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**CONSORTIUM FOR INTERNATIONAL DEVELOPMENT**



ADMINISTRATIVE REPORT No.  
INFORME ADMINISTRATIVO No.

002/77

Colorado State University  
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Texas Tech. University  
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QUARTERLY REPORT OF  
CONTRACT NUMBER GOB/AID 511-92  
BETWEEN  
THE MINISTRY OF RURAL AFFAIRS AND AGRICULTURE  
OF BOLIVIA AND  
CONSORTIUM FOR INTERNATIONAL DEVELOPMENT

Period Reported: April 1, 1977 to June 30, 1977

LA PAZ, BOLIVIA

1

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The following report of contract activities is submitted in accordance with Paragraph IV-A, Appendix B, of said contract.

ACCOMPLISHMENTS

Personnel and Administration

Ministry and USAID approval has been given to Dr. William Brown as a replacement for Dr. Kenneth Ellis since Dr. George Bridemon, who was previously approved, was not available. Two CID nominations of an Agricultural Economist for the Marketing Office were refused by the Ministry. During the year, three nominations for the Soil and Water position as specified in this year's Plan of Work were also refused. These positions therefore cannot be filled as programmed this year.

Dr. Hagen Lippke, Texas A&M University, visited Bolivia to evaluate Animal Research and Training programs in the Valleys and Low Lands (April 5 - May 2).

A program evaluation was made by a CID team consisting of Dr. Clark Ballard (Utah State), Dr. Gary McIntyre (Colorado State) and Dr. Stanley Miller (Oregon State).

Dr. R. L. Smith completed his long term assignment as Research Advisor and returned to the United States (June 1977). He will be replaced by Dr. David James in July.

The CID Campus Coordinator, Dr. James Thomas, and the CID Executive Director, Dr. Bruce Anderson, visited Bolivia to discuss contract progress and initiate negotiations for contract renewal.

#### Agricultural Research and Technology Development

The following report of activities generally represents a cooperative effort between Bolivian and CID technicians which is the intended operational procedure for the project. The following status report of agronomic experiments are identified by letter references as shown in the Technical Plan of Work, CID Administrative Report No. 006/76.

Saavedra. This quarter marked the completion of all field trials at the Saavedra Station. Inadequate or in some cases no plot threshing equipment is available at the station. Consequently this task must be done by hand causing considerable delay in tabulating the results of the various field tests. At this particular time, the soybean threshing is nearly complete, but the task of hand-shelling the peanuts has just begun. Overall, the oilseeds tests were satisfactory this year with some problems encountered due to poor seed quality and at times excessive rainfall. Plot weights are not yet available on any test.

Soya (Ing. Hebert Zurita and Ing. Agron. Zenón Nuñez, Bolivian technicians).

1. Breeding. Due to lack of time during the summer growing season, the crosses planned were not completed. This work is currently in progress using potted plants of the various parental varieties.

Several new introductions were evaluated in observation plots this year and the best will be entered in yield trials in 1977-78. A Brazilian strain UFU-1 looked especially promising.

A large number of plant selections were made in the variety Pelican. The object of these selections was to eliminate varietal mixtures and off-type plants. The seed from these selections was bulked and has been used to plant a seed increase field of approximately three hectares on the station. This planting produced a reasonably good stand but at this time is badly in need of rain. Also Rogelia (Rottboellia exaltata) is very bad in parts of the planting. It is planned to turn over this nucleus of seed to the Division of Seeds for their summer increase if the Rogelia can be satisfactorily extracted.

2. Variety tests. No results available yet.

a. The INTSOY test (16 varieties) was a successful test at Saavedra. Seed of this test was supplied to cooperators at Abanó Izozog, Villamontes, Yacuiba and Chipiriri, but results are unknown.

Taiwan strains (20 strains and varieties) was a successful test.

b. Other yield tests.

1) Group 1 - twelve varieties that have been tested for three years.

2) Group 2 - twelve varieties that have been tested for two years. Stands in both of these tests were so poor that the tests are of little value. The problem is primarily one of

poor seed quality resulting from inadequate storage facilities.

