1977 ANNUAL REPORT

CIMMYT REGIONAL MAIZE PROGRAM

CENTRAL AMERICA, PANAMA

&

THE CARIBBEAN

CONTENTS PAGE NO.

TABLES

CIMMYT
El Batán, México
Marzo 7, 1978.

CIMMYT'S REGIONAL MAIZE PROGRAM FOR CENTRAL AMERICA AND THE CARIBBEAN REGION

This report will summarize activities of the regional maize program for Central America and the Caribbean region for the year ended December 31, 1977.

The report is based upon the work of two CIMMYT maize scientists assigned to work full time for the region.

Six Central American countries and eight Caribbean are participating in the regional maize program. The regional activities are financed through a restricted grant from the Swiss Government.

Dr. Willy Villena D.
Maize Breeder

Dr. Roberto F. Soza
Maize Agronomist - Trainer

1) BACKGROUND FACTS

Population of the region.

Fourteen countries of the Central American and Caribbean region had a population of 30.7 millions in 1973 and of 33.1 millions in 1976 (see Table 1 and 2, end of this report). This population was increasing at more than 3% a year. At that rate the population will double in less than 25 years.

If population is recalculated for 1973-80 at 3% growth rate, we find:

1977	33.2 millions
1980	38.6 millions

Maize is the No. 1 crop.

Maize is by far the largest food crop in the region (Table 1). The ranking of crops (FAO Production Yearbook 1976) is as follows:

Cereal Production (15% moisutre)

Crop	1976 (MT)
Maize	2,108,000
Rice	806,000
Sorghum-millet	642,000
Wheat	49,000
TOTAL	3,601,000

Tuber Production (65-80% moisture)

Crop	1976 (MT)
Cassava	446,000
Sweet potato	205,000
White potato	138,000
TOTAL	789,000

Maize contributes perhaps 60% of the total calories and 60% of the total protein consumed by the population of this region.

Rising food deficit.

This region had a food deficit of more than 1.4 million tons in 1976 (FAO Trade Yearbook 1976):

Cereal Deficit:

Wheat	816,000 MT
Maize	485,000 MT
Rice	138,000 MT
TOTAL	1,439,000 MT

Food deficit were intermittent during the 1960s. In the 1970s the deficit is chronic and rising. (See Tables 3 and 4).

Yields of Food crops have remained relatively static, while both the population and the population growth rate have speeded up.

Previous programs for maize improvement were only moderately successful.

Mexico and Central America are the historic home of maize, yet the average yield for the countries of the region is now about 1,200 kilograms per hectare (Table 4). This is not much above the average of cereal yields dating back to the dawn of human history when cereals were first domesticated.

A predecessor agency of CIMMYT (Office of Special Studies, Secretary of Agriculture, Government of Mexico) began a modest effort in 1954 to distribute improved maize seed in Central America, and provided training for some Central American scientists.

Over a period of two decades, maize yields rose about 30%, and each government in the region can recommend in the 1970s some maize varieties that are better than those of the 1950s.

The type of maize program of the 1950s and 1960s, however, will not enable Governments to increase maize production at a rate that keeps pace with population growth. More staff time and more systematic methods are required. That was the premise on which CIMMYT agreed to undertake a more intensive program beginning October 1, 1974.

2) DEVELOPMENT OF CIMMYT's REGIONAL PROGRAM IN CENTRAL AMERICAN AND THE CARIBBEAN TO IMPROVE MAIZE PRODUCTION.

CIMMYT started in October, 1974, a regional program on maize in the Central American and the Caribbean area serving nine countries. For two years, this

program was funded by the Interamerican Development Bank. From 1976, the Swiss Government provided funds for the continuation of the program, and extending the number of countries to fourteen. The regional program is operated by two scientists posted at CIMMYT's headquarters of El Batán, from where they constantly travel to the countries of the area for consultation and promoting activities described ahead.

METHODS PROPOSED BY CIMMYT

CIMMYT will develop a system in each country in which breeding, agronomy research, seed production, and training are linked together in a logical fashion to constitute the building blocks towards increasing national maize production.

Breeding

Breeding will be done at the experiment station. Experimental nurseries IPTT (International Progeny Testing Trials) will be sent from Mexico for testing. The breeder will cooperate with local scientists to identify and select the best families from each IPTT. Remnant seed of the selected families will be used for recombining them to develop an experimental variety.

Experimental variety trials including different types of maize varieties will be sent from Mexico to be tested at the experiment station twice a year.

Seed of experimental varieties that proved to be superior will be immediately increased locally, at the same time these varieties will be tested on farmers'

lands. The selected variety for commercial production will be increased with selected farmers, while foundation seed will be increased by hand pollination at the experiment station.

Research on farmers' land.

Research on farmers land will develop the appropriate production technology for maize production areas of the country following a system:

Step 1) Evaluation of production factors. This is a preliminary experiment. The object is to detect the main limiting factors of production in the area. This experiment should also be planted in other areas of the country where the program will be moving in the future.

Step 2) Cluster of experiments on farmers' land. The cluster of experiments will include variety trials, levels of fertilizers, insecticides and herbicides. In some programs, soil preparation trials will be included. Soil analysis should be run for each cluster of experiments. Information obtained from the evaluation of production factors will determine which factors should be given major emphasis for study in step 2.

Groups of experiments on levels of the main factors will be studied on farmers' land specifically selected for these trials. The number of clusters of experiments will depend on the size of the area of production, soil and environmental variations and personnel assigned to this job.

Step 3) Demonstration trials. Technological packages assembled from information obtained in Step 2 will be compared with the farmers' technology to accomplish the following objectives:

1) To demonstrate the advantages of the technological package developed for the area of production.
2) To verify the results of breeding research and get the response of the farmers to the new variety.
3) To select the best agronomic practice for the farmers.
4) To demonstrate the new technology to extension service and to serve as a classroom for training extension service personnel.
5) To demonstrate the new technology to representatives of foreign aid agencies posted in the country (IDB, USAID, UNDP, etc.)
6) To demonstrate the new technology to policy makers (Administrators of seed agencies, credit agencies, price support agencies, storage agencies, etc.)

TRANSFERENCE OF TECHNOLOGY

The new technology for maize production should be transferred to the farmers by means of direct technical assistance to them.

Seed production.

The new improved variety should be increased by hand pollination at the exper-

iment station in order to make available fresh foundation seed. Commercial production of the variety should be done with selected farmers or through the national seed production institute.

Workshop.

At least one workshop a year will be held for maize scientists of the region, to review their current trials and discuss their next steps.

Training.

Training courses will be offered both in Mexico and in national programs.

Feed back to CIMMYT

CIMMYT will provide a steady flow of improved maize varieties and technology. Experience has shown that flow is consistent only if CIMMYT staff are working closely with the national programs. The continuous visits of the coordinators to the cooperating countries help in keeping the national programs alive, active, and well-organized in spite of continuous changes of scientists in the local programs. In addition there is a continuous feed back to CIMMYT on the results of the trials. Information about weak traits in a population should be transmitted to the CIMMYT Maize Program where the trait will receive a higher priority for selection.

The Central American Regional Program is a two way strategy: It provides CIMMYT with guidelines for developing new varieties and it provides govern -

ments with new maize varieties.

The two operations are idenpendent.

3) ACTIVITIES OF 1977

The number of cooperating countries in the regional maize production program sponsored by the Swiss government has increased to 14 with the addition of five Caribbean countries.

This year has shown dramatic changes in levels of production in some countries and moderate increases in others.

Visits.

Altogether CIMMYT's two consultants assigned to Central America performed the following travel during 1977.

Central America	Villena visit days	Soza visit days	Total days
Costa Rica	18	17	35
El Salvador	16	8	24
Guatemala	2	-	2
Honduras	36	20	56
Nicaragua	14	19	33
Panama	31	24	55
TOTAL	117	88	205
Caribbean			
Dominican Republic	-	11	11
Haiti	-	5	5
Jamaica	-	2	2
Barbados	3	-	3
Antigua	2	-	2
Dominica	2	-	2
St. Kitts	3	-	3
Trinidad Tobago	2	-	2
TOTAL	12	18	30
GRAND TOTAL	129	106	235

Other scientists on CIMMYT staff spent 93 days consulting with Central American and Caribbean governments during the same period, making approximately 1/3 man-year of staff service within the region during the year ending December, 1977.

Breeding.

At the request of governments, experimental nurseries were shipped to the national programs and the CIMMYT Breeder (Villena) made 15 tours at the request of the participating governments. The objectives were:

1) To visit the Ministries of Agriculture for consulting about their programs of maize production, seed production, credit and price support, and training.
2) To visit their research stations to review their trial plots and to cooperate with local scientists in the selection of superior families from the International Progeny Testing Trials (IPTT). The selected families were later recombined in Mexico to form an Experimental Variety. In addition, selection was made of the best experimental varieties tested and seed of these varieties were sent from Mexico for further seed increase and testing at farmers level.
3) To discuss their national breeding programs and advise the best way of utilizing CIMMYT's material.
4) To promote seed interchange among the countries. Experimental varieties already produced commercially in some countries were sent to other programs in large quantities.

The following maize trials were grown in the national stations during 1977.

Country	IPTT	EVT
Central America		
Costa Rica	2	17
El Salvador	2	11
Guatemala	3	12
Honduras	1	17
Nicaragua	2	10
Panama	2	12
TOTAL	12	79
Caribbean		
Dominican Republic	-	5
Haiti	-	12
Jamaica	-	11
Barbados	-	1
Dominica	-	3
Antigua	-	1
St. Kitts	-	1
Trinidad Tobago	-	1
TOTAL	00	35
GRAND TOTAL	12	114

CIMMYT has observed that:

1) Scientists in the national programs have been acquiring experience in developing experimental trials and have done an excellent job during 1977.
2) Visits by national scientists to other countries' programs in the company of the coordinator has created a spirit of betterment and competition among scientists of the area. Therefore a true net of maize scientists if gaining strength in the region. In general, data from the trials and the quality of insect and disease rating has improved as expected.
3) Selection of superior families out of the IPTT trials has been improved by careful study and observation of the plots in the field.
4) During 1977, fourteen experimental varieties selected in Central America were tested in the EVT (Experimental Variety Trials) and ELVT (Elite Experimental Variety Trials). So far the best performing varieties tested across the world are those selected in Central America.
5) The following varieties are already classified as the best ones and seed is produced commercially. The data was obtained from 17 experiments in Central America. A white hybrid H - 5 regarded as one of the best in Central America was used as check.

Yield Data and Percentage Over the Check of Experimental Maize Varieties Grown in 17 Locations, 1977.

Variety	kgs/ha	% over the checks
La Máquina 7422	4862	101
Across 7422	4692	97
Across 7429	4688	97
Pichilingue 7429	4614	95
Check: Hybrid H-5	4814	100

Gran yield of these open pollinated varieties were similar to that of the F_1 hybrid H-5.

Central American farmers who use hybrids keep the seed for two or three years. The yield loss in the F_2 and F_3 generations amount to 15 to 20%. On the other hand, open pollinated varieties maintain their yield potential; therefore, no losses of yield are expected when farmers keep their seed for planting.

So far the best performing varieties tested across the world are those selected in Central America. Among them: La Máquina 7422 (Guatemala), Tocumen 7428 (Panama), San Andrés 7628 (El Salvador).

New experimental varieties such as Santa Rosa 7624/1 (Nicaragua) and Tocumen 7635 (Panama) tested first time in 1977 have shown excellent performance and have potential for commercial use.

6) CIMMYT's material is already used commercially as open pollinated varieties or as the basis for hybrids.

Variety	Population Source	Country
La Máquina 7522	Mezcla Tropical Bl.	Guatemala
Honduras P. B.	Tuxpeño - 1	Honduras
Tocumen 7428	Amarillo Dentado	Panama - Haiti
NB 1	Tuxpeño 1	Nicaragua
ICTA Tropical 101	Tuxpeño 1 x Eto Blanco	Guatemala
H - 8	Tuxpeño 1 x Eto Blanco	El Salvador
ICTA B - 1	Tuxpeño - 1	Guatemala
TICO V - 2	Mezcla Amarilla	Costa Rica

Other varieties already increased for commercial seed production include Pichilingue 7429 (Honduras), Tocumen 7527 (Panama).

7) Interchange of experimental and commercial seed has been enhanced within the region by the facilities provided by the regional program.

Research trials on private farms.

Research on farmers land has been increased during 1977, as a natural response to the benefits obtained by information obtained from them.

Ten governments have requested the coordinators (Villena and Soza) to organize

research on farmers' land, and to continue collaborating with those already in progress.

Each government has assigned local staff, vehicles and cash budget for the production program. The cost was not provided by CIMMYT.

Research on farmers land has a definite pattern. The system can be recognized when one moves from one country to another. A scheme of the system is shown below:

Research on Farmers' Land

Study of factors of production	Study of level of factors and development of technology of production for the area.	Evaluation of new technology vs. traditional technology

Study of factors of production.

The relative importance of factors that limit maize production are easily detected by means of small experiments (ten treatments) replicated in space within the area. The treatments include a conservative technological package as one treatment, the other treatments include the technological package from which one factor has been deleted at a time, to make the other nine treatments.

Appendix Table No. 5 lists the treatments.

A factor of production does not have the same importance in different areas of

production. An example of such difference can be observed from results obtained in Honduras and Costa Rica in figures Nos. 1 and 2.

Differences are particularly obvious in relation to main factors such as nitrogen and phosphorus application. In Honduras, the most limiting factor is nitrogen (N), while in Costa Rica the main limiting factor of production is phosphorus (P). Variety is a limiting factor common in both countries.

Trials on levels of factors

All Central American countries have this stage of the system already in operation in their production programs. Although differences among countries exist due to the fact that some countries started with more aggressive programs. At the present time all of them are making rapid advances.

Levels of factors are determined and studied in clusters of experiments planted in selected farmers' land. Appendix Tables 6, 7 and 8 show levels and treatments of some experiments involving fertilizers, herbicides and insect control.

So far the coordinators have found:

1) The experiments on farmers land have been well conducted and are comparable to those obtained on an experiment station with the advantage that the information obtained from them will contribute to help solve problems in the area of production. The number of clusters of experiments vary according to the size of the area of production, apparent soil variability and climatic

FIGURE 1 .- Production Factors Evaluation Trial
Honduras, San Pedro Sula 1976, (Average of 6 trials)

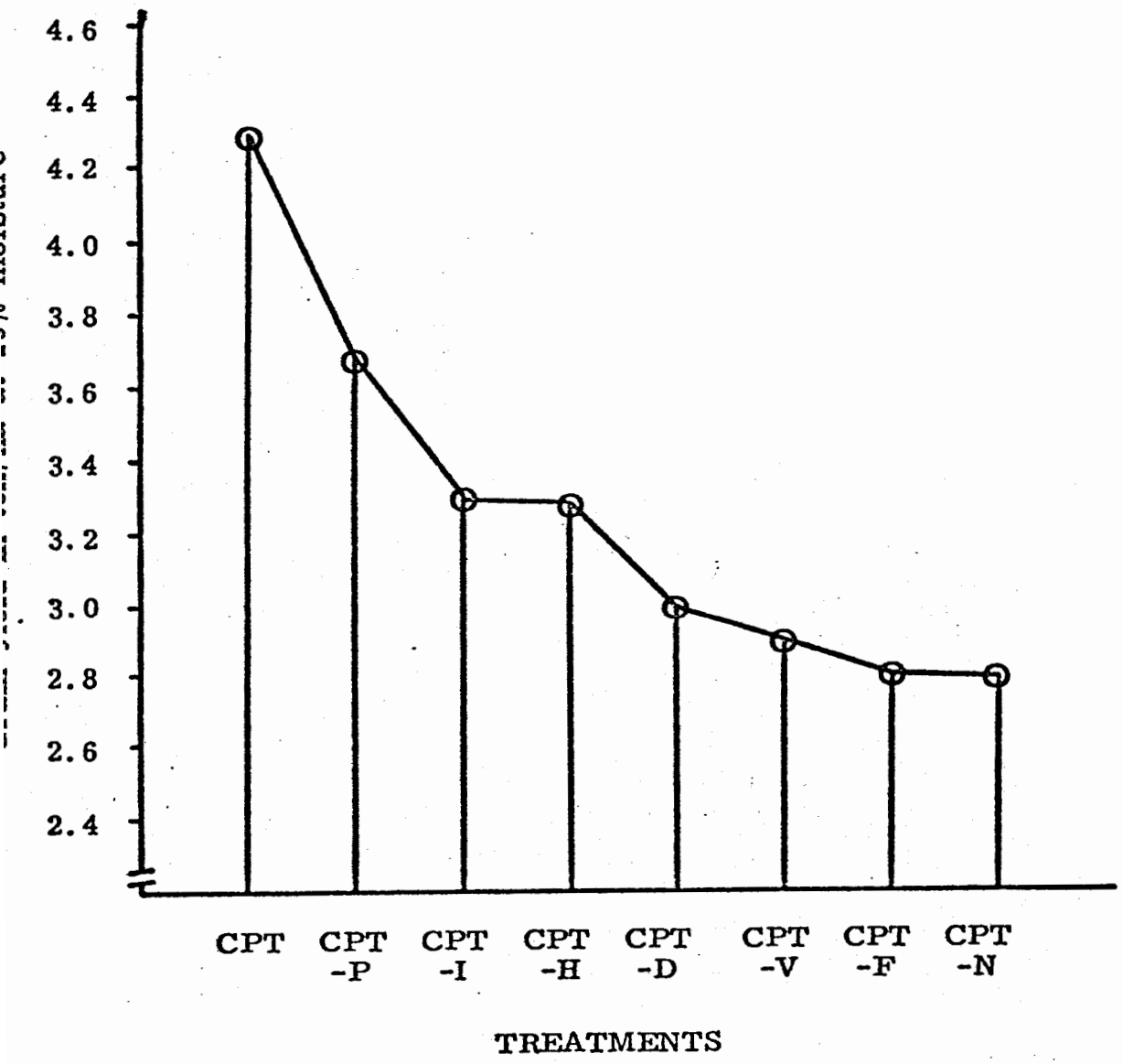
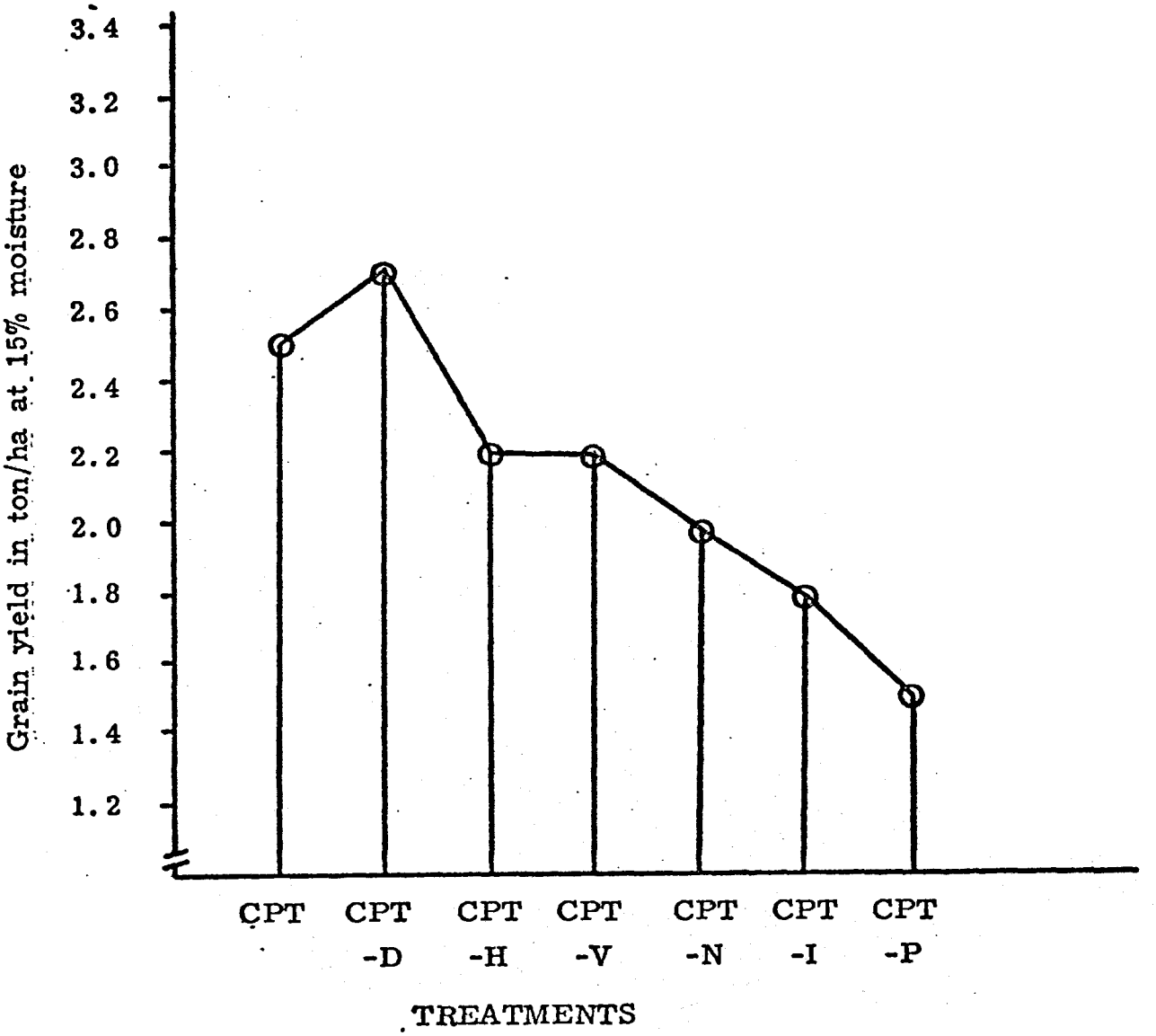


FIGURE 2 .- Production Factors Evaluation Trial.
Costa Rica 1975 (Average of 4 trials)



differences.

2) Data from this experiment are being analyzed. Accumulated information through space and time will aid in developing the appropriate technology for a particular area or modify the generalized type of recommendations used at the present time.

The type of agronomic data required for the experiments and the field book format, have been standardized for the region. The instructions for data recording has been carefully elaborated. This procedure has contributed tremendously for recording meaningful data in a clear manner.

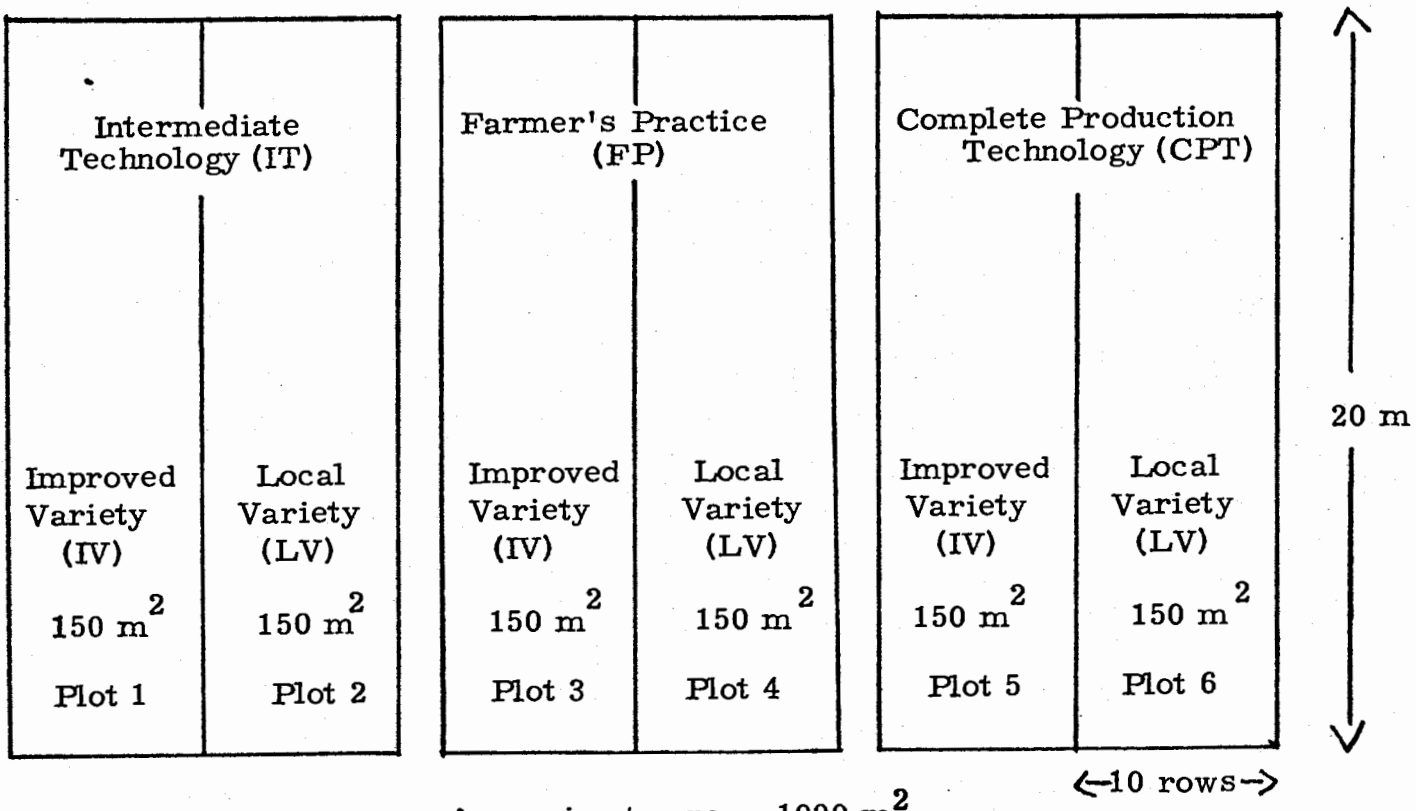
The field books for on farmers' land trials are put together at CIMMYT's headquarters and sent to the directors of national programs at request.

In addition to agronomic data recording, data on costs of production are also recorded. This information allows to select the best treatments, in function of their yield potential as well as in function of their net economic return.

Evaluation of alternatives of production.

The recommended technological package that is already available or that one that has been elaborated by the mentioned procedure, is compared with two other alternatives of production: the farmers technology and an intermediate technology of production.

Hundreds of this type of simple demonstration trials were planted on farmers' fields in all the countries of the region. The diagram of a simple demonstration trial is shown below.



Approximate area: 1000 m^2

The intermediate technology is designed as a function of the difference between the complete technology and the farmers technology.

Table 9 shows the average yields in tons/ha for 138 simple demonstration trials conducted in Central American and Caribbean countries during 1975 and 1976.

Figure 3 shows the same data as histrogram to graphically illustrate the average differences between yields of the six treatments.

The results indicate:

1) Yield of improved variety exceeds the local varieties at each level of technology.
2) The yield differences attributable to the improved variety amounts to 1.5 tons/ha when the complete technology is used. These differences were only 0.3 tons/ha when the farmers practice was used. This data indicates the improved varieties respond much better when combined with higher levels of technology.

Figure 4 shows average net benefit curves for the treatments included in the trial. Variable costs sources were labor (planting, fertilization, herbicide and insecticide applications).

The three levels of technology were defined so as to approximate the actual trial conditions. Taking into consideration the reported technical coefficients and the relative average prices, the variable costs in grain were equivalent to: 370 kg/ha with the farmers practice, 790 kg/ha with the intermediate technology and 1,500 kg/ha with the complete technology.

The data accumulated suggests that:

1) The farmer should not use improved technology with his local varieties, since the net benefits were reduced as the technology levels are higher.
2) When the net benefit curve of the improved variety is observed (between the intermediate and complete technology) there could be several intermediate

FIGURE 3.- Average grain yield of Simple Demonstration Trials 1975 - 1976. (No. of trials: 138).

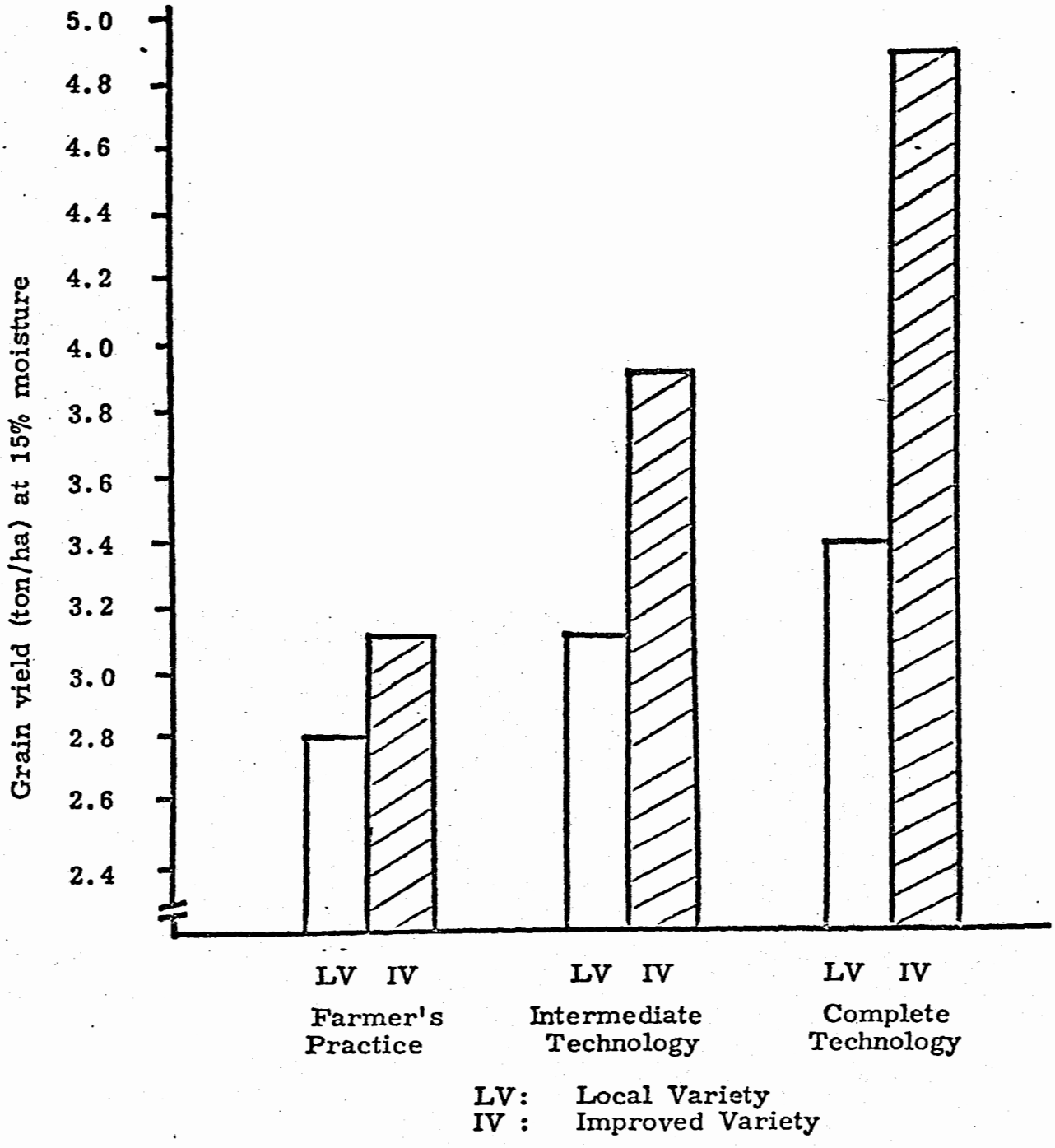
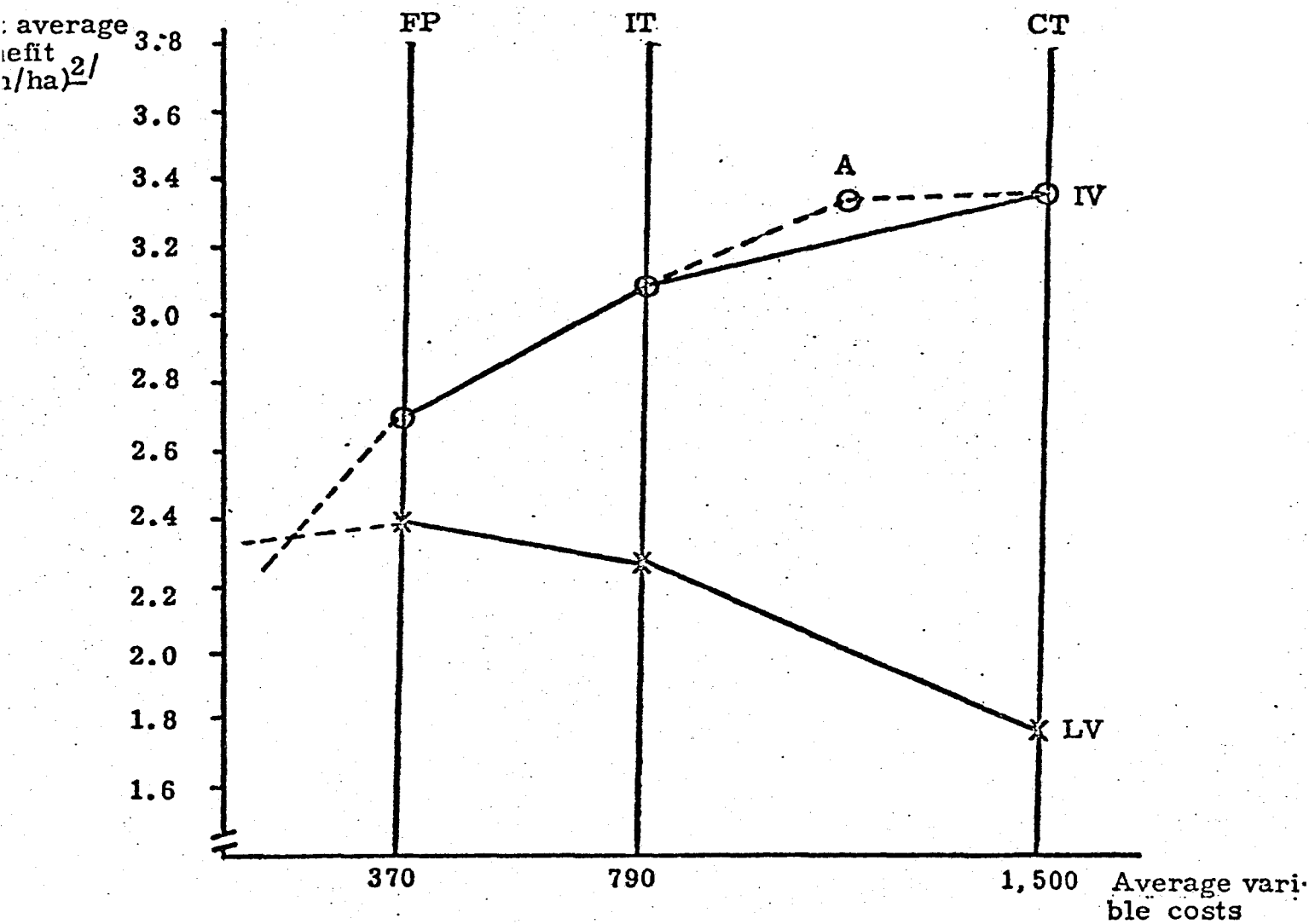


FIGURE 4.- Average net benefit curves for the six treatments of the simple demonstration trial.1/



FP = Farmer's Practice
IT = Intermediate Technology
CT = Complete Technology
IV = Improved variety
LV = Local variety

1/ Average relative prices used:

$$\frac{PN}{P\ maize} = 4 \qquad \frac{P_{P_2O_5}}{P\ maize} = 6 \qquad \frac{P_{labor}}{P\ maize} = 15 \qquad \frac{P_{Insect(i.a.)}}{P\ maize} = 50$$

2/ Costs and benefits are expressed in maize equivalent grain per hectare.

levels of technology (such as point A in the graph) that could produce similar net benefits at lower costs of production.

3) As a consequence of the two previous points it is evident that the technological package could be further modified or refined in order to obtain higher degree of efficiency in maize production.

Very encouraging results on dramatic increase of maize production are already being observed as a result of well organized national programs based on CIMMYT's system of research and transference of technology. An example of an efficient production program is PROMYF* in the area of Danli, Honduras, that through its action, farmers involved in this program have increased from 1.3 tons of grain per hectare to 3.0 tons.

FOUR WORKSHOPS

During April 17 - 23, 1977, CIMMYT brought six directors and one vice-minister of agriculture from five countries of the region to Mexico for a five day workshop. The visitors toured CIMMYT's tropical stations at Poza Rica and Tlaltizapán. Visited CIMMYT's training program and research on farmers land at Poza Rica. Listened to briefings by CIMMYT staff. A general comment made by the visiting group was that this type of workshops should be arranged more often since their results are very effective in promoting and improving maize national programs throughout the interaction of national authorities, policy makers, scientists, economists and CIMMYT's regional staff.

* PROMYF: Programa de Maíz y Frijol (Maize and Beans Program)

From August 28 to September 2, 1977, three directors from Central America and four from the Caribbean countries visited Mexico for a five day workshop. They visited CIMMYT's low land tropical maize stations at Poza Rica and Tlaltizapán, and held two days discussion in CIMMYT's conference room about CIMMYT's approach to research at experiment stations, research on farmers land and transference of technology.

Another workshop was held in Panama, March 21 - 24, 1977. Maize researchers from the region reviewed the 1976 results and made plans for joint activities during 1977. This meeting occurred in association with the PCCMCA annual meeting, in order to save costs. (PCCMCA is the acronym for Programa Cooperativo Centroamericano de Cultivos Alimenticios).

During September 19 to 22, 1977, CIMMYT's regional program and the government of Honduras organized a visit to the maize and beans program (PROMYF) in Danlí. CIMMYT has been cooperating with this national program since it was created. The objective was to show the visitors how a well organized program could produce dramatic changes in maize production. Twelve visitors (Directors of national programs) and five CIMMYT staff members attended the workshop. Discussion was held in farmers land where relevant maize experiments had been planted and also with farmers of the area that had their maize fields grown according to recommendations from information obtained from experiments in farmers land of the area. Yields of the best farmers were estimated at 6 tons per hectare.

Representatives from Panama and Costa Rica requested cooperation from CIMMYT to develop similar programs in their respective countries.

RESISTANCE TO CORN STUNT

Corn stunt is a serious disease in Central America, but not in Mexico. The disease is produced either by a mycoplasm or by a spiroplasm and is transmitted by an insect vector of the of the disease (Dalbulus sp.). CIMMYT is helping Central American research programs to identify and select maize strains resistant to this disease.

El Salvador and Nicaragua are very effective locations to select resistant material. During 1977 resistant strains were already identified. The resistant material will be made available to maize researchers in Central America.

ECONOMIC STUDIES

A CIMMYT economist initiated a maize production survey for the northern part of Honduras in cooperation with the Government of Honduras. For 1978 CIMMYT will provide the regional program with an economist. The economist will work part time in the region to:

1) Develop survey patterns for new areas of maize production.
2) Cooperate with national researchers on handling economic data to determine cost of production and net income to farmers using different alternatives of production.
3) To determine the degree of adoption of the new technology.

TRAINING

Training at CIMMYT.

During 1977 the coordinators of the region interviewed candidates for training in maize breeding or production in CIMMYT, México. Twelve candidates from the region were accepted for a six month training program.

Short training courses.

Dr. Soza was responsible for promoting, preparing and developing short training courses of one week duration.

The objective of these training courses is to prepare local personnel that will be involved in on farm research and transference of technology in national maize programs following CIMMYT's outlines.

Most of the training is of practical nature and includes teaching on how to organize the personnel and the arrangement of materials needed, how to prepare experiments to be grown in farmers land, how to plant and develope these experiments and what type of data is needed to be recorded and the proper way of taking experimental data.

During 1977 three short courses were given in the region as described below:

Country	Date	No. of Trainees
Dominican Republic	May 23 - 27, 1977	40
Panama	August 15 - 20, 1977	42
Nicaragua	Sept. 31 - Oct. 4, 1977	38

Due to the fact that the number of national maize programs is increasing, there is an urgent need for preparing larger numbers of young scientists per country. CIMMYT's regular training program in Mexico will not be able to train all the people required in the region, therefore, CIMMYT thinks that the program in Mexico will do best by training trainers. These trainers in cooperation with CIMMYT coordinators will develop national training programs. Training will be done in close association with the on farmers land research program, which will be used as a classroom and where the trainees will have the opportunity to contribute to the progress of the maize program.

SEED PRODUCTION

Open pollinated experimental varieties developed through CIMMYT's international program are adopted by national programs following proper evaluation on farmers land. These varieties are made available in reasonable amounts to local researchers for local increase. The open pollinated varieties are further increased commercially by farmers of the area or by national seed organizations. It is expected that with proper guidance some farmers may eventually develop small seed commercial companies. As example, Tocumen 7428 experimental variety has been increased in Panama for commercial use. Approximately 140 tons of seed will be avilable and possible some excedent of this seed will be shipped to Haiti. Another example is Hondureño Plant Baja (short plant) which has been increased to 200 tons in Honduras by the farmers.

4) FINAL COMMENTS

The progress made during 1977 in the regional maize program, suggests that substantial positive changes in maize production should be able to be achieved over the next five years.

The Central American and Caribbean Governments have recognized that superior varieties can be obtained through CIMMYT's systematic approach for maize population improvement and that new improved experimental varieties will be available each year for further selection. CIMMYT is the only agency presently providing advise on maize technology. This is proving useful not only to governments but also to international agencies.

CIMMYT's approach for development of appropriate maize technologic packages and transference of technology by means of research on farmers land in the areas of maize production is demonstrating its tremendous value. It is expected that research on this line will produce technological packages with lower costs of production maintaining the yield potential of the variety used, therefore, increasing the net income of farmers.

Training of national personnel at CIMMYT or at local level is urgently needed if we pretend to build up solid maize production programs in the region.

Table 1.
Basic food crops, production and food deficit.
Central America and Caribbean region, 1973

	Population (millions)	Maize (1000 MT) Production	Maize (1000 MT) Deficit 1/	Rice (1000 MT) Production	Rice (1000 MT) Deficit 1/	Wheat (1000 MT) Production	Wheat (1000 MT) Deficit 1/	Sorghum-Millet (1000 MT) Production 1/	Cassava (1000 MT) Production 2/	Sweet Potato (1000 MT) Production 2/	White Potato (1000 MT) Production 2/
Central America											
Costa Rica	1.8	52	-43	90	- 1	-	-81	12	10	-	35
El Salvador	3.8	435	-58	26	- 1	-	-72	153	15	-	10
Guatemala	5.6	760	-65	38	- 2	44	-75	36	7	-	32
Honduras	3.0	336	+ 8	17	- 5	1	-43	42	42	4	3
Nicaragua	2.2	201	-35	81	+ 1	-	-39	44	18	-	1
Panama	1.6	57	-30	165	- 1	-	-45	-	40	-	5
Sub-total	18.0	1841	-223	417	- 9	45	-355	287	132	4	86
Caribbean											
Dominican Rep.	4.8	40	-53	177	-28	-	-121	-	205	97	26
Haiti	4.4	260	-	82	-	-	- 95	216	136	90	7
Jamaica	2.1	5	-110	-	-32	-	-210	-	22	20	14
Barbados	0.2	1	- 5	-	- 7	-	-20	-	1	19	-
Trin.y Tobago	1.0	3	-78	12	-12	-	-97	-	4	1	-
Dominica	0.1	-	-	-	- 1	-	- 5	-	-	-	-
Saint Kitt	0.1	-	-	-	-	-	-	-	-	-	-
Sub-total	12.7	309	-246	271	-80	-	-548	216	368	227	47
Regional totals	30.7	2150	-469	698	-89	45	-903	503	500	237	133

Notes:

1/ Deficit refers to international trade. Minus sign indicates deficit. Plus sign indicates surplus.

2/ Production figures for tubers are green weight with moisture 65-80%, whereas production figures for cereals are converted to 15% moisture.

Source: FAO Yearbooks

Table 2.
Basic food crops, production and food deficit, Central America and Caribbean region, 1976

	Population (millions)	Maize (1000 MT) Production	Maize (1000 MT) Deficit 1/	Rice (1000 MT) Production	Rice (1000 MT) Deficit 1/	Wheat (1000 MT) Production	Wheat (1000 MT) Deficit 1/	Sorghum-Millet (1000 MT) Production 1/	Cassava (1000 MT) Production 2/	Sweet Potato (1000 MT) Production 2/	White Potato (1000 MT) Production 2/
Central America											
Costa Rica	2.0	92	- 15	92	--	--	- 9	36	11	--	24
El Salvador	4.2	463	- 22*	51	- 8	--	- 85	164	20	--	16
Guatemala	6.3	686	- 68	24	- 6	48	- 83	96	8	--	30
Honduras	3.1	289	- 27	26	- 1	1	- 56	47	11	1	5
Nicaragua	2.4	201	- 20	80	+ 6	--	- 41	55	19	--	1
Panama	1.7	55	- 13	111	--	--	- 52	--	42	--	9
Sub-total	19.7	1786	-165	384	- 9	49	-326	398	111	1	85
Caribbean											
Dominican Rep.	5.3	49	- 70	286	- 32	--	-164	19	162	89	30
Haiti	4.6	250	- 4	112	- 14	--	- 87	225	147	92	8
Jamaica	2.1	13	-160	3	- 46	--	-213	--	19	16	14
Barbados	0.3	2	- 11	--	- 7	--	- 17	--	1	3	--
Trin. y Tobago	1.0	4	- 75	21	- 29	--	--	--	5	3	--
Dominica	--	--	--	--	- 1	--	- 5	--	1	1	1
Saint Kitt	--	--	--	--	--	--	- 4	--	--	--	--
Sub-total	13.3	318	-320	422	-129	--	-490	244	335	204	53
Regional totals	33.1	2104	-485	806	-138	49	-816	642	446	205	138

Notes:

1/ Deficit refers to international trade. Minus sign deficit. Plus sign indicates surplus.

2/ Production figures for tubers are green weight with moisture 65-80%, whereas production figures for cereals are converted to 15% moisture.

Source: FAO Yearbooks, 1976.

* Data from 1975.

Table 3.
Maize production and imports,
Central America and Caribbean Region, 1971-73

	Population (1000)						Production (1000 MT)						Maize deficit (1000 MT) 1/					
Central America	71	72	73	74	75	76	71	72	73	74	75	76	71	72	73	74	75	76
Costa Rica	1868	1941	2018	2000*	1968	2014	61	64	52	42	92	86	- 26	- 19	- 43	- 35	- 10	- 15
El Salvador	3573	3698	3828	3968*	4108	4239	377	237	435	353	439	463	+ 41	+ 21	- 58	- 12	- 22	---
Guatemala	5257	5409	5566	5848*	6129	6312	747	666	760	669	683	686	- 13	- 15	- 65	- 72	- 68	- 68
Honduras	2798	2896	2998	3018*	3037	3143	354	290	336	343	363	289	+ 13	+ 8	+ 8	0	- 44	- 44
Nicaragua	2084	2150	2221	2270*	2318	2396	243	131	201	203	192	201	- 1	- 28	- 35	+ 6	0	- 20
Panama	1517	1569	1623	1651*	1678	1725	54	44	57	59	65	55	- 14	- 21	- 30	- 3	- 16	- 13
Sub-total (or aver.)	17097	17663	18254	18755	19238	19829	1836	1432	1841	1669	1834	1790	- 30	- 58	-233	-116	-160	-160
Caribbean																		
Dominican Rep.	4444	4602	4765	4942*	5118	5291	47	50	40	49	53	49	- 13	- 27	- 53	- 67	- 55	- 70
Haiti	4285*	4345*	4410*	4480*	4552	4626	252	257	260	250	250	250	---	---	---	---	- 4	- 4
Jamaica	2038	2079	2120	2075*	2029	2058	5	4	5	10	13	13	- 70	-112	-110	-106	- 17	-160
Barbados	239	240	241	242*	245	247	1	1	1	2	2	2	- 4	- 5	- 5	- 8	- 12	- 11
Trin. y Tobago	1030	1035	1040	1025*	1009	1019	3	3	3	4	5	4	- 42	- 61	- 78	- 59	- 78	- 75
Saint Kitt	62	62	62	63	63	63	---	---	---	---	---	---	---	---	---	---	---	---
Dominica	74	75	75	76	76	76	---	---	---	---	---	---	---	---	---	- 10	- 8	- 8
Sub-total	12172	12438	12713	12903	13092	13380	308	315	309	315	323	318	-129	-205	-246	-250	-374	-328
Total	29269	30101	30967	31658	32330	33209	2144	1747	2150	1984	2157	2108	-159	-263	-469	-366	-434	-488
Rate of growth in percentage	100	102.8	105.8	108.2	110.5	113.5							100	165.4	295.0	230.0	273.0	406.9

Source: FAO Yearbook

* Estimates

Table 4.
Maize production and imports,
Central America and Caribbean Region, 1973-1976

	Crop area (1000 Ha)				Crop yield (Kg/Ha)				Production (1000 MT)				Maize deficit (1000 MT) 1/			
Central America	73	74	75	76	73	74	75	76	73	74	75	76	73	74	75	76
Costa Rica	50	41	65	65	1040	1080	1024	1416	52	42	92	96	- 43	- 35	- 10	- 15
El Salvador	210	211	246	230	2071	1668	1784	2017	435	353	439	463	- 58	- 12	- 22	---
Guatemala	870	562	514	514	874	1191	1328	1335	760	669	683	686	- 65	- 72	- 68	- 68
Honduras	300	322	330	330	1120	1065	1099	876	336	343	363	289	+ 8	0	- 44	- 44
Nicaragua	222	263	210	228	908	772	916	883	201	203	192	201	- 35	+ 6	0	- 20
Panama	67	76	74	74	851	786	877	734	57	59	65	55	- 30	- 3	- 16	- 13
Sub-total (or av.)	1719	1475	1439	1441	1071	1132	1274	1240	1841	1669	1834	1790	-223	-116	-160	-160
Caribbean																
Dominican Rep.	27	29	29	24	1481	1683	1816	2008	40	49	53	49	- 53	- 67	- 55	- 70
Haiti	330	238	238	239	788	1050	1050	1048	260	250	250	250	---	---	- 4	- 4
Jamaica	4	13	13	13	1184	757	998	1000	5	10	13	13	-110	-106	-117	-160
Barbados	1	1	1	1	2800	2614	2614	2614	1	2	2	2	- 5	- 8	- 12	- 11
Trin. y Tobago	1	1	1	1	4677	3923	3921	3132	3	4	5	4	- 78	- 59	- 78	- 75
Saint Kitt	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Dominica	---	---	---	---	---	---	---	---	---	---	---	---	---	- 10	- 8	- 8
Sub-total (or av.)	363	288	282	278	851	1094	1145	1144	309	315	323	318	-246	-250	-374	-328
Regional totals	2082	1757	1721	1719	1033	1129	1253	1224	2150	1984	2157	2108	-469	-366	-434	-488

Notes

1/ Maize deficit reflects international trade. Minus sign indicates imports. Plus sign indicates exprorts. Total deficit is net of imports and exports.

Source: FAO Yearbooks 1973 and 1976

TABLE 5. EVALUATION TRIAL ON PRODUCTION FACTORS

Design — Randomized Complete Block Design.
Replications — 4
Plot Size — 6 x 10

NO. OF TREATMENT	TREATMENT	CODE
1	CPT*	CPT
2	CPT - Less Fertilizer	F
3	CPT - Less Nitrogen	N
4	CPT - Less Phosphorus	P
5	CPT- Less Insecticide	I
6	CPT - Less Herbicide	H
7	CPT - Less Plant Density	PD
8	CPT - Less Improved Variety	IV
9	CPT - Less Soil Preparation	SP
10	Farmers Practice	

* Complete Production Technology.

Design	RCBD.
Replications	4
Plot Size	6 x 10

NO. OF TREATMENT	TREATMENT		CODE
	N (Kgr/ha.)	P_2O_5(Kgr/ha.)	
1	0	0	N_1- P_1
2	0	40	N_1- P_2
3	0	80	N_1- P_3
4	50	0	N_2- P_1
5	50	40	N_2- P_2
6	50	80	N_2- P_3
7	100	0	N_3- P_1
8	100	40	N_3- P_2
9	100	80	N_3- P_3
10	150	0	N_4- P_1
11	150	40	N_4- P_2
12	150	80	N_4- P_3
13	Soil Laboratory Recommendations.		

TABLE 7. WEED CONTROL TRIAL

Design	RCBD.
Replications	4
Plot Size	6 x 10

NO. OF TREATMENT	TREATMENT
1	No Weed Control
2	Absolute Control
3	Farmers Method
4	Pre-Emergence Gesaprim
5	" " Gesaprim Combi
6	" " Gesaprim + Laso
7	" " Gesaprim Flowable
8	Post Emergence 2; 4D

Erradicane
Round-Up

Treatments to be added when high infestation Nut Grass (Cyperus rotundus) occur in the area

TABLE 8 INSECT CONTROL TRIAL

Design	RCBD.
Replications	4
Plot Size	6 x 10

NO. OF TREATMENT	TREATMENT
1	Control
2	Seed Treatment (Systemic)
3	Seed Treatment (Systemic) + 1 Foliar Application (No Systemic)
4	Soil Application (Systemic)
5	Soil Application (Systemic) + 1 Foliar Application (No Systemic)
6	Soil Application (No Systemic)
7	Soil Application (No Systemic) + 1 Foliar Application (No Systemic)
8	Soil Application (No Systemic) + 2 Foliar Application (No Systemic)
9	1 Foliar Application (No Systemic)
10	2 Foliar Application (No Systemic)
11	1 Foliar Application (Systemic)
12	2 Foliar Application (Systemic)

TABLE 9.- Summary of grain yields in 1975 - 1976 Simple Demonstration Trials of maize. (Data in ton/ha at 15% moisture).

Country [1]	Intermediate Technology		Farmer's Practice		Complete Technology		Number of Trials
	Improved [2] Variety	Local Variety	Improved Variety	Local Variety	Improved Variety	Local Variety	
Honduras	3.8	3.1	3.1	2.8	5.2	4.2	73
El Salvador	3.9	-	4.0	-	4.3	-	32
Costa Rica	3.4	2.2	1.5	1.8	3.0	3.0	7
Haitf	4.5	-	4.0	-	5.7	-	21
Jamaica	4.0	3.6	4.0	3.4	5.6	3.4	5
Average [3]	3.9	3.1	3.1	2.8	4.9	3.4	138

1/ When this analysis was prepared the data from the other countries in the region had not been received.

2/ Commonly used improved varieties and hybrids in Central America and the Caribbean countries are shown in Table 4 in the Appendix.

3/ Weighted average according to the number of trials.