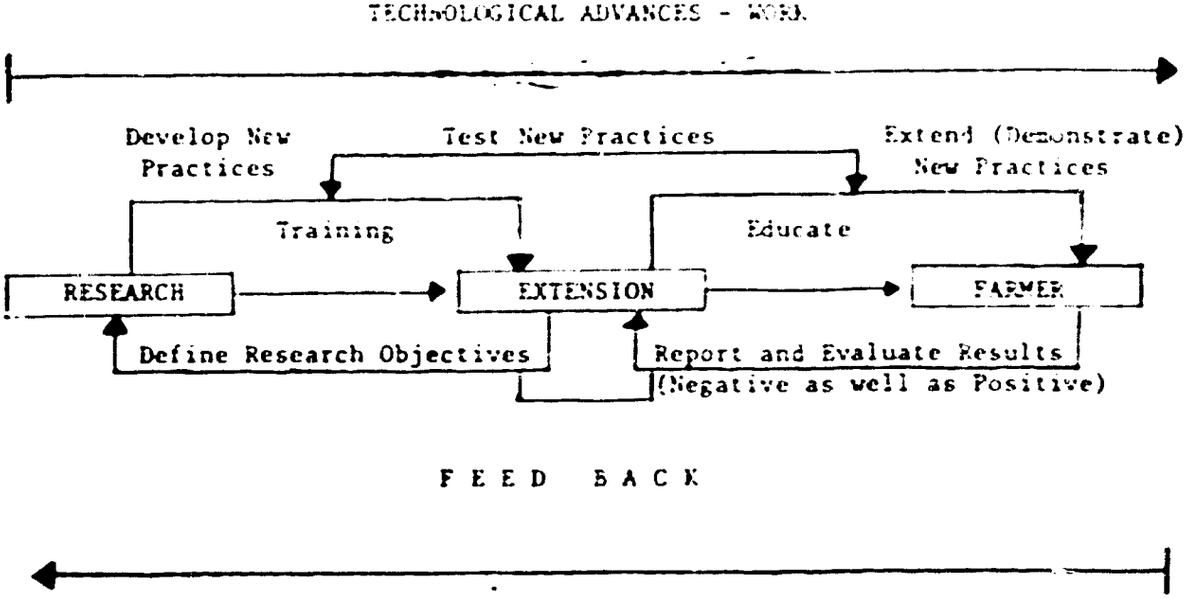
CENTA, THE BASIC GRAIN CROPS AND THE SMALL FARMER

A. Antecedents

The Centro de Tecnología Agropecuaria CENTA a first line dependency of the Ministry of Agriculture was created in 1973. CENTA was founded on the assumption that the functions of agricultural research, agricultural extension, and advanced agricultural technical training are simbiotic and should be housed under one institutional umbrella. The original model for CENTA was the Land Grant University/Cooperative Extension System of the U.S. CENTA functions with three Divisions, Agricultural Research, Agricultural Extension and the National Agricultural School. Until August of this year, a special corn production program and a special bean production program functioned as separate autonomous programs within CENTA. In August 1975, these programs and their personnel were absorbed into the Extension Division.

CENTA has succeeded in putting the functions of Research and Extension under one institutional roof with the exception that livestock activities are still administered by a separate dependency of MAG. At the time of this report, the Land Grant University model is being abandoned and ENA the National Agricultural School will become a separate dependency of MAG as it was before CENTA was established.

One of the principal reasons for creating CENTA was to establish the work flow and feed-back system that is idealized in the following diagram.



CENTA has been slow to implement this model. The principal obstacles have been vested professional interests, inflexible definitions of the role of research and the role of extension, rapid turnover of key Directors, and time.

Coincident with this review the first changes under the banner of 'integration' were being implemented. The fifty technicians who had worked in the autonomous bean and corn programs were being re-assigned and integrated into the extension service as Técnicos en Granos Básicos (Basic Grains Production Specialists). At the same time extensionists were called into headquarters for a two day short course in basic grains for which the instructors were drawn from the Research Division of CENTA and from the special corn and bean programs.

Some Extension-Agents reported that this was the first occassion that they had had any direct contact with research workers.

B. CENTA and the Small Farmer

Any directed technological change which is destined to benefit the small farmer has to emanate from CENTA. It is the only institution doing applied research in the Basic Grains Crops, and the only institution which has the capacity, through the Extension Service to extend advanced technology to large number of farmers.

The fact that GOES has established a high priority for basic grains production has turned CENTA's attention to the Basic Grains crops which in turn creates a favorable flow of public resources into those enterprises where the small producer currently enjoys a position of dominance. Approximately 50 % of CENTA's budget for research is dedicated to basic grains research or to research/in labor-intensive cropping systems.

The Extension Service has been traditionally oriented towards the small to medium sized farmer. In the last few years, because of the high national priority placed on basic grains production extension contacts have shifted toward the smaller farmer.

We estimate that 90% of the Extension Services' budget is dedicated to activities which are directed to the immediate or future well being of small farmers.

Such a "bias" in favor of the low-income agricultural sub-sector is unusual. Whether or not it is a sector directed bias 1/ could only be determined if El Salvador suddenly becomes a surplus producer of basic grains.

C. "Spot Light" on CENTA July August 1975

The most objective test of what CENTA can do for the small-scale farmer, now and in the immediate future, is the state of development of Technology in the basic grain crops and in intensive cropping systems. The conceptual model which we employed for reviewing this condition was the following: (Table 5)

1/ The question is: Is CENTA dedicating an increasing portion of its budget to activities which are potentially of direct benefit to small farmers because the small scale farming sector is being favored as a matter of policy or because of the accident that the small farmer is primarily a producer of basic grain crops?

TABLE 5

DIRECTED TECHNOLOGICAL CHANGE MODEL

	Applied and Adaptive Research		Results	Reccomendations	
1	Small-plot experiments (national station)		Hypotheses	None	1
2	Regional experiments (regional sub-station)		Positive/or Negative	Tentative	2
3	Farm experiments (local)	Area of Interaction and Collaboration Research and Extension	Positive/or Negative	Tentative	3
4	Result tests		Confirmation of Results under farm conditions	Positive Reccomendation	4
5	Result demonstrations		Confirmation of response of farmers	Revised in response to farmers reaction	5
6	Mass application		General acceptance	" " "	6
7	Advice to Farmers		Empirical adjustments	Empirical Adjustments	7

Extension Work

Source: Economic and Technological Guidelines for Volunteers Asigned to Agricultural Programs. Basico Inc. 1970 .

For the Basic Grains crops and multicultivos, an inventory was compiled of all the discrete activities which were being carried out at each stage (1-7) in the research-extension continium. (Table 6)

The inventory combined with information about the numbers of technicians employed serves as an indicator of the relative emphasis which is being placed on the development and extension of any specific crop technology.

TABLE 6

OVERALL INVENTORY-CENTA ACTIVITIES IN BASIC GRAINS AND INTENSIVE CROPPING SYSTEMS 1975

	EXPERIMENTS	FIELD TEST PLOTS	DEMONSTRATION PLOTS	DIRECT TECH. ASSISTANCE TO FARMERS
CORN	39	40	50	12,430 Manz.
BEANS	6	180	--	6,572 Manz.
SORGHUM	6	--	110	4,765 Manz.
RICE	5	--	--	2,656 Manz.
INTENSIVE CROPPING	13	56	150	---

Source: Contractor's contacts with CENTA personnel.

TABLE 7

NUMBERS OF CENTA TECHNICIANS WORKING IN GENETICS OR AGRONOMIC RESEARCH, BASIC GRAINS CROPS, 1975

RESEARCH	ING. AGRONOMOS	AGRONOMISTS	TOTAL TECHNICIANS
Corn Production	2	6	8
Bean Production	*(2)	1	2
Sorghum Production	1	2	3
Rice Production	1	2	4
TOTALS	6	11	17

*Not present: Currently receiving advanced training at CIAT.

Source: Departamento de Fitotecnica

D. Advances in Basic Grains Technology and in Intensive Cropping Systems

1. Corn Production Technology

The majority of small farmers in El Salvador accept the corn production practices recommended by CENTA. A few are using the maximum levels of fertilization recommended (150 # N and 80 # P_2O_5 /Manzana).

The use of soil insecticides is common, and treatment for the corn whorlworm, cojollero, is universal.

The white hibreds H-3 and H-5 are universally known and accepted with a tendency for the poorer farmers to plant second and third generation seed (degenerated seed) instead of F-1 generation which must be purchased.

CENTA's recommendations for corn production have not changed much in eight years. Refinements in fertilizer ratio recommendations have probably not been made because Salvadorian soils are relatively uniform in testing low in phosphorus and high in Potassium. No micronutrient deficiencies have been identified. Yields that can be expected are the following:

TABLE 8

RANGE IN CORN YIELDS, EMPLOYING PRACTICES CURRENTLY RECOMMENDED BY CENTA. QUINTALES/MANZANA

	DRY YEAR	GOOD YEAR
CLASS I LAND (Irrigated)	70-100	70-100
CLASS II LAND	40-50	60-90
CLASS III LAND	20-40	50-60
CLASS IV LAND	(Not using advanced practices)	

Sources: Authors, Extensionists, farmers and Researcher's observations and CENTA Data Sources. (See Annex A)

As we stated earlier farmer acceptance of these recommendations is not a limiting factor in reaching high yield levels. Land class and financing are the limiting factors, given the present state of technology.

For the very best small farmers, lack of technological advances is the limiting factor preventing them from securing higher yields. The H-3 and H-5 varieties are subject to lodging which limits the possibility of increasing corn yields in response to increasing nitrogen applications. Plant population is also a limiting factor at the higher rates of overall fertilization recommended by CENTA. For the Poorest farmers purchase of expensive hibred seed is a limiting factor as is purchase of fertilizer.

CENTA research in corn varietal development promises to remove the present varietal constraints. A synthetic variety H-1B has been developed which has yielded as high or higher than H-3 and H-5 and is highly resistant to lodging. The Extension Service, which jumped the gun on the Research Division on the release of H-1B, has set out a large number of small demonstration plots of this new variety. The contractor observed plots of H-1B in areas buffeted by high winds in August which were standing upright while adjacent, plots of H-3 suffered 60-80% lodging. H-1B not only has strong resistance to lodging but since it is a synthetic (open-polinated) variety farmers can hold back their own seed from one year to the other. The use of this variety by farmers who are now using degenerated H-3 or H-5 should result in substantial overall increases in corn yields secured by the poorest farmers.

CENTA also is working on the transfer of the brachitic (dwarf) growth habit to the H-3 and H-5 hibred varieties which would eliminate the tendency for H-3 and H-5 to lodge. The goals of the Corn Breeding and varietal development program are ambitions; to release for testing two new hibred varieties and one new synthetic variety per year. The corn breeding program receives strong support from CIMMYT (Centro Internacional de Mejoramiento de Maíz y Trigo) in Mexico.

The agronomic work in corn is not very impressive. There is evidence from the trial and error efforts of individual farmers and from the trials conducted with corn as a companion crop in the multicultivos program that low plant populations are a barrier to increasing yields at high levels of fertility. Agronomic research in corn has not been systematically addressed to date to this opportunity to increase yields.

2. Bean Production Technology

There has been no technological breakthru in bean production comparable to that which has occurred in corn production. Over the period 1963-1974 national average yields have held in the range of 10 to 13 quintales per manzana. Increase in bean production have been achieved by increasing acreage.

Table 9 - BEANS PRODUCTION, AVERAGE AND YIELDS 1963-1974

Año Agrícola	Mz	QQ	QQ / Mz
1963/64	39 690	314 400	7.9
1964/65	30 541	269 082	8.8
1965/66	33 600	359 700	10.7
1966/67	37 761	336 120	8.9
1967/68	40 595	380 120	9.4
1968/69	45 270	462 400	10.2
1969/70	46 965	571 460	12.2
1970/71	51 600	649 500	12.6
1971/72	57 000	750 000	13.2
1972/73	56 850	595 700	10.5
1973/74	64 440	814 700	12.6

Source: Anuario de Estadísticas Agropecuarios MAG 1973/74.

3. Grain Sorghum Technology

Grain sorghum is traditionally grown as a late season catch crop and is interplanted in corn. It is a triple purpose crop. The dry forage is used to maintain cattle. The grain is used for human consumption if corn is in short supply and for animal feed if corn is abundant. It is buffer crop which serves as drouth insurance. Over the reference period 1963-1974 yields have been low and show no significant increase trend.

TABLE 10

SORGHUM PRODUCTION, AVERAGE YIELDS, 1963-74

Año Agrícola	Mz	QQ	QQ / Mz
1963/64 1/	143 453	2 117 024	14.8
1964/65	124 455	1 907 450	15.3
1965/66	158 700	2 295 900	14.5
1966/67	153 719	2 493 049	16.2
1967/68	148 400	2 350 000	15.8
1968/69	162 500	2 700 200	16.6
1969/70	162 575	2 784 100	17.1
1970/71	177 400	3 199 700	18.0
1971/72	180 000	3 400 000	18.9
1972/73	186 400	3 170 000	17.0
1973/74	170 000	3 400 000	20.0

Source: Anuario de Estadisticas Agropecuarias 1973-74 MAG

No significant advances have been made to date in sorghum technology because:

__ Research until recently was concentrated on sorghum as a primary crop (May seeding) and it is a secondary crop (interseeded in corn in July).

__ Sorghum research until recently did not receive a high priority.

__ The only high performance varieties available until the release of CENTA, this year were imported hibreds.

__ Criollo varieties are not fertilizer responsive.

__ Sorghum tends to be grown on the more marginal lands.

Increasing sorghum yields represents a significant opportunity to raise incomes in the target group. If average yields were only increased by 5 quintales/manzana (20%), the gross annual income of the target group could be increased by as much as ¢13,500,000. 1/

Two new open-pollinated varieties of grain sorghum have been developed which are promising, CENTA - 1 and CENTA - 2. The extension service has approximately 150 CENTA - 1 demonstration plots out. It is too early in the season to evaluate results.

4. Rice Production Technology

Small farmers (to 4.99 hectares) account for approximately 50% of rice production 2/ their yields 2/ of 55 qq of rough rice per Manzana compare favorably with the average yields secured by larger farmers of 61 qq per manzana. The big breakthru in rice growing technology occurred in the early sixties with the introduction by a few large scale commercial growers of the fertilizer responsive Nilo varieties.

The emphasis of current research by CENTA is on the introduction and testing of fungus resistant (Pelicularia) type varieties from CIAT (Centro de Investigación Tropical) in Cali, Colombia. CIAT provides CENTA's rice variety program with continuous assessment and advanced training courses.

Agronomic work with rice is limited and not impressive.

1/ 180,000 Manz. (71-74 av.) x 5qq x ¢15.00/qq

2/ Anuario de Estadisticas Agropecuarias 1973-1974, MAG, Cuadro #21.

5. The Development of Intensive Cropping Systems (Multicultivos)

The most aggressive research effort currently being conducted by CENTA is called Multicultivos. This program started out as the development of systems of intensive use of irrigated land through a combination of companion and staggered cropping systems. The principal advantage of the system that can be supported with hard data to date is the tremendous increase in income potential from the high-income horticultural crops that are supported on corn stalk trellises. The system employs and innovative double corn row, the residue of which (standing corn stalks) serves as a cheap substitute for an expensive wooden stake and wire trellis system. The most dramatic results have been recorded with yields and gross sales per land unit of trellised cucumbers. However, given the limited market for cucumbers this is not a technological breakthrough that will benefit a significant number of the target group.

The potential impact of multicultivos research in the context of this review (increasing the incomes of a significant number of the rural poor) does not lie in the original research concept (intensive production of horticultural crops interplanted and companion-cropped with basic grains crops on irrigated lands). The opportunity as redefined this year by the Florida State advisors to the project is to develop more 1/ intensive cropping systems for basic grains production on non-irrigated lands. There is a theoretical potential to secure as many as four crops instead of the normal two within the May-October growing season.

In the context of this review, the multicultivos program is a good example of implementing a policy (in this case; increasing the income potential of small-scale farmers) by the choice of research objectives. With its emphasis on labor intensive cultural practices, any technological advances which are derived from this research program will redound to the comparative advantage of the target group.

The multicultivos program is the only work currently being undertaken by CENTA in which there is a programed linkage between the Department of Research and the Extension Service. Fifty-six test plots and approximately one hundred fifty demonstration plots have been established this year by the Extension Service. There is no difference in design between the test plots and the demonstration plots. The fifty-six test plots are those designated by Research as data sources.

Due to the high degree of interest that has been developed in the program, we made a special effort to visit as many as possible of the plots which fell within our eight Agency sampling area. Of thirty reported plots we were able to visit eighteen from which we made the following observations:

1/ We use more because present corn/bean and corn/sorghum double cropping systems are relatively intensive. What is new about the companion cropping sequences being tested under the multicultivos program is a higher rationalization and intensification of these systems.

Two of the plots visited were irrigated; one was part of a new irrigation project near Atiquizaya and results were meeting or surpassing the predictions. Yields of phase I corn and beans were 70qq and 12qq respectively. Returns from the Phase II cucumber plot were very high. The farmer-cooperator here was obviously an innovator and perhaps even ahead of Extension recommendations. In an adjoining small corn plot which was not part of the multicultivos trial, he had exceeded 100qq/Manzana. The other irrigated plot, located on a small traditional irrigation system, had been badly neglected and was a near failure. Weeds were threatening to choke out the tomatoes and the cucumbers. On the five non-irrigated plots supervised by the Atiquizaya agency, first phase bean yields were disappointing; 30#, 60#, 22#, 85#, and 22# per 800m^2 to 900m^2 plot, the equivalent of from 2-7qq/manzana. Also the corn double rows had suffered from severe lodging.

In Tenancingo, the agent had badly misunderstood the multicultivo plot design (he had been in this agency for only three months and the only multicultivo plot out had been established by his predecessor). He had become convinced that the double corn rows were a mistake and had moved phase II of the trial (27R beans and S1 sorghum) to an adjoining area where there were single corn rows. Apparently this plot had not been visited either by the zonal extension supervisors nor by the supervisors for the Multicultivo program.

One farm was visited on which the 900m^2 multicultivo plot accounted for almost all of the tillable area on the farm. The May bean harvest had been low (sixty pounds, equivalent to 4.6qq/mz) and the farmer was unconvinced of the value of 27R beans. However, it was the first year that he had planted hibred seed corn and the estimated yield of 90qq/mz was double the highest yields he had previously harvested. The same farmer reported that in previous years he had harvested only one crop, corn, on his land. He was planting cucumbers, tomatoes and both Rojo 70 and local beans (the latter probably because of the poor performance of the recommended 27R beans planted in May). He was generally impressed with the results. In the same area, the agent had another plot with a group of schoolboys as a means of promoting multicropping and basic grains production in the area. The group of boys had cleared the rather heavy brush on a loaned piece of steep land and had given quite reasonable care to the plot. One boy reported that his father had planted at home on the same pattern. The other two multicultivo plots were located back to back on the same farm. The agent's explanation for this was to compare the results of 27R beans on the one plot with criollo and the other. Neither of the bean plantings had done very well. The corn was late, had suffered considerable wind damage, but otherwise looked very good. There were three other multicultivo plots in this area for which the cooperators had provided all the inputs. One of these was a second plot with the school group - the other two were the work of a farmer's cooperative.

In another agency it appeared that very close and understanding supervision of the multicultivo plots had been exercised. This agency (Texistepeque) had a small amount of land available adjoining their office and had put out a multicultivo plot which included CENTA MIB synthetic corn. In Texistepeque, on most of the farms where there were multicultivo plots or other CENTA-related plots, one was also likely to see terraces, contour strips, or other conservation practices incorporated into the experimental work. Further, almost all the farmers appeared to have agreed that the sorghum, bean, or maize (MIB) harvested would not be consumed, but sold or exchanged to other neighbors for seed.

Records of work, expenses, and income on these plots at several agencies would indicate that the calendar of activities and basic materials provided by CENTA to the extension personnel and through them to the farmers are reasonably good. There were some confused situations, but generally the objectives and experimental design seemed better understood by extension personnel than was the case with the CIMMYT corn plots.

E. The Extension Service (Dirección de Extensión)

1. Organization and Operations

The Extension Service (Dirección de Extensión) enjoys a parallel status with Agricultural Research and the National Agriculture School as a primary operational unit of CENTA. It maintains 71 local offices which are well distributed throughout the country. As of September 1975 the Extension Service employed 349 people.

Table 11

PERSONNEL EMPLOYED BY THE EXTENSION DIVISION CENTA

CLASS OF EMPLOYEE	"OLD" 1/ EXTENSION SERVICE MAY 1975	SPECIAL CORN & BEANS PROGRAMS	"NEW" 2/ EXTENSION SERVICE SEPTEMBER 1975
Executive Administrators	3	2	5
Clerical Nat. Office	5	2	7
Program Supervisors	15	4	19
Technical Specialists	6	4	10
Extensionists	102	41	143
Home Demonstration Educators	70	-	70
4-C Club Educators	10	-	10
Ext. Agency Secretaries	53	-	53
Ext. Agency Handymen	32	-	32
TOTALS	296	53	349

SOURCES: Extension Service Roster July 1975.
Corn and Bean Programs Rosters July 1975.

1/ Before corn and beans programs were integrated into Extension Service.

2/ After corn and beans programs were integrated into Extension Service.

a. Programatic Assignment of Extension Personnel.

For budgeting and programming purposes the Extension Service divides its activities into Technical Assistance and Rural Development. (Asistencia Técnica y Desarrollo Rural). According to these categories Extensica Service Personnel are divided as follows.

Table 12

FUNCTIONAL DISPOSITION OF EXTENSION SERVICE PERSONNEL

1/	Administrative	97
	Desarrollo Rural	90
	Asistencia Técnica	162
	TOTALS	349

1/ 5 Executive administrators and 7 national office secretaries plus 85 office personnel assigned to the local Extension offices.

b. Personnel Available to Provide Technical Assistance to the Target Group.

The Desarrollo Rural category in Table 12 above includes the home demostration agents, 4-C Club (Rural Youth Club) educators and their supervisors. Since the focus of this review is on the capacity of CENTA to provide technical assistance to the target group, their work was not reviewed.

One hundred sixty two (162) agronomists are assigned to technical assistance activities. Of these 143 are in direct contact with the farm population, 10 provide them with technical backstopping, and 9 are regional or program supervisors. Of the 143 agronomists who are the direct purveyors of technical assistance, 102 are called Extension Agents or Assistant Extension Agents and 41 are called Basic Grains Technicians (Técnicos en Granos Básicos). The latter consist of the former promotors in the special Bean and Corn Programs. The Extensionists are expected to provide an open-ended type of technical assistance and the Basic Grains Specialists are directed to provide specific technical assistance in corn, beans, sorghum, and rice production.

2. Number of Small Farmers Reached by the Extension Service.

The Extension Service reports the impact of its sub-programs both in terms of numbers of farmers reached and in numbers of manzanas supervised. The word tecnificado (technified) is often substituted for supervised. It implys that on the areas of production supervised by the Extension Service, CENTA recommendations were carried out by the participating farmers.

Table 13

NUMBERS OF FARMERS REACHED BY CENTA TECHNICAL ASSISTANCE ACTIVITIES

SUB-PROGRAM	Nº OF FARMERS	MANZANAS SUPERVISED (TECNIFICADA)
Hortalizas	981	488
Fruits	1,217	1,180
Sorgo	2,294	4,768
Rice	1,058	2,658
Beans	5,186	6,572
Corn	7,590	12,430
	18,326	28,096

SOURCE: MAG Anuario 1974-75, July 1975

These statistics are highly arbitrary and tend to be self-fulfilling. They are better estimates of what the extension service considers to be the scope of its work, given the personnel and other resources at its disposition, than they are measures of work actually achieved. There is no base line data with which these kinds of reports can be compared. For example: how many of the reported 18,326 farmers were contacted las year and the year before, etc., and how many of the manzanas reported as being "tecnificadas" last year, the year before etc.? Our interpretation of this data is that the Extension Service feels most secure if it is called upon to serve approximately 100 rural families per extension agent. The data can also be interpreted to confirm that they are working with relatively small farmers since the average project size is approximately one and one half manzanas.

The eight extension agents whom we interviewed claimed at extremes to cover 15 to 85% of the geographical areas assigned to their agencies. The implication here is the number of farmers who are aware of the Extension Service may range from a low of 15% to a high of 85%.

The contractors field visits to eight extension agencies, which were made unescorted and unannounced, substantiate the claim that the extension services principal client is the small farmer. In the course of following agents through their normal daily rounds we encountered among their clients the poorest of the poor up to medium sized farmers. As a general observation they were not reaching the poorest of the low-income farmers who comprise the target group.

3. The Technical Assistance Functions of the Extension Service.

The Extension Service has been traditionally oriented towards social objectives. A joint study 1/ by MAG/USAID recommended that the extension service place greater emphasis on short and intermediate term economic assistance to farmers and that greater use be made of direct-impact extension methods such as result demonstrations. Since it was incorporated into CENTA the extension service has been moving in this direction.

The 162 to 90 disposition of field personnel (Table 12) in favor of Technical Assistance type programs over Social Development type programs confirms this trend. However, it is not as pronounced as the numbers indicate since the Extension Agents provide many supporting services to the home demonstration and 4-C club agents and in the absence of a 4-C club agent (there are only ten distributed throughout seventy one agencies), the local Agent or Assistant is often called upon to assist with 4-C club work.

Extension Agents have a variety of responsibilities:

1. Supervise the 'technification' of a specific number of manzanas of Basic Grain Crops.

2. Establish result test plots. 2/

3. Establish result demonstration plots. 2/

1/ Analysis de la Asistencia Técnica en El Salvador. MAG/USAID, Marzo 1972.

2/ The distinction the contractor makes in this review between the result test as an information gathering proceedure and the result demonstration as a promotional/educational proceedure, is not made by Extension Agents. Everything is a "parcela".

4. Inform tennants of their rights under the Rent Law. Report any abuses of the law to local judicial authorities.

5. Distribute BFA fertilizers (Some Agencies).

6. Collaborate with FOCCO and BFA in promoting and supervising Grupos Solidarios.

7. Provide technical backstopping to social development projects.

8. Respond to a variety of requests for technical assistance.

4. Work Output of the Extension Service; Technical Assistance Activities.

Judged by one important performance criterion, numbers of result test plots and result demonstration plots established with cooperating farmers, the effective work output of the Extension Service is very low. This year the 162 field technicians assigned to technical assistance type programs, have established an estimated 550 field plots or slightly less than three each.

Table 14

NUMBERS OF SUPERVISED FIELD PLOTS
EXTENSION SERVICE AND SPECIAL CORN AND BEAN PROGRAMS
AS OF AUGUST 1975

TYPE OF PLOT	NUMBER PROGRAMMED	CONTRACTOR'S ESTIMATE 1/
Multicultivos	206	180
MIB Corn Increase Plots	NONE	50
CENTA-1 Sorghum demo. plots	150	100
Beans High prod. demo. plots	180	180
Corn, CIMMYT test plots	60	40
TOTALS	596	550

1/ A generous estimate.

Result tests and result demonstrations are the most effective means of exposing a farm population to new technology. If we were to make the generous assumption that twenty farm families were within the

orbit of influence of each of the activity points enumerated in Table 14. 11,000 farm families could be considered to be exposed to new technology this year. The number is probably closer to 5,000 because many single collaborators have as many as three different plots on their land. Also, we noted that there had been very little systematic exploitation of the plots as field day sites. In terms of exposing farmers directly to new technology, the Extension Service this year is probably working at a rate of approximately thirty farmers per field agent. Not employed as an indice of concrete contact were numbers of method demonstrations. A method demonstration in extension parlance is the act of demonstrating how to perform one particular operation. At the time of our field visits many of the agents were conducting method demonstrations in slug control (use of bait) in second season bean plantings.

We note that there is a danger in this type of analysis of overemphasizing numbers of field plots and method demonstrations per se. and of underemphasizing the impact that can be derived from a single well-located result test or result demonstration.

Although we judged effective work output to be low we found the agencies we visited to be very active. Almost all of the agents visited were busy with their "rounds".These consisted of farm and community visits, and small meetings (the slug bait demonstrations). In the Occidente Region the Extension Agents were busy introducing the recently re-assigned Basic Grains Technicians to their local areas.

It is difficult for Extension Agents to avoid their work. It is forced upon them by the condition of their direct exposure to farmers.

5. The Extension Agents

The Extension Agents tend to be young, unexperienced, and with their eyes on a future other than extension work. A move from the Extension Service to private employment or to some other job in MAG or in another government agency such as the BFA is considered an advancement. Extension Agents probably work harder and receive less recognition and consideration than any other class of technicians in MAG.

The contractor interviewed twenty extension agents in the eight agencies visited. We noted that the most effective people seemed to be assigned to the active agencies which in turn tend to be located in the areas where better land classes prevail. None of the extensionists interviewed had been at his post more than three years. At Sensuntepeque where four agents are employed, none had been on the job more than five months. Only three of twenty agents were mature men in their forties or fifties. Only one of them had spent his career in extension. Two workers had graduated from ENA (Escuela Nacional de Agricultura) in 1968 and one in 1970. All of the remaining 13 had graduated from ENA in 1973 or 1974.

F. Integration of the Research and Technical Assistance Functions Within CENTA

The creation of CENTA contemplated a close working relationship between Research and Extension. It was assumed that if these two key functions were carried out under the same institutional roof with equal heirarchal status, that the release time between the development of improved technology and its adoption by farmers would be reduced. An important adjunct to this marriage was to be a shift in emphasis in extension work from social development type activities towards technical assistance type activities. The name of the Extension Service was changed to the technical Assistance and Promotion Division of CENTA (División de Asistencia Técnica y Promoción).

1. Consolidation of Technical Assistance Activities Within the Extension Service.

At the time CENTA was formed, the two most important programs of directed technical assistance, the Bean Production Program, and the CIMMYT inspired plot program in intensive corn production, operated independently of the Extension Service. These programs involved the two most important basic grain crops and occupied 52 agronomists. In August of this year, 1975, two years after CENTA's formation. they were apparently integrated into the Extension Service. We say "apparently" because although the 40 field workers formerly assigned to the bean and corn programs had been transferred to local assignments with Extension Agencies, their former supervisors and back-up technicians had not yet been assigned to the Extension Service.

The former field workers in the special programs are now called Basic Grains Technicians, Técnicos en Granos Básicos. This is a very positive change since at the level at which these specialists are working; supervising result test plots, establishing demonstration plots, and providing direct technical assistance to farmers; it is reasonable to assume that a graduate agronomist can effectively comprehend four crops. Also, by working with all of the basic grains crops, they will be better abie to maintain an even work load throughout the entire growing season.

2. Collaboration Between Research and Extension

Judged by four criteria: collaboration in establishing results test plots; field contact between research and extension workers; informal contact between the two divisions - the integration of research and extension work within CENTA is in its infancy.

Field Contact: Approximately a third of the experiments established by the Research Division in the current crop season are located outside of the two national experiment stations. Some of these experiments were

located in the eight areas that were focal points of the field observations made by the contractor. No case came to our attention where the Research Technician had appraised the local Extension Agent of the work he was undertaking or of the location of the experiment. In eight agencies visited only one instance was cited of a research worker establishing contact with the agency. This was the case of an entomologist who was measuring the indicidence of slug infestations in second crop beans. The only formal field contact between the two divisions occurs in the Multicultivos program. Research workers do visit the result test plots that were programmed in collaboration with the Extension Service.

Technical Instruction for Extensionists: Only in the case of the Multicultivos program have extensionists been formally exposed to research work in progress at the national experiment stations. The two day special orientation course in basic grains which was given in August to all field technicians was the first time in the memory of older extension workers that they had received formal instruction from Research Technicians.

Communications: Information available to Extensionists with respect to input-output relationships under farm conditions is never formalized and communicated back to research workers. Research reports are never communicated directly to Extensionists.

Technical Planning: Extension workers have not been represented on the ad-hoc committees within CENTA that set crop practice recommendations.

The notable exception to the lack of contact between research and extension occurs in the multicultivos program. However, this program has not gained acceptance within CENTA as a model of an integrated research-extension effort. The integrating force is external, the Florida State Advisory group. Also some influential CENTA technicians claim the extension phase of the program is premature given research results to-date.

In the opinion of the contractor the multicultivos program is a model of how research and extension can collaborate in the final phase of research where results should be tested at the farm and farmer level. Our criticisms of the multicultivos program center on the over-optimistic interpretation of limited knowledge of results at the farm level.

SECTION IV:
ACCELERATING THE PROCESS OF TECHNOLOGICAL ADVANCE: SMALL FARM SECTOR

A. Research: Basic Grains and Intensive Cropping Systems

1. Choice of Research Projects

As has been emphasized earlier CENTA has placed a priority on research programs in the Basic Grains and intensive cropping systems. If the lines of applied research associated with these programs are productive, technological changes will result that will increase the productivity of the small farm sector at no loss of comparative advantage. In the case of research in intensive cropping systems, any technological advances which might be achieved would result in an increase in the small farmers comparative advantage. In the context of this review. CENTA has established the desired policies with respect to research objectives. Table 15 indicates that about half of CENTA's resources (excluding the ENA budget) budgeted to Research and to Technical Support Services are dedicated to projects which are of consequence to the small farm sector. The proportion could be higher if the Services category were not so loaded with personnel.

Table 15

ASSIGNMENT OF TECHNICIANS WITHIN CENTA
ESTIMATE OF PROPORTION INVOLVED IN PROJECTS OF CONSEQUENCE
TO THE SMALL FARM SECTOR

ACTIVITY	Nº TECHNICIANS	Nº CONTRIBUTING TO ADVANCES IN BASIC GRAINS AND HORT. PRODUCTION
Basic Grains, Genetics and Agronomy	25	25
Cane, Fruit, and Horticulture Genetics and Agronomy	7	4
Soil Fertility	9	6
Entomology and Pathology	16	8
Statistics	4	2
Services: Soils Lab	4	2
Services: Ag. Chemistry	22	2
Services: Seed Prod. & Cert.	19	19
	136	68

SOURCE: Plan Operativo CENTA/MAG 1975

2. Increasing the Effectiveness of Applied Research in Basic Grains and in Intensive Cropping Systems.

a. Personnel

Research work in crop breeding and agronomy in the basic grains crops was restricted this year because of lack of personnel. Geneticists were responsible for monitoring both crop breeding, varietal testing, and agronomic experiments. Experimental work with Beans was severely restricted because the two key technicians were absent during the growing season attending advanced training courses at CIAT. This case points up the need to have sufficient depth in key research personnel, in the Basic Grains that they can receive advanced training on a rotating basis. Current plans call for doubling the numbers of technicians working on applied genetics and basic agronomy in the basic grains.

Table 16

NUMBERS OF TECHNICIANS EMPLOYED DIRECTLY IN
BASIC GRAINS AND INTENSIVE CROPPING SYSTEMS RESEARCH
COMPARISON 76 AND 75

TYPE OF RESEARCH	PLANNED 1976 ING. AGRON	PLANNED 1976 AGRON	TOTALS 76	TOTALS 75
CORN PRODUCTION	4	12	16	8
(Genetics)	(2)	(6)	(8)	-
(Agronomy)	(2)	(6)	(8)	-
BEAN PRODUCTION	2	4	6	2
(Genetics)	(1)	(2)	(3)	-
(Agronomy)	(1)	(2)	(3)	-
SORGHUM PRODUCTION	2	4	6	3
(Genetics)	(1)	(2)	-	-
(Agronomy)	(1)	(2)	-	-
RICE PRODUCTION	1	2	3	2
(Genetics)	(1)	(1)	-	-
(Agronomy)	-	(1)	-	-
INTENSIVE CROPPING SYSTEMS (all Agronomy)	1	3	4	3
	—	—	—	—
TOTALS PLANNED 1976			35	
TOTALS ACTUAL 1975				18

b. Administrative and Logistical Support

A common current complaint of research workers is the difficultv of securing supplies and simple equipment at the time they are needed. They were refering to such conventional inputs as fertilizer, insecticides, and backpack sprayers. This has to be an administrative rather than a budgetary constraint because by our estimates 1/ supplies represent only about 2% of the total cost of carrying a replicated plot type of experiment to conclusion. Depending on how you prorate the Research workers time this estimate could be manipulated within a range of 1% to 5%. In any case, one of the key ingredients in a sucessful research project, the timely arrival of key inputs, depends on a relatively small allocation of funds. There are cases where experiments have been rendered ineffective for lack of a few Colones worth of insecticide at the appropriate moment to effect insect control proceedures. The most frequent reason for the late planting of experiments is the late arrival of fertilizer. Any administrative action which will resolve the "insumos" problem for researchers will result in an enormous increase in productivity and work quality at a very low cost.

1/ Based on the following estimates of costs of experimental work in Basic Grains in 1975 (See Table 6 and 7, page 15).

Personnel Costs, 17 Technicians (Table 7)

Ave.Mo. Salary ¢800/mo.		
Ave.Annual	¢ 9,600/yr.	
Benefits 25% of salary	2,400/yr.	
Admin. & Support overhead 80%	8,000/yr.	
Est. Total cost/technician	¢20,000/yr.	
Total Personnel Costs, 17 Technicians		¢340,000/yr.
Est. Value. Prorated use of Exp.Stations		40,000/yr.
Est.Cost of supplies 69 exp. x 1/2 manz.X ave. ¢200/manz.		7,000/yr.
Total costs, 69 Exp (Table 6)		¢387,000/yr.
Total ave. cost/Experiment	¢ 5,600	
Ave. Cost of supplies/exp.	¢ 100 = 2%	

3. External Assistance

a. CIMMYT 1/ and CIAT 2/

A disproportionate portion of the research which is effectively programmed and implemented is being carried out by a few technicians. These are men who in most cases have received advance training at the International Research Institutes, CIMMYT and CIAT. Having been trained at these Institutes they welcome the advisory and evaluative visits of CIMMYT and CIAT personnel. Maintenance and strenthening CENTA's relationships with CIMMYT and CIAT is the single most important investment which can be made in the development of improved technology in the Basic Grain crops.

b. The Florida State Contract

Prior to the multicultivos program which was inspired by Florida State advisors to CENTA, research results in the basic grains were singularly focused on the output of one crop. The reality in El Salvador is that three of the basic grains, corn, beans, and sorghum are more often grown in association with one another than they are in isolation. What is important to the farmer is his total output of corn/beans or corn/sorghum grown on the same field. One the chief potential benefits of what was formerly called the multicultivos program, now called Intensive Cropping Systems, could be to re-orient corn, bean, and sorghum researchers to evaluate input/output relationships in terms of total yields per normal growing season (May-November).

The first step towards drawing other researchers out of their monoculture isolation was accomplished this year when the Florida State advisory group broadened the scope of their work to include variations in traditional basic grain associations. The research concept could be broadened even further to include labor intensive systems of monoculture such as very high population/patterned spacing/high fertility systems. The research concept should also contemplate minor as well as radical changes in existing double cropping systems.

Given the broader scope of work and the need to involve all researchers in Basic Grain crops, the proper institutional spot to seat research in intensive cropping systems would be the department of Fitotécnica (Agronomy) where those researchers reside. This would be much preferable to the sub-department of Economía Agrícola where the program is currently lodged because of an accident of circumstances. The lack of apparent enthusiasm of CENTA officials for the Florida State Contract might vanish if this move were made.

1/ Centro Internacional de Mejoramiento de Maíz y Trigo.

2/ Centro Interamericano de Agricultura Tropical.

B. Closing the Gap Between Research and Extension

1. Field Testing: Integration of Efforts at the Level of the Result Test.

The common criticism of research workers by extension workers is that they are too theoretical and as a result they cannot be expected to make practical and reliable recommendations at the farm level. The common criticism of extension workers by research workers is that they lack technical discipline and as a result their observations with respect to applied technology are not reliable. There is a happy meeting point where this issue can be resolved and this is at the level of the Result Test.

The result test also called a Field Test or Field Trial, is the procedure which is employed to indicate the range of profitability of a given practice or set of practices under farm conditions. It is the pivotal point in the Research-Extension continuou. (Point 4 in Table 4, page 14. The reader is urged to review this table before proceeding any further). Since its primary purpose is to generate information, it can be conceived of as a function of research, although the designs accepted for this order of information-retrieval are not as complicated as those that investigators are accustomed to employing in Experiment Station work. Since the result test is a procedure which requires collaboration with farmers, the extension agent is the indicated technician to locate test plot sites. Also, if the result test is positive, it can be employed by the Extensionist at one and the same time as a result demonstration. In terms of the relationship between the Research and Extension, the Result Test forces the Researcher out to the farm and it requires that the Extensionist obey some basic principles of information retrieval.

Ideally research workers establish the design for the result tests; extension workers select farmer collaborators and supervise the plantings; research workers accompanied by the extension workers visit the plots at intervals during the growing season; research workers are on hand at harvesting time to help extension agents collect yield data; research workers interpret the results statistically; and finally the research and extension workers involved, collaborate in working up recommendations based on the results of the tests.

The most sophisticated result tests programed this year by CENTA were the CIMMYT type plots which were intended to compare agronomic and economic returns at traditional, currently accepted, and high levels of use of inputs. The CIMMYT plots, it should be noted, represented no test of CENTA's capacity to integrate the research and extension functions. They were undertaken as a special program which had no direct or collaborative relationship with either the Research or Extension Division of CENTA. Because of our special interest in the result test procedure, the contractor's group made a special effort to visit as many of the CIMMYT plots as possible. Of a total of 25 of such plots reported in our observational areas, 14 were visited.

The original design of the plots which was probably borrowed from Plan Puebla turned out to be innappropriate for El Salvador conditions. The first of the three treatments was "Local Practices Using Criollo Seed". In the areas where the project was established, the Occidente, no one uses criollo varieties. All of the cooperating farmers plant H-3 or H-5 seed. The criollo corn of the region is degenerated H-3 or H-5 seed (F_2, F_3, or F_4, etc., generations). Some of the field agents, in order to be faithfull to the design managed to dig up some old fashioned criollo varieties. On most of the plots the number of treatments was reduced from three to two by eliminating the two criollo control plots. A creative reaction to the situation would have been to conceive of degenerated H-3 or H-5 as the criollo control varieties.

Because of the criollo problems most of the plots were wisely reduced to two replications of the second and third treatments, low risk (moderate levels of use of cash inputs with H-3) and high risk (high levels of use of cash inputs with H-3 + high population). They were called costo mínimo and técnica completa. The low risk plots were supposed to employ inputs at currently accepted levels of use. The high risk plots were programed for what were perceived by the CIMMYT project advisors to be high rates of use of inputs by comparison to accepted rates. The difference between the rate the farmers applied in the costo mínimo treatment and the rates fixed for the técnica completa treatments did not turn out to be very great. Also, there was a tendency for the cooperating farmers to up the rates on their reference treatments because they consider themselves tecnificados. On some of the plots the only significant difference between the farmers treatment and the maximum risk treatment was plant population.

Result tests were also established by the special Bean Program. Prior to being integrated into the Extension Service the bean field workers had been distributed throughout the area where beans are customarily grown as a first season crop. Among their several responsibilities they were each charged with establishing six sets of result tests for a total of 180. Each set consisted of three 400 m^2 treatments in which varieties were the variable element and fertilizer applications (2qq 16-20-0/Manz) and timely insect control were the constant factors. They were called parcelas demostrativas although they were in effect Result Tests, since they were designed for data collection, as well as demonstration purposes.

As reported by the former Bean Program field workers whom we contacted in their new assignments with the Extension Service there seemed to be less confusion with respect to the designated purpose of the tests than was the case with CIMMYT corn plots. However, in their answers to our inquiries about data yield, there was such a strong tendency towards round numbers in reporting, that we suspect that there was some dry-labing of results. As was the case with the CIMMYT plots, the bean parcelas did not represent a legitimate test of CENTA's capacity to integrate the Research and Extension functions at the field level. The Bean Program operated independently of the Research and Extension Divisions.

The only project where Research and Extension joined hands this year was in the multicultivos program. Since there were Florida State advisors resident in both the Research and Extension Divisions coordination of efforts did not encounter any institutional obstacles.

The multicultivos plots are basically the simplest form of a result demonstration. They are single plots without a companion control practice plot. However, of 206 plots programed with the extension service, 56 were designated as data collection plots and as such can be considered result tests. Twenty of these result tests were assigned to experienced extension agents and thirty six to Peace Corps Volunteers assigned to the project.

In the extension agencies visited by the contractor there seemed to be confusion as to which plots were designated as sources of data and which were simple demonstrations. There also was a tendency if a plot did not do well in its first phases to discount it as a source of data. For the research worker "negative" data is as important a product as "positive" data. For the extension worker negative results are bad news.

Most of the field workers who were responsible for the corn, bean and multicultivos result tests were confused as to the purposes of these tests. Many conceived of the plots as demonstrations and as a consequence they were not as carefull about land measurement, plot location and applying inputs at precise rates as they should have been given the data yield objectives of the projects. On the other hand in the case of the CIMMYT corn plots, since they were not the simple one treatment/no treatment type of result demonstrations which Extensionists normally employ, they were unsure of how to employ the plots for educational purposes.

The result test can be a double purpose instrument; a source of information under adequately controlled conditions and a demonstration of the practices isolated in the treatments. However, this dual purpose concept is dangerous if the Extensionist does not understand that the primary function of a result test is to collect information.

What CENTA needs in order to avoid confusion about the purposes of field plot work is a model similar to one outlined in Table 4 of this report. The issue is how "proven" is the practice. If it is not proven, result tests are indicated in order to evaluate the practice and the primary objective of field work is to secure information. If it is proven, result demonstrations are indicated so farmers can see the "proof" of the practice.

If Research and Extension with CENTA are to collaborate productively at the level of the Result Test a common vocabulary needs to be employed which will segregate information-gathering procedures from demonstration procedures. The words experimento, ensayo, lote, parcela, demostración as they are currently employed by research workers and extension workers in CENTA do not convey the same concepts.

2. Sharing Information: Research and Extension

A. Publication of Research Reports

All Extension workers should receive reports of research results. The concept that such reports are too technical and that the extensionist is likely to misinterpret them is denigrating and presumes that the Extensionist is a lower order technician.

B. Feedback: Campo to Researchers

Extensionists tend to be crisis oriented. When something is wrong such as unusual disease or insect infestations, they run to Research with the news and expect an immediate solution. On the other hand, there is no systematic flow of information back to the Research about yields, levels of inputs employed by farmers, revisions (often ingenious ones) which farmers have made in recommended practices, patterns of insect and disease infestations, etc.

Researchers cannot be held to developing practically oriented hypotheses and research objectives unless they receive feedback from the campo. The Extension Service is the logical instrument for providing this feedback.

3. Training: Short Courses for Extensionists

The specialists who reside in the Research Department are the logical source of instruction to keep Extensionists abreast of current technological developments, and to provide them with the background information they need to understand the crop-practice recommendations they may be demonstrating.

Short courses could be programed in the months of January and February when both research and extension activities are at their low point in the annual agricultural cycle.

C. Providing Effective Technical Assistance Services to Large Number of Small Farmers.

1. Choice of Objectives: The Shift From Traditional Extension Programs to Programs of Directed Technical Assistance.

Historically the Agricultural Extension Service in El Salvador developed under the influence of U.S. advisors as was the case throughout Latin America. U.S. extension objectives, methodology and organization were imposed with such a degree of uniformity that one country's Extension service was the mirror image of every other. The pattern of the local extension office team composed of the agricultural extension agent, the home demonstration agent and the 4-H club agent was universally established. The mission of agricultural extension was to improve all aspects of rural life. The primary constraint to improving rural life conditions was conceived to be ignorance and emphasis in extension methodology and training was on mass education methods.

The Extension Service in El Salvador as it has been incorporated into CENTA is no longer burdened with the task of improving all aspects of rural life. Its primary mission as a Division of CENTA is to provide Agricultural Technical assistance to farmers. The last vestiges of the 'old' comprehensive extension system are the ninety Home Demonstration Agents and 4-C club educators whose work is segregated programatically as Community Education. The agricultural extension agent has been 'freed' to dedicate his attention to agriculture.

The justification for the shift from comprehensive goals to emphasis on agricultural technical assistance is that you cannot expect to improve the farmers' social condition until you have improved his economic condition. And the most expeditious manner of improving his economic condition is to help him increase his farm production. The first step in developing an Extension Service with the capacity to provide technical assistance services to large numbers of farmers is for the Extension Service itself to accept this more restricted definition of its role.

2. The Substance of Technical Assistance: What is there to extend?

Programs of technical assistance presume that improved technology is available which if adopted by the farmer would increase his income. Otherwise a program of technical assistance has no merchandise to peddle - nothing to extend.

Technical assistance programs function in a vacume unless they relate to active programs of applied research. This may be one of the explanations why the 'old' extension service did not place much emphasis on technical assistance programs. Until recent years applied research programs in many Latin American countries were so underdeveloped that little to no improved technology was being generated. Had the extension services chosen to emphasize technical assistance, they would have been frustrated for lack of merchandise on their shelves.

In El Salvador at the present time, there are a number of technological advances in the Basic Grains crops which are at stages of development that justify 'extending' them to small farmers. (Table 17).

Lack of something to extend is not a constraint to the Extension Services' developing an effective program of technical assistance.

TABLE 17

TECHNOLOGICAL ADVANCES AVAILABLE TO A DIRECT TECHNICAL ASSISTANCE PROGRAM FOR SMALL FARMERS IN EL SALVADOR, 1975-76

TECHNOLOGICAL ADVANCE	WORK INDICATED FOR THE EXTENSION SERVICE
Improved Grain Sorghum Variety - CENTA-1	Distribute Seed and establish result demonstrations.
Improved Grain Sorghum Variety - CENTA-2	Establish result tests in collaboration with Research.
Improved Corn Variety H1B	Distribute seed and establish result demonstrations.
Increased corn population on high fertility treatments	Establish result tests.
Intensive Cropping Systems	Establish result tests or result demonstrations depending on the particular system employed.
Improved Bean Varieties	Establish result tests or result demonstrations depending on the variety, zone and season.
Bean Production, moderate fertilization high P_2O_5 carriers, timely control of insects.	Establish result demonstrations. Give method demonstrations for insect control systems.

3. Extensive Rather than Intensive Contact

There are 192,850 farmers in El Salvador who qualify as small farmers under the criteria applied for this study. 1/ Even if you assume that as many as 40% of these farmers are not within the possible influence of the Extension agencies 2/, the number of potential beneficiaries of a program of directed technical assistance is greater than 100,000 farmers. The work of extending technical assistance to this huge group must be predicated on extensive contact systems; otherwise the costs of providing technical assistance will be greater than any potential economic gains that may accrue to the target group.

For example: It probably costs no less than $6,000 per year to maintain one CENTA agent in the field. 3/ If the scope of his influence is limited to 100 farmers which is what CENTA's reports indicate 4/, each of these farmers would have to maintain gains of $60.00 in annual net farm income to justify the agent's presence at a break-even point.

In Section V, Part C.2 of this report we estimate that a field agent could maintain an effective sphere of influence in an area comprised of between 500 to 800 farm families. This would bring annual influence charges down to a range of $7.50 to $12.00 per farmer.

1/ Numbers of farm families that have access to less than 2.0 hectares (3.5 manzanas) of land; From CONAPLAN data presented in USAID/El Salvador memorandum dated February 24, 1975.

2/ For reasons of inaccessability, minimum funds, occupancy of marginal lands, etc.

3/ Annual salary range $2,640-$3,360 - Salary X 100% assumed to account for all overhead costs.

4/ Table 13, page 25.

4. Essential Conditions

With the present allocation of 161 field agents in CENTA, we estimate that an effective program of technical assistance could be developed serving a target group of as many as 120,000 small farmers, provided that the following conditions are established:

a. Technical Assistance Activities are Selective

The emphasis in technical assistance work should be on proving (testing) and demonstrating improved practices. The first priority of the extension agent should be to establish effective result tests, result demonstrations, and method demonstrations. Once farmer responses to result demonstrations indicate that a particular practice or set of practices is accepted, the work of diffusion should be carried out through mass communications instruments, credit programs (the credit-in-kind package of inputs), and retail farm stores. Also, the corn production revolution in El Salvador would indicate that if a new production practice is profitable, farmer to farmer diffusion of the practice through informal channels can be expected to be rapid.

b. Secure Greater Impact From Each Discrete Activity

The number of result tests and result demonstrations that an extension agent carries out within his work area need not be massive if the quality of his work is high, if he is selective in his choice of farmer-collaborators, and if demonstration plots are strategically distributed and located. A single result test carefully installed with accurate records is obviously more valuable than several tests into which extraneous variables have been introduced. A few demonstration plots strategically located highlighted by clearly visible signs and used effectively as sites for field days are more valuable than a dozen that are "shotgunned". Slides taken at the planting, growth and harvest cycles of a specific plot can "preserve" the activity for "demonstration" to groups in the dry season.

c. Eliminating the Mobility, Equipment and Supplies Constraints

(1) Mobility

Every Extension Agency should have a four wheel drive vehicle, and in those agencies where more than one field worker needs to be mobilized, supplemented transportation in the form of trail bikes and horses should be provided. Office handymen should be qualified as drivers so that the extension agent can be relieved of the ridiculous intrusion on his time of carting-around the home demonstration and 4-C club agents.

(2) Timely Arrival of Supplies for Result Tests and Result Demonstrations

Late arrival of seed and fertilizer was cited by both the former corn and bean program workers as the reason that the majority of their plots were late. The late arrival of supplies poses two serious problems. Potential collaborators are lost because they are more concerned with planting on time than they are with cooperating in establishing a result test or a result demonstration. And late planting eliminates one of the principal premises on which the result test and result demonstration methods are predicated; that results are evaluated

under prevailing farm conditions.

Unless this simple logistical problem is surmounted, forget about establishing an effective high impact program of technical assistance.

(3) Equipment: Local Extension Agencies

Very effective use is made of Ditto or Mimeograph machines in the few offices which have them. Some sort of reproduction equipment in each office can be justified solely for the purpose of printing circulars announcing meetings.

Provided the other conditions in this series (1)-(5) are met, every extension agency could effectively use the following additional equipment:

1 Ditto Machine
1 Pocket Calculator
1 Slide Projector
1 35 mm Camera
1 Field Scale
4 Tape Measures

(4) Broadening the Scope of Contact and Communications Methods Employed.

The shift in emphasis in extension work from total rural community development to a more restricted focus, agricultural technical assistance, does not mean that communications and contact methods should be correspondingly restricted. The development, testing, and employment of mass contact and communications techniques is just as important to the "new" extension as it was to the "old" extension.

Our visits to extension agencies indicate that relatively effective use was being made of such traditional methods as direct farm visits, giras (the rounds), and community meetings. Relatively little use, however, was made of visual aides at the meetings. No agency visited reported the direct use of radio, TV, or the press. Only in a few instances were agents using innovative contact methods. Two examples of an innovative approach were the use of students to carry announcements back to their parents and the scheduling of community visits in isolated areas to coincide with the drawing power of the Priests' scheduled visits.

(5) The Status, Stability, Residence and Working Hours of the Extension Agent.

The Extension Agent should be the most permanent, stable and respected element in the entire CENTA complex.

The new extension needs to foster a special work discipline and mystique that can only be fostered if the job of Extension Agent becomes a career instead of a wayside station for recent ENA graduates which is its present status.

The most critical requirement is relative permanence of assignment in the same agency. There is no training program which will substitute for the factor of time in residence as the means of becoming adequately oriented to the local agricultural environment and for developing effective contacts with farmers and farmers groups. The policy which was established for assigning the former bean and corn program agents is evidence that CENTA recognizes the problem. When these field workers were re-assigned to Extension Agencies in August of this year, wherever possible, they were assigned to agencies close to the towns where their families reside.

Although the pay scale $2,640-$3,360 per year is a source of universal complaints, we don't believe that at the starting range it represents the principal constraint to retaining good technicians in the extension service. At the upper limits it is a critical constraint because it is not competitive with middle scales for almost any other technical slot within CENTA. The upper limit of the Extension agents' pay scale needs to be increased by 30% to make long term employment in the Extension Service competitive with other alternatives within CENTA and MAG.

Extension agents should not be bound by directives to fixed working hours. One result of the fixed working schedule is that the best days of the week for some extension activities, Saturdays and Sundays, are sacrificed as the agents head back to their respective domiciles for the weekend.

The new extension with its emphasis on agricultural technical assistance requires that the agent become technically knowledgable in terms accepted by both farmers and other technicians about the major crops in his area of assignment. He must be both an extension specialist and a specialist in the Basic Grain Crops. The principal constraint to his assuming this role is the vested interests of the super-specialists who claim that a specialized knowledge of all of the basic grains crops is beyond the capacity of low-order technicians. Half the battle to establish an effective extension service will be won the day that other technicians within CENTA recognize the extensionist as a fellow professional.

SECTION V:

CONCLUSIONS

A. Farm Size and Potential Productivity

1. Small Farmers' Receptivity to Change

The acceptance of small farmers of advanced production technology should not be considered a constraint when evaluating programs that aim to increase incomes among the rural poor in El Salvador. The recent history in this country of the rapid adoption by small farmers of advanced production practices in corn and rice production would indicate that if the economic advantages of new production practices are clearly demonstrated small farmers will be quick to adopt them.

2. Farm Size and Output

Farm size is not a constraint to achieving high and efficient production of horticultural crops and of basic grains crops. This may also be true for the export crops but they did not fall within the scope of work of this report.

At current labor costs (₡3.00/day) mechanization of cultural operations in basic grain and horticultural crops is as costly as oxen and hand operations, with exception of initial land preparation (plowing). In the double cropping systems (corn/beans and corn/sorghum) that account for approximately half of El Salvador's total Basic Grains acreage, labor intensive systems enjoy a monopoly of advantage. There is no way to mechanize the interplanting of the second crop.

Farm size should be considered a total income constraint per family but not a production constraint.

B. Constraints to Technological Change: Small Farm Sector

1. Access to Good Land

Small farm enterprises are competitive with larger scale operations for the use of good land. However, many small farmers occupy marginal lands where slope and accessability of terrain and depth of topsoil are the principal constraints to employing advanced production technology.

2. Applied Research. Beans and Sorghum

No high production technology has been developed for sorghum as it is grown by small farmers in El Salvador - as a second season crop interplanted with and following corn.

By comparison to the advances that have been made in corn and rice production, advances in Bean production technology have been very slow.

3. Agricultural Production Credit

An estimated 14% 1/ of the target group were recipients of formal agricultural credit in 1975. Lack of purchasing power is probably the chief constraint to maximizing returns from the current level of accepted advanced corn production practices. 2/ Lack of cash was the most frequently cited reason for not employing first generation hibred seed. (The pivotal element in the CENTA corn production recommendations).

C. The Needs of Small Farmers for Technical Assistance

1. Type of Technical Assistance Required

The needs of small farmers in El Salvador for technical assistance per se are minor compared to their needs for access to good land and access to crop financing on a timely basis. When these two constraints are removed relatively high levels of use of the inputs associated with advanced production practices can be anticipated without recourse to a technical assistance stimulus. The salvadorean small farmer is sufficiently advanced in both his use of available technology and his predisposition to accept technological change that a rapid adoption of new practices can be anticipated once these practices are proven at the farm level. In this kind of a situation the principal function of technical assistance should be that of proving and demonstrating improved practices, when and if such practices are developed through applied research.

2. Numbers of Technical Assistance Change Agents Potentially Required

Given the primary function of proving and demonstrating improved production practices to farmers and assuming that there are no

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1/ 27,025 out of 192,850

2/ Contractor's Field Observations

logistical or administrative constraints, we estimate that one Technical Assistance Agent could service an area comprised of 500-800 farmers. This conclusion is based on the following additional assumptions:

- The objectives of result tests (proving practices) can be accomplished at a dispersal rate of one result test per 500-1000 farmers on an annual basis.

- The objectives of result demonstrations can be accomplished by establishing one well located demonstration per 100 farmers over a two year period or one demonstration per 200 farmers per year.

- 60% of the technical assistance agents total time would be available to select collaborators, supervise the installation of result tests, and result demonstration, provide follow up supervision, organize field days, and publicize (divulgar) results.

- One agent could handle 3 result tests, a proceedure requiring very close supervision and 12 result demonstrations, a proceedure that requires close supervision only at planting time.

- Based on the advances predicted in Part D below the following improved practices projects are currently available:

Result tests indicated	-	Two patterns multicultivos
Result tests indicated	-	Corn, High Fertility/High Population
Demonstrations indicated	-	Introduction of HIB Corn
Demonstrations indicated	-	Introduction of CENTA-1 Sorghum
Demonstrations indicated	-	Use of moderate level of inputs Bean Prod. Package.

- If the above is what an agent has available to extend he could distribute his work as follows:

WORK	BASE NO. OF FARMERS
2 Multicultivos Result Tests	500-1000
1 Corn/High Fertility/High Population Result Test	500-1000
4 Corn HIB demonstrations	800
4 Sorghum CENTA-1 demonstrations	800
4 Bean package demonstrations	800

D. Immediate Prospects (1-4 years) for Increasing Productivity in the Small Farm Sector; Basic Grains Production

Given production practices as they are currently proven 1/ and given the lines of research which have reached an advanced stage 2/ of developuent, we estimate that the following advances in Basic Grains production technology can be anticipated in the immediate future:

1. Corn Production

The practical yield thresholds for corn production can be raised to 80qq/Manzana on Class I and II lands and to 50qq on Class III lands. This will come about through the partial substitution of the H 1 B synthetic variety of corn for the H3 and H5 varieties. The introduction of H 1 B which is an open-pollinated variety equal (or slightly superior) to H3 and H5 in its yield potential will remove the constraint of annual seed purchase which has prevented many poor farmers from using H3 and H5 effectively - (they have been planting second and third generation seed with subsequent loss of hibred vigor). The introduction of H 1 B which has greater lodging resistance than H3 and H5 will permit those small farmers who are prepared to assume higher risks to combine higher plant populations with higher rates of application of nitrogen.

2. Bean Production

El Salvador's dramatic increase in bean production in the post-Honduran conflict period has been achieved from increased acreage. Records from the special Bean Production Program that has just been integrated into the Extension Service indicate that a modest breakthrough in increasing yields can be expected in the immediate future.

The only two yield-increasing practices currently proven, modest fertilization and timely control of insect pests, have a potential to raise top yields to 30qq/Manzana on Class I, Class II, and the best Class III lands, and to 15qq/Manzana on marginal lands.

3. Rice Production

Rice production is the least important of the basic grains for the target group. Yields of small farmers (who tend to be the

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1/ Proven = Successful results consistantly obtained.

2/ Ready to be submitted to result tests under farm conditions.

largest of the small farmers) averaged 55qq of paddy (unmilled rice) per manzana in 1973-74.

The adoption of the technology associated with these high yields was largely due to the transfer of improved practices from the commercial farming sector.

The introduction of fungus resistant varieties from CIAT could increase yield potentials by as much as 20%.

4. Grain Sorghum Potential

The greatest potential for increasing yields of the basic grains is with grain sorghum which is almost exclusively grown as a second season crop following corn. Average yields are extremely low, 20qq/Manzana. The release this year of a high yielding open polinated grain sorghum variety, CENTA-1, combined with modest second crop applications of nitrogen offers the potential to double grain sorghum yields. However, this increase in grain yields will involve some sacrifice of forage yields. The criollo varieties which currently account for almost 100% of sorghum production as a second crop are dual purpose varieties (grain/forage).

5. Multiple Cropping (Intensive Cropping Systems)

When drawing conclusions about gains that may be realized from research in Intensive Cropping Systems, it should be acknowledged that the two-crop systems traditionally employed by small farmers in El Salvador are both labor-intensive and make highly efficient use of the soil moisture available in the normal growing season.

The type of research which has been stimulated by the multicultivos program has the greatest long-range potential of any line of agronomic investigation to increase small farm productivity. However, no effect on basic grain production technology should be anticipated in the immediate future.

Plans which are currently being discussed to launch massive multicultivos demonstrations next year are premature and should be discouraged.

E. CENTA as the Instrument for Providing Technical Assistance to Small Farmers

CENTA has the institutional capacity through its Research and Extension Divisions to both develop, test and deliver advanced production technology. CENTA is the logical chosen instrument to put modern agricultural technology to work to the advantage of the small-scale farmer.

How effective CENTA will be in this role depends on three factors; the relative emphasis in research which is placed on crops and coping and livestock systems which are labor intensive; the effectiveness (productivity) of this applied and adaptive research; and the effectiveness of the Extension Service in reaching enormous numbers of small farmers.

1. Positive Bias Towards the Small Farm Sector

CENTA's programs as measured by the assignment of personnel and budget to specific sub-programs and projects show a positive bias towards the target sector. Emphasis in research projects is directed towards the Basic Grain crops and the Extension Service's contacts are largely with small farmers.

2. Effectiveness of Applied Research

The effectiveness of CENTA's research program seems to be proportionate to the amount of assistance it receives from the International Research Centers. The corn and sorghum breeding programs are strong and receive sustained guidance from CIMMYT.

While work in crop breeding is relatively strong. Agronomic research in the basic grain crops by CENTA admission is weak. Work with rice varieties is concentrated on the introduction of CIAT lines.

Research in intensive cropping systems which is supported by the Florida State team is aggressive but suffers from lack of linkage with related lines of research. The reorientation this year to dry land systems in which the interrelated crops are the basic grains is a move that has the potential to ultimately affect large numbers of small farmers.

The work in soil fertility seems to be weak but is not a development constraint since responses to conventional (general) fertilizer recommendation are economic.

We were unable to review research in Entemology and Pathology.

Work output as measured by the numbers of experiments carried successfully to conclusion by researchers is low.

As a general observation the research which is being carried out which is of significance in the context of this review is being done by a very few technicians.

3. Effectiveness of the Extension System

The extension system is well dispersed, and, as judged from our unannounced field visits, active. There is no resistance to seeking out the small farmer as a client. Contacts however tend to

be with the least marginal farmers in the target group. There is little resistance at the agency level to the switch in emphasis from conventional extension objectives to concentrating on providing technical assistance. There is resistance at the supervisory and administrative levels.

The numbers of concrete projects and activities such as result demonstrations, result tests, and field days were judged to be low by comparison to the numbers of field technicians working out of the agencies.

The job of Extensionist is low status and low paid by comparison to other positions in CENTA. Turnover is extremely high and continuity of residence in one agency is rare. Agents tend to be recent graduates of ENA with their eye on the next chance.

Mobility is universally cited by the Agents as the factor which most limits their field contacts. Late arrival of supplies was cited as the factor that most frustrates establishing effective result tests and result demonstrations.

If the extension service is to provide effective technical assistance to larger numbers of farmers (assumptions under Part C of this Section):

- The job of Extensionist must acquire greater status and authority.

- Stability of tenure in the Service and permanence of residence in the local agency must become the rule rather than the exception.

- Extension agents must accept a more sophisticated model of technical assistance than that which prevails.

- Inovative client contact techniques need to be introduced.

- The mobility and supply problems must be resolved.

These changes are more likely to transpire if the Extension Service is acknowledged as <u>the</u> technical assistance agency.

4. Integration of Research and Extension Activities

Affirmative steps have been taken to unify Technical Assistance Services. The fifty field technicians who had worked in the autonomous Bean Production and Corn Production programs were reassigned in August to the Extension Service as Basic Grains Production Specialists (<u>Técnicos en Granos Básicos</u>).

Outside of the multicultivos program, communication and collaboration between Research and Extension are almost non-existant.

There is a semantical barrier to integration. Researchers and Extensionists are not in agreement among and between themselves as to the operational definitions of an experiment, a result test, and a result demonstration.

5. Personnel vs. Support

Aside from a motivational constraint, the principal obstacles to achieving greater work output in both Research and Extension are administrative and logistical. No additional personnel would be required within CENTA to intensify and amplify research and extension work in the Basic Grain crops. What is needed is a higher ratio of support resources per active worker (per researcher and per extensionist). When a researcher loses a planting date because he can't put his hands on the $10.00 worth of supplies the experiment requires; or when the extensionist halts his "rounds" the last week in the month because his monthly gasoline ration of 50 gallons has run out; what is needed as of the moment is more supplies available on a timely basis, not more and better trained personnel.

F. Implications for ISTA (Instituto Salvadoreño de Transformación Agraria)

In contemplating a prospective loan to ISTA, the availability of technical assistance should not be considered a limiting factor in reaching production goals which are based on currently accepted production technology. If land access is secure and if production credit is available yields equal to those currently being obtained by better small farmers can safely be projected without programming a heavy technical assistance input. We suggest the following yields as being reasonable objectives to set for the beneficiaries of agrarian transformation projects.

Table 18

SUGGESTED YIELD GOALS FOR AGRARIAN TRANSFORMATION PROJECTS

CROP	ANTICIPATED AVERAGE YIELDS PER MANZANA BY LAND CLASSES		
	CLASS I	CLASS II	CLASS III
Corn	70qq	60qq	50qq
Beans	25qq	20qq	15qq
Rice	60qq	50qq	--
Sorghum	--	30qq	20qq

SOURCE: Contractors Projections

The provision of technical assistance to ISTA projects should be provided by CENTA Extensionists working out of the existing Extension Agency which is located closest to the project site. Unless the settlers are working with unfamiliar soil conditions or with unfamiliar crops or cropping systems (such as irrigation), Technical Assistance should not be apportioned to the projects at any higher rate than 1 to 500 ratio postulated in part C of this Section.

If the parcelarios are to be favored in the allocation of technical assistance resources, the strategy should be to assign the best Extension Agents available to agencies in the project areas.

SECTION VI:

RECOMMENDATIONS

A. Support of Applied Research

1. Basic Grains; Genetics and Agronomy

Research work in Basic Grains was restricted this year because of lack of personnel. There is a need for greater depth of personnel to provide space for advanced training and to allow for ultimate attrition. The corn genetics program is so important that it should be three deep as an insurance policy.

The current USAID policy of financing advanced training at CIMMYT and CIAT should be continued - maybe intensified.

2. Intensive Cropping Systems

This is the line of research which is most appropriate for USAID grant funding because it carries a built-in bias toward the small farm sector. However, no results should be anticipated in the immediate future which can be evaluated in terms of significant numbers of small farmers achieving advances in production. It would be unfair to hold the Florida State Advisors to the project to a number-of-farmers affected type of performance criterion at this stage of evolvement of the project.

Based on our observations of demonstration plots in the Occidente, we feel strongly that it would be premature to launch a massive demonstration campaign in the 1976 crop-year.

Strong continued grant funding for research in intensive cropping systems is recommended. The emphasis in recruiting external advisory technicians should be on agronomists. Given the complexity of the research problem, two-year tours of duty will be insufficient.

B. Support of Technical Assistance Services for Small Farmers

1. Implications for a Possible ISTA Loan

The availability of direct technical assistance services to potential beneficiaries of ISTA loans should not be considered a critical constraint to their achieving high production in the basic grain crops under dryland farming conditions.

The only situations where direct technical assistance should be contemplated on an intensive scale would be where farmers without previous experience in irrigation are being settled on irrigated lands.

The provision of technical assistance to ISTA projects should be a function of CENTA. No overall increase in CENTA personnel need be programed to provide this service, only shifts in assignments.

2. Construction of the Regional Centers under the USAID/CENTA Loan. Possible Diversion of Funds.

Construction of the regional centers will not in itself remove the principal constraint to dispersing CENTA services. This is the problem of non-residence of the technician in the area where the service is to be performed. Most of the types of specialists scheduled to work out of the regional centers are domiciled in the greater San Salvador area. They are not likely to spend any greater net-working time in the campo as semi-commuters assigned to regional centers than they will working directly out of San Andrés.

In terms of the needs identified in this review we would recommend that a portion of the funds destined to build and equip the regional centers be diverted to remodeling those local extension offices which have longterm leases and to purchasing for each agency, the equipment package outlined on page 43 of this report.

3. Project Development and Management

What we have been discussing in this report is the process of directed technological change, in this case directed by a specific institution, CENTA towards a specific class of farmers. Conditions will be near optimal going into the 1976 crop season for unifying and rationalizing this process within CENTA:

- The obstacle of having independent technical assistance programs operating outside of the Extension Service has been eliminated.

- Four lines of developing technology 1/ have reached the stage where field testing proceedures are indicated. Consequently this is an opportune time to test the possibility of Research and Extension collaborating at the level of the result test proceedure.

- Another four lines of developing technology 1/ have reached the stage where promotion through result demonstrations are indicated. Consequently, this is an opportune time to test the capacity of the Extension Service to put new technology at the disposition of large numbers of small farmers.

USAID Grant funded technical assistance is recommended to help CENTA achieve the following specific goals in the years 1976-1977.

(1) Develop and implement a system for tracking the progress of specific lines of developing technology (see the model on page 14 of this report).

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(2) Develop and implement a system for the joint involvement of Research and Extension technicians in setting technical assistance goals, proceedures, and evaluating criteria. (See the model on page 11 of this report).

(3) Develop a set of definitions of field investigation proceedures and field demonstration proceedures which will be mutually acceptable to Research and Extension personnel.

(4) Develop and implement a training system for extension agents in field investigation proceedures.

(5) Develop and implement a mini-PERT system for Extension Agents. (Critical path proceedures for an individual agent).

(6) Set up a pilot program in the use of extensive extension contact and communications methods.

ANNEX A
OBSERVATIONS YIELDS, BASIC GRAIN CROPS

CROP	LOCATION	LAND CLASS	FERTILIZER	SEED	AGRICULTURAL CHEMICALS	ESTIMATED YIELD qq/Mnz	OBSERVER AND COMMENTS
CORN	Ahuachapán	II	1-3qq/Mz.20-20-0 1-2qq/Mz.$(NH_3)_2SO_4$		Always for Cojollero 50% use soil insecticides	45-50 qq	65qq/Mz. Prize farmer led to by agent. Average per 20 fields estimated by J.G.S.
CORN	Candelaria Monteverde	III	Most use some.	H-3	Frequently for Cojollero.	40 qq	Average yield per area according to farmer.
CORN	Candelaria Cantón Paraje	III-IV	4qq/Mz.20-20-0 2qq/Mz.$(NH_3)_2SO_4$	Mainly H-3, H-5	Cloro-Hep Volaton	40-50 qq	Estimate of farmer.
CORN	Candelaria San Jerónimo	II	2.2qq/Mz.20-20-0 8 days after seeding. 2.0qq/Mz.$(NH_3)_2SO_4$ 60 days after seeding.	H-5	?	95 qq	Plowed with tractor Average per 10 Mz. cultivated on remains of poorer large hacienda.
CORN	Atiquizaya Izcaquilillo	II	3qq. 20-20-0 2qq. $(NH_3)_2SO_4$	CENTA MIB	Volaton	80-90 qq	1000m seed increase plot. Estimated by J.G.S. and Agent.
CORN	Atiquizaya San Juan Espino.	?	?	?	?	30 qq	Average of 113 farms, predicted yields compiled by local military comandant.

ANNEX A (Continuation)
OBSERVATIONS YIELDS, BASIC GRAIN CROPS

CROP	LOCATION	LAND CLASS	FERTILIZER	SEED	AGRICULTURAL CHEMICALS	ESTIMATED YIELD qq/Mz	OBSERVER AND COMMENTS
CORN	Atiquizaya San Lorenzo	I (Irrigated)	According to Multi-Cultivo schedule	H-3		100 qq/Mz.	Observed in Granary. Dense population. Model farmer in area. Estimated by Agent and J.G.S.
CORN	Texistepeque	III-IV	70#actual N/Ha. 50#actual P_2O_5/Ha	H-3 H-5		40-45 qq/Mz.	Estimate of farmer and agent for area average.
CORN	Texistepeque Cantón Santa Elena.	II	96 actual N/Ha. 96 actual P_2O_5/Ha	CENTA MIB	Soil insecticides and treatment for cojollero. Plowed with oxen.	100-110qq/Mz.	Estimate for 1 Ha. on cooperator's farm plus small plot at agency. Agent and M.D.W.
CORN	Sensuntepeque	V	Little or none	Local	None: To rough or steep for plowing	15-20qq/Mz.	Estimate for steep lands M.D.W.
CORN	Tonacatepeque	III-IV	4.4qq/Mz.20-20-0 4.4qq/Mz $(NH_3)_2SO_4$	H-3 H-5		50-60qq/Mz.	Estimate of agent and President of local cooperative.
CORN	San Martín Cantón El Triunfo.	III	4.4qq/Mz.20-20-0 4.4qq/Mz $(NH_3)_2SO_4$	H-5		50 qq/Mz.	Small farmer probably typical for area M.D.W.
CORN	San Martín	II	Same as above	H-5	Soil insecticides closely follows extension recommendations. Plowed with tractor	60 qq/Mz.	Probably top yield in area farmer estimated area average 45.55 Modern, well-educated tobacco farmer.

ANNEX A (Continuation)
OBSERVATIONS YIELDS, BASIC GRAIN CROPS

CROP	LOCATION	LAND CLASS	FERTILIZER	SEED	AGRICULTURAL CHEMICALS	ESTIMATED YIELD qq/Mz	OBSERBER AND COMMENTS
BEANS	Tonacatepeque	IV	Sulphate	Criollo		12-1Mqq/Mz	Estimate of Agent Salvador Aguilera T.
BEANS	San Martín	III-IV V-VI	Limited	Criollo	Very limited. Includes steep slopes surrounding Lake Ilopango.	14qq/mz	Estimate of former Bean Promoter, Wilfredo Escalante.
BEANS	San Martín	II	1 saco 23-23-0/mz.	Criollo	Followed recommendations of Extension	40qq/mz	Highest yield in area by acre of area's best farmer Agent in Atiquizaya formerly at Ilobasco.
BEANS	"Oriente"	?				16qq/mz	Results of a survey by José Benjamín Meléndez, former bean promoter for normal year in Tierra Alta-Tepetitán.
BEANS	"Oriente"	?				11-12qq/mz	Last years average in Sto. Tomás, San Miguel, San Francisco due to drougth. José B. Meléndez.
BEANS	Candelaria de La Frontera	?				10qq/mz	Average for Candelaria according to Estimate by Bean Promoter.