- 3) Group 3 - this test is composed of twelve varieties selected from last year's introductions and are being tested for the first time for yield. This was a successful test.
  - 4) Regional test - a regional test of ten varieties was conducted at Rio Grande in cooperation with Extension personnel and was a successful test.
- c. Planting dates. This is the third year for this test using four varieties (Acadian, Pelicano, Colombia and Santa Rosa) and eight planting dates (from November 15 to March 1). The combined data from these tests form the basis for an article in the proposed Bolivian Agricultural Journal by Ing. Zurita and also the material for his thesis. Yields, plant heights, height of first pod, flowering dates, maturity dates, lodging and other characteristics were measured in these tests.
- Densities. Three planting dates (early, normal, and late) with four between-row and six within-row spacings were used. Only the normal planting date resulted in a satisfactory test.
- d. Herbicide tests - These were successfully carried out by John Tollervey, weed control technician of the British Mission and Saavedra personnel.
- e. Insect collection and identification - Sampling was completed during the quarter with the cooperation of Dr. Charles Ward

and his Bolivian counterpart Ing. Agron. Hugo Serrate.

f. Seed increase - See previous section on breeding.

Peanuts (Ing. Hebert Zurita and Ing. Agron. Zenón Nuñez).

1. Variety tests. Two variety tests were conducted, one test with 12 entries of Chinese origin and the other with 14 varieties mostly of U. S. origin. Stands were satisfactory but yields do not appear to be as high as last year. The soils in these tests were too heavy for good peanut production.

2. Small increase blocks of the following varieties were grown: Perla de Saavedra, Tainang Sel 9, Spancross, Argentine, Spanish and Tanash. Heavy soils and excessive rainfall resulted in rather poor quality seed and below average yields.

Sunflower (Ing. Hebert Zurita and Ing. Agron. Zenón Nuñez)

1. Variety tests - actually three different tests were planted: (1) twelve U. S. varieties, (2) seven Argentine varieties, and (3) a test with four synthetic varieties. Seed for these trials arrived at different times. Stands were satisfactory but yields appear to be quite low.

Sesame (Ing. Hebert Zurita and Ing. Agron. Zenón Nuñez)

1. Variety trial. Thirteen varieties of sesame were used. Stands were satisfactory but yields appear quite low.

Other

A proposed program for oilseeds has been prepared and submitted to CIAT for 1977-78. Whether there will be sufficient financial and personnel support to carry out the program remains to be seen. Herbert Zurita is the

only technician assigned to oilseeds at the present, and because of his experience he is frequently called upon to carry out various other assignments. Zenón Nuñez resigned at the end of May to accept a position with IBTA at Belén.

Rice (Ing. Francisco Paz and Ing. Melvin Pozo, Bolivian technicians).

1. Breeding. As indicated in the last quarterly report, Dr. Manuel Rosero (CIAT/Colombia) reviewed the rice program at Saavedra January 17-21 and recommended that the development of a breeding program be delayed until some basic facilities and equipment were available (CID Working Paper 003/77). Based on his report, drought problems in the plots planted for expected crosses, and the excessive time demands of other phases of the program, crossing were delayed to the winter season or to the next cropping season.

2. Variety comparison. Plots including the same eighteen varieties were planted at Saavedra and Portachuelo. Yields of all varieties were higher at the Portachuelo location than at Saavedra with some yields being twice those at Saavedra. Three of the entries have been selected for seed increase during the next season for possible variety releases in 1973-79 if next year's data supports those obtained this year. These have been tentatively designated as Saavedra 1 (IR-2042-178-1), Saavedra 2 (IR-1480-147-3-2) and Saavedra 3 (IR-1529-430-3). The ten highest yielding varieties at Portachuelo and comparative yield data (Kg/Ha) for Saavedra were: IR-2042-178-1 (8199-4839), IR-1529-430-3 (7302-3758), IR-22 (6623-2638), CICA-6 (6386-4809), IR-1154-243-1 (6363-4748), CICA-4 (5234-3969), IR-2035-353-3-2 (5928-4194), IR-2043-104-3 (5710-4561), IR-1480-147-3-2 (5674-5601), and Dawn-sel (5489-4785). Two of the varieties commonly grown, Dorado and Bluebonnet-sel, yielded 4574 and 4524 at Portachuelo and 1520 and 4132 Kg/Ha at Saavedra.

With the assistance of Ing. Serrate, data were collected on all plots for Diatraea (stem borer) damage at harvest and some differences were found. Based on any evidence of larval feeding whether resulting in significant economic damage or not, these varieties had from 27 - 100 percent of the plants damaged at Portachuelo and from 13 - 93 percent of the plants damaged at Saavedra. The three varieties proposed for release had some of the lowest damage ratings, with Saavedra 1, Saavedra 2, and Saavedra 3 having average ratings of 25, 34, and 26 percent respectively. The taller varieties tended to have the highest rates of damage.

3. Regional trials. The results of the variety comparison trial conducted at Portachuelo were given in Section 2 above. The trial planted at San Pedro was completely lost as the plots had been harvested by the cooperating farmer by the time roads were clear enough for travel to them. Ing. Melvin Pozo was reassigned to the CIAT Extension Service in May and is no longer assisting with regional trials. This change in personnel, coupled with the departure of Sr. Paz, leaves the program without an experienced Bolivian technician.

4. Cultural practices. Demonstration plots were established at both Saavedra and Portachuelo to compare current small farm practices with three levels of improved practices. Three varieties (Bluebelle, CICA-6, and Bluebonnet-sel) were planted and maintained throughout the season at four technology levels--farmer's technology, minimum technology, medium technology and advanced technology. The plots were planted at various seeding rates, distances between hills or in rows, hand weeded or herbicides were applied,

insects were controlled only in the last three levels, and fertilizers added only at the top two levels.

Again yields for all varieties and technology levels were higher at Portachuelo than at Saavedra. Bluebelle was the best yielding variety at Portachuelo with Bluebelle and CICA-6 the best at Saavedra. Average yields (averaging across varieties) were lower (3347 Kg/Ha) in the farmer's technology plots, but almost equal at the other three technology levels (4414, 4238, and 4473 Kg/Ha).

Special plots were established at Saavedra to determine optimum seeding rates for the varieties Bluebonnet-sel, CICA-6, Bluebelle, and C-22. Each variety was planted at seeding rates of 20, 40, 60, 80, and 100 Kg/Ha in a randomized block design with 4 replications. No significant differences were found among seeding rates due to high coefficients of variation (CV = 16 - 27 percent), but yields tended to be higher at the lower (20-40 Kg/Ha) seeding rates and would be much more economical. Bluebelle and CICA-6 were the highest yielding varieties at 4094 and 3926 Kg/Ha respectively. Bluebonnet-sel and C-22 only yielded 2656 and 2304, respectively. All three of the taller varieties suffered yield losses from lodging, but it was much more severe in Bluebelle than in Bluebonnet or C-22.

5. Chemical weed control. These tests were conducted in cooperation with Dr. John Tollervey (British Mission), Dr. Robert Frans (CID), and Ing. Rogelio Villarroel. The first experiment was used to test control systems against an unweeded check and twelve pre-plant and pre-emergence herbicide treatments. Most plots were pure stands of Rogelia. Post-emergence sprays

of propanil at 3.2 Kg of AI/ha controlled this weed unless it was larger than the fourth leaf stage. However, the control quickly broke down when a new flush of the weed germinated. Mixtures of butachlor and isoproturon plus propanil at reduced rates were less effective. All plots needed hand weeding twenty-two days after the post-emergence sprays were applied and, although no obvious visual signs of control by the treatments were evident, time required to weed each treatment indicated these treatments had affected weed numbers. The death of all rice plants in the unweeded check plots and the higher yields in the early treatments indicate the competitive pressure of this pernicious weed.

The screening trial indicated better results of the pre-emergence treatments. The performance of molinate even at double the recommended rate was poor. The failure of the mixture of dimethametryn and pipophos to control Amaranthus resulted in all treatments using these chemicals to quickly break down. Elusine was not controlled at the lowest rate used. Prometryne was the best pre-emergence herbicide used and gave control of all weeds present with the exception of Cynodon; however, it had the least crop selectivity. None of the other 13 pre-emergence herbicides were effective. Weed populations were very variable at the time the six post-emergence sprays were applied and made evaluations difficult. However, no obvious differences between propanil and thiobencarb plus propanil mixtures for control of Commelina was observed (neither were effective).

6. Irrigation trials. These trials were cancelled due to the lack of an operable irrigation system during the planting season.

7. Fertilizer trials. As reported last quarter, none of the special regional fertilizer trials were ever established. However, the results obtained

in the "transfer of technology" plots discussed in (4) above, indicate poor fertilizer responses at Saavedra and Portachuelo.

The fertilizer trial established at Saavedra in cooperation with Dr. R. L. Smith (CID) utilizing the CID provided pure phosphorus and potassium were harvested this quarter. None of the fertilizer treatments resulted in significantly higher yields than those in the unfertilized check plots. Plots treated with 160-160-40 Kg/Ha yielded 2085 Kg/Ha (the highest in the test) as compared to 1850 Kg/Ha in the check plot. Other treatments tended to indicate that a balanced fertilizer application would be superior and in fact the 160-0-0 treatment resulted in a yield of 1,043 Kg/Ha which was significantly lower than the check. Apparently the drought period encountered in late January and early February coupled with the heavy nitrogen application was very detrimental in spite of the supplemental sprinkler irrigation applied. The late initiation of these plots may have affected the results obtained, also.

8. Disease control. No special disease control plots were established due to the low disease incidence encountered during this season. However, rice blast (Piricularia oryzae) was observed to be causing quite heavy damage in some fields during this crop year and fungicide and resistance tests should be continued during the next season. The virus disease hoja blanca and its insect vector, Sogatodes orizicola (Muir), which were identified for the first time in Bolivia during the last quarter, were monitored at Saavedra but no additional spread of the disease was noted. The International Rice Blast Nursery and International Rice Tungro Nursery reports were completed and returned to IRRI this quarter. As previously reported, neither of the tests were infected heavily enough for good resistance evaluations.

The failure to detect plants infected with the Tungro virus would appear to confirm that this disease does not occur in Bolivia.

9. Insect control (These tests were conducted in cooperation with Ing. Hugo Serrate). The first test compared the effectiveness of nine chemical treatments for Diatraea spp. control. Treatments with carbofuran, carbaryl, monocrotophos, and dipel<sup>®</sup> (Bacillus thuringensis), showed the best control with methomyl and hamidop<sup>®</sup> giving intermediate control. The azinphosmethyl and phosnhamidon treated plots resulted in larval populations equal to the untreated check at the fourteen day post-treatment counting date. However, it should be pointed out that the azinphosmethyl formulation used did not form a good emulsion when mixed for spraying and this may have caused the poor results. In spite of the good level of control obtained, no statistically significant differences were observed in yields among the plots at the 95 percent level of statistical probability. However, carbofuran treated plots yielded 3,491 Kg/Ha while the untreated check plots yielded 3,051 Kg/Ha, indicating some possible yield advantage for Diatraea control.

In the second test only seven chemical treatments were evaluated. Some of the more effective chemicals from the first test were included at lower rates of application. However, none of the treatments resulted in significant reductions in numbers of Diatraea larvae by the 15 day post-treatment counting date. Therefore, a second application of the same chemicals were made to each plot, but higher rates of application were used. Subsequent evaluations showed significantly reduced Diatraea numbers in the carbofuran, hamidop<sup>®</sup>, diazinon, and monocrotophos treated plots. The carbaryl

and methomyl treatments were less effective in this test and the treatments with formothion indicated very little effectiveness. Again, in spite of high populations in the check plots and good control with carbofuran, the difference in yields of 726 and 1518 Kg/Ha, respectively, from these plots were not significantly different at the 95 percent confidence level. The very high coefficient of variance for the yield estimates of 47 percent makes it very difficult to obtain significant differences and points out some serious problems in soil uniformity at the Saavedra Station.

Although the third experiment was sprayed with a general spray for Diatraea control to encourage a buildup of other pests, no significant populations developed. Therefore, this test was abandoned.

All other insect studies were dedicated to pest collection and identification, determination of natural enemies, and host plant resistance studies. These results are reported elsewhere in this or other quarterly reports.

10. Seed multiplication. Three hectares each of Bluebonnet-sel, and Bluebelle were harvested, threshed, cleaned, and treated with malathion and fungicides for delivery to the Seed Division. It has been strongly urged by CID technicians that these seeds not be used for planting due to a high content of Rottboella seeds. It is also strongly recommended that seed production plots be moved to a noninfested area in future years even if this involves moving these plots off-station.

11. Other. The two remaining date-of-weeding studies were harvested during this quarter but detailed analyses have not been completed. Preliminary

results indicate differences between the two varieties tested, but both tests show total yield loss without weed control (principally Rogelia). Severe yield losses are indicated if weed control is delayed too long after planting and losses continue unless weeding is continued almost to the harvest date.

Corn (Ing. Florian Rodriguez and Ing. Erwin Ortiz)

1. Breeding. Plots have all been harvested and the data are being prepared for analysis. From the preliminary results obtained and the observations made during the past year on the twelve materials included, several changes are being planned in the breeding program to satisfy the more pressing needs of the area. As previously indicated, the breeding method will be changed from mass selection to a system of half-sibling (or selection familiar) in the varieties Cubano Amarillo, Sintético 10 líneas PD (MS) 6, Amarillo Universal, Tuxpeño p.b., La Posta, and the variety Portachuelo that has been produced by the national program. This will eliminate the white grained varieties Blanco endospermo modificado, Compuesto Opaco, and Tuxpeño O<sub>2</sub>x La Posta; the very variable selection GLS 75 is also excluded and the three selections of Tuxpeño (Tuxpeño p.b. (SM) 3, Tuxpeño p.b. sel and prolificidad C3) are being combined into a single breeding line. Anyone wishing to have basic seed of the selections being eliminated, may obtain them from the station or the national maize program. Due to the additional time required in the half-sibling technique, all lines previously in the program cannot be maintained if any other research is to be conducted.

2. Introduction and comparison of varieties. Tests have been completed on 168 varieties this year. Harvest data have been obtained and materials coming from CIMMYT have been summarized and data sent to CIMMYT for

statistical analysis. No definite conclusions can be drawn as we are still awaiting the return of these analyzed data. However, since CIMMYT changes the entries in these tests every year based on the results obtained, we plan to include the following tests from CIMMYT next year: 13, 14A, 15, Elite 18 and 19, ENZAT (Ensayo Zona Andina Tropical), and the uniform experiments of PCCMCA. Experiment 14B is being deleted because it contains only white grained varieties and producers in this area prefer yellow dents or yellow flints. It is also planned to include a test of "Ensayo Uniforme de Materiales Amarillo Dentados" from various sources, variedad Tuxpeño grano amarillo from INIAP, Ecuador, and varieties and hybrids from Pairumani, Bolivia (Dr. Gonzalo Avila's program) and promising materials included in last years variety comparison trials (the selection Portachuelo will also be included).

3. Regional trials. Were established in eight locations. Plots at San Pedro, Portachuelo, Mairana, Puesto Fernandez, and Okinawa were harvested but the data from San Pedro and Okinawa cannot be used due to various problems encountered. The plots at Valle Grande were lost due to the severe drought encountered during this year. The plots at San Isidro and Masicurí have yet to be harvested due to lack of transportation.

Yields from plots harvested were very variable within varieties due to the varying conditions among the zones such as soil type, rainfall patterns, weed competition, etc. It appears that some varieties will be better adapted to particular zones than others, but additional years data will be necessary to decide which will be best.

The technology demonstration plots planted at Portachuelo, Mairana, Puesto Fernandez, and Okinawa, were essentially lost. Due to various problems

including lack of transportation and loss of personnel, the treatments of herbicides, insecticides, fertilizers, etc., that were to be made on these plots during the season were never made. The demonstration plots at Saavedra demonstrated the value of these kinds of plots in transferring technology to the small farmer if properly conducted and did show yield advantages.

The regional trials are invaluable in the transfer of technology to the farmers and additional support should be given to this program. Detailed instructions for the conduct of regional trials are being written so that extension agents can be placed in charge of trials in their areas and use them as an extension function in future years. Unless additional researchers are added to the corn program, this is the only way regional trials can be conducted in future years if an adequate research program is to be maintained.

4. Weed control. Plots were completed and the best treatments were with Atrazina, Ametrina, and Terbutrina or combinations of the three at rates of 2.5 Kg/Ha of the formulation. Although the data have not been analyzed, it appears that manual weed control resulted in higher yields than chemical control. However, this was probably due to the severe Rogelia problem on the station. Different results may be obtained in other areas. Additional studies are being planned for the coming year in cooperation with Dr. John Tollervey, British Mission.

5. Insect control (these studies were conducted in cooperation with Ing. Serrate and six student assistants from Gabriel René Moreno University). Studies planned for the special plantings were not completed as no significant insect activity was observed in the earlier planted plots and the later planting

failed to germinate properly. The large plot, unreplicated Cogollero control trials indicated that Nuvacron<sup>®</sup> 40% EC applied at 1.0 Lt/Ha gave superior initial control (three days post-treatment) but Sevin<sup>®</sup> 80 percent applied at 2 Kg/Ha resulted in the lowest Cogollero counts at the six days post-treatment count. Both Nuvacron<sup>®</sup> and Sevin<sup>®</sup> were more effective than Endrin<sup>®</sup> 19.5 percent EC applied at 2 Lt/Ha.

In the small plot, replicated Cogollero control trial, Furadan<sup>®</sup> 3 percent G (75 Kg/Ha), Diazinon<sup>®</sup> 10 percent G (10 Kg/Ha), Lannate<sup>®</sup> 90 percent SP (0.3 Kg/Ha), and Endrin<sup>®</sup> 2 percent G (30 Kg/Ha) were the superior treatments for initial control (3 day post-treatment) but were closely followed by Dipterex<sup>®</sup> 80 percent WP (2 Kg/Ha). Probably due to the washing effect of a heavy rain which occurred on the fourth day post-treatment, none of the treatments showed an effective residual as all plots had 21 - 43 percent of the plants reinfested with young worms by the seven day post-treatment counting date.

No detailed results can be given for the Diatraea and Metamasius bilobus resistance observations made on the CIMMYT trials (13, 14A, 14B, 15, 18, and 19) since the data were sent to CIMMYT for analysis and they have not been returned. Plans are being made to expand this work into Master of Science thesis projects for Ing. Florian Rodriguez and Ing. Hugo Serrate. Several special trials are being requested from CIMMYT for these studies.

6. Seed multiplication. Plots were severely damaged by the heavy rains received in January and February and essentially no quality planting seed were harvested. However, we were able to obtain 180 quintales of Cubano Amarillo-sel seed from the mass selection plots and other isolated plots. These

seeds have been promised to the Comité de Obras Públicas for planting in the area of Mairana in 1977-78.

Other seeds such as Tuxpeño p.b., Sint. 10 líneas, etc., are being selected from available sources for production of seed next year.

Sorghum (Ing. Rodriguez, Ing. Ortiz, Ing. Serrate)

1. Variety introduction. Very little information was obtained from this test of thirty-two varieties due to poor seed germination and to almost complete yield loss due to bird damage.

2. Insect and disease resistance. As reported last quarter the ADIN nursery was abandoned due to poor germination. The sorghum midge resistance nursery was also destroyed by heavy bird damage. No future sorghum trials should be conducted unless attendants can be placed at the plots to guard them from bird damage during the daylight hours of everyday during the period of heading to maturity.

Wheat (Ing. Ortiz and Ing. Serrate)

1. Insect control. Two sets of plots have been planted for use in insect control studies. One of these is at Saavedra and the other at the Gabriel René Moreno University Farm near Santa Cruz. A University student will be using these data to satisfy thesis requirements. So far, insect populations have been very low.

2. Chemical weed control. These plots were established at Saavedra in cooperation with Dr. John Tollervey, British Mission, to compare pre and post-emergence treatments of various herbicides.

Toralapa

Potatoes. The report of potato research reflects the combined efforts of Bolivian technicians, Ing. Gonzalo Claure, and egresados Gerardo Caero, Israel Avilés, Rómulo Claure, and Mario Torrez with the CID staff.

## 1. Plant breeding, potato breeding and improvement.

a. A total of 1030 crosses were made, as shown in the following table.

<u>Male parent</u>		<u>Female parent</u>	<u>Quantity</u>
Tunti Imilla	(+)	Sani Imilla	28
Tunti Imilla		Imilla Blanca	190
Tunti Imilla		Alpha	118
Imilla Blanca	(++)	Tunti Imilla	25
Condor Imilla	(+)	Imilla Blanca	216
Imilla Blanca		Condor Imilla	18
Wilahuacalajra	(+)	Sani Imilla	94
"		Imilla Blanca	120
"		Alpha	49
"		Tunti Imilla	83
Imilla Blanca		Alpha	17
"		Sani Imilla	28
Imilla Negra	(++)	Imilla Blanca	27
Zapallo	(++)	Imilla Blanca	1
Wilahuacalajra		Radosa	5
Sani Imilla	(+++)	Wilahuacalajra	1
Wilahuacalajra		Imilla Blanca	10
			1,030

(+) Resistant to Nacobbus aberrans  
 (++) High content of total solids  
 (+++) High yield  
 (++++) High yield and early maturity

The resulting true seed has been extracted from the seed balls and stored in plastic bags. Also, true seed was planted in the greenhouse from self-crosses of Sani Imilla and Imilla Blanca, from which 25 clones were selected for high yields and shallow eyes. There were no crosses made for frost resistance because of chromosome number problems in the frost-resistant parent.

- b. Fourteen selections from the Peruvian breeding program were grown at Toralapa for selection for early maturity. The crosses were between S. andigena and S. tuberosum to develop early maturity in S. andigena. Two of the selections were higher yielding than the check varieties Sani Imilla and Imilla Blanca, but there was no difference in earliness, probably due to (1) the trial being planted late, December 15, (2) not breaking dormancy on the seed potatoes that were harvested only a few weeks earlier. Project leader is Dr. Fermín de la Puente with the Peruvian Agricultural Experiment Station, who was not present at planting time. Also, 14 selections, resistant to late blight (Phytophthora infestans), from CIP and some 160 from the Bolivian collection were planted in an area of high late blight infection. Several of the Bolivian selections displayed medium resistance to several races of P. infestans while four selections from CIP showed high degrees of resistance to one or two

racas of P. infestans, according to Project Leader Israel Avilés.

- c. Approximately 260 clones in the Bolivian national collection were grown, evaluated and harvested on the Toralapa station. They were also grown near Tiraque to evaluate for nematode resistance. The following varieties were considered to have high resistance to Macobbus aberrans:

Wila papa	Puca chaskañahui
Pala pala	Chiar papa
Pitu papa	Jlaca
	Macacho

They were selected for another evaluation next season.

- d. The native and Dutch variety yield trial was planted late. The four top yielding were Runa, Alpha\*, Sani Imilla, and Spunta, respectively. In another Dutch and native variety trial, the yield rank was as follows: Radosa\*, Imilla Blanca, Estima\*, Sirtema\*, Bintje\*, Doré\* and Alpha\*.
- e. Will be covered under 3, a.

## 2. Agronomic Practices

- a. The effects of eight nematicides on the percentage galls on the potato roots and the yield of tubers were extremely variable. The average yield was the same as the yield in

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\*Dutch varieties.

the check plot, but there did appear to be more galls in the check plot than in any of the treatment plots.

- b. Six different rates of an experimental Union Carbide chemical (UC21865) were applied to seed tubers and planted in pots in the greenhouse, 10 pots per treatment, in heat treated soil. The tubers were all taken from mother plants containing nematode nodules on their roots. The incidence of nodules was found to decrease as chemical application increased, but no statistical analyses has been completed.
- c. Tubers from Imilla Blanca and Sani Imilla were greened for 0, 7, 14, 21 and 28 days. There was no effect on the yield of Sani Imilla, and the yield of Imilla Blanca was higher where there was no greening of the seed. We now have three year's data from this experiment, and anticipate a publication by Romulo Claure on this subject.
- d. This is also the third year for plant density studies. The plots were somewhat dry earlier in this growing season; therefore, the better yields were obtained from the larger spacings. There was a corresponding increase in small tubers (50-60 grams) in the closer within-row spacings.
- e. Total yield data are available for the time of harvest-optimum seed size experiment (60 gram seed). As the time of harvest moved from 90 days, in 15-day increments, to 165 days, the average yield of tubers per plant went from 1.15 grams to

794.9 grams for Imilla Blanca. Yield data for the other native variety, Sani Imilla, was similar. The same yield data for the two Dutch varieties for from 75 to 150 days, as follows:

Alpha 45 gr to 662 gr per plant

Radosa 97 gr to 637 gr per plant

- f. The testing of preplant incorporated, preemergence and post-emergence herbicide applications in comparison with hand weeding control was completed. An inadvertent hand weeding of all plots negated the pre-plant and preemergence applications. Metribuzin applied postemergence gave 90 percent control. Yield variability was high among plots (average 29 percent) which is related in large part to soil variability at the station. However, higher yields were associated with better weed control practices. The check plot yield was 5.2 metric tons per hectare and the two postemergence application of Metribuzin yielded 5.2 and 5.5 metric tons per hectare. There were significant differences in yields among treatments.
- g. The consortiated planting trials have been completed and excellent data are expected. Only potato data are available now due to the slowness in drying barley and habas. These trials should provide excellent data for small farmer cultivation systems.
- h. Data from the national potato fertilizer trial on Toralapa show good response to phosphorus fertilizer with a trend toward

higher yields at the higher levels of phosphorus. The trials at Chinoli were lost due to extreme drought.

Other fertilizer trials at Toralapa on Imilla Blanca potatoes involved fertilizer source, placement residual, and potassium level trials. A preliminary analysis of the fertilizer source data resulted in a 10-fold increase in total yield by adding fertilizer, compared to no fertilizer. Also, yields from two of the supply sources were significantly lower at the 1 per cent level than yields from the other three sources. No significant differences in yield were obtained by placing the fertilizer in a band about five cm below the seedpiece, compared to the regular practice of scattering the fertilizer in with the seedpieces. There was a significant difference in stand-count, but not enough to affect the outcome of the treatments. Results from the residual fertilizer trial show very high variation among replications, except where no phosphorus was applied. This trial was especially dry in the early season. The potassium level trial was also very dry early in the season and was planted late. There were no apparent differences due to treatments.

3. Regional trials. Regional variety trials using eight Dutch and three native varieties were carried out in five locations, close to the following towns: Cliza, Capinota, Mizque, Aiquile and Quillacollo. Trials in the last three locations were lost due to drought and/or terrible infestations of weeds

and insects. Good yields were obtained from Cliza and Capinota, but the data are not summarized.

Regional fertilizer trials were conducted in nine locations: Vacas (Ouispe Rancho), Vacas (Chihuahuaque), Independencia, Totora, Sacaba (Quimza Mayo), Sacaba (Aguirre), Mizque, Aiquile and Capinota. The trial at Mizque was lost due to weeds. Soil phosphorus levels ranged from 9.3 ppm at Aiquile to 11 ppm at Vacas. Good responses to phosphorus were apparent in most of the trials, but the data are not yet analyzed.

#### 4. Production of Basic Seed

- a. Single tubers were selected for planting and were harvested this season for indexing and other testing procedures as well as for increase.
- b. Clonal selection - Nothing new to report.

#### 5. Special Studies

- a. The Bolivian clonal collection, grown in two areas, was evaluated during the season for resistance to Nacobbus sp. and Phytophthora infestans. The 56 clone samples sent to the U.S.A. have not been analyzed to date for amino acids, due to the high costs of this analysis. The search is continuing for a laboratory with lower costs.
- b. Israel Avilés has been working on species identification of the Bolivian collection, but chromosome counts have not been made, to date, due to the lack of orsein dye that cannot be obtained in either Bolivia or from CIP. It has been ordered by CID from the U. S.

Specific gravity determinations of tubers are being done by the brine method on tubers from the residual fertilizer trial and the late blight resistant material from CIP.

This year all experimental plots at Toralapa were treated with TEMIK 10G<sup>Ⓟ</sup> for nematode control. The average yields for the station appear to be substantially higher than last year despite extremely dry conditions during the first half of the growing season. The control of nematodes is believed to have permitted near maximum use of available water during the early season and thus contributed to the higher yields.

### San Benito

#### Wheat

The cereals research activities reported herein reflect the collaboration of Bolivian technicians Inq. Jaime Salamanca, René San Martín, and Alberto Córdova, and the CID technical staff.

#### 1. Plant Breeding

- a. Wheat Crosses - The wheat crosses were completed this quarter. A total of 190 crosses were made at each of two different dates. These crosses were generally between improved varieties selected from previous years introductions and "criollo" varieties. This material plus existing crosses should bring the total number of crosses in all generations to about 440.
- b. Selections have been made from approximately 1350 variety introductions. The final count is not available yet but it looks like not more than 30, out of the 1,000 or more...

have the characteristics necessary for a good variety in Bolivia.

- c. The comparative yield trials have been harvested. No yield data are available yet due to a lack of personnel to complete threshing of the wheat.
- d. Less than a fourth of the regional trials were harvested, but two yield data are yet available. Trials lost was because of drought.
- e. Production of basic wheat seed suffered considerably from the drought and no irrigation water.

## 2. Agronomic Practices

- a. & b. Soil preparation and crop rotation experiments were lost due to drought.
- c. Weed control - One of the experiments was lost because of drought and also the inadequate selectivity of the herbicide. A second experiment using an experimental herbicide (dichlofop - methyl + 2.4-D) applied postemergence, gave effective weed control. Yield data are not yet available.

## 3. Special Studies

- a. Rust race identification.
- b. Identification of virus vector in wheat.
- c. Identification of smuts.

These three projects were not completed again this year for lack of equipment (laboratory, greenhouse, equipment, etc.). However, Fabián Crespo

of his own initiative did initiate the renovation of an unused room at the station for a plant path laboratory.

### Barley

#### 1. Plant Breeding

- a. Variety introductions - The plots at San Benito have been harvested but not weighed yet.
- b. & c. Comparative yield trials and crossing blocks. Comparative yield trials at San Benito and Tiraque have been harvested but not yet at Toralapa. There was some confusion as to who was in charge of this project after Fabián Crespo was transferred to strictly plant pathology. As a result, the crossing and disease evaluation suffered. Some work was done in disease evaluation but these data have not been tabulated.
- d. The regional variety trials have been harvested with the exception of Toralapa, but not weighed.
- e. Basic seed production plots of San Benito 75 and Promesa have been harvested. The Promesa plots suffered from poor irrigation.

### Oats

#### 1. Plant Breeding

- a. & b. Variety introductions and yield trials have been harvested. The variety introductions with the exception of 1 or 2 varieties should all be discarded due to susceptibility to stem rust. Yield data are not available yet.

- c. & d. Seed production and regional trials have been harvested. There should be adequate seed for the Seed Division to make increases this coming year. No data on yields are available.

### Fruit

The peach harvest was completed this quarter. Station total sales amounted to about \$b. 340,000.00.

An additional 1,000 strawberry plants of the Quinolt variety were received. Five hundred plants were planted in the nursery at San Benito and the remaining 500 were planted in two regional trials.

Plans were initiated to purchase several temperature recording meters to be located throughout the Cochabamba valley. Data from these meters will be used in the programming analysis of potential apple and peach varieties.

### Other Research Activities

The weed investigation work of Dr. Robert Frans ended this quarter. He has completed his NSF grant and his consultation with CID. A complete report of his activities and the results of his research is being prepared for publication as a consultant report. In addition, a herbicide recommendation pamphlet is being prepared in collaboration with Mr. John Tollervey of the British Mission and Ing. Raúl Lara of MACA.

A 5-year research and development plan of work for potatoes was completed this quarter by CID personnel. The working paper will be circulated for comments after which a final version will be developed.

A survey of nematode types was made by Bolivian and CID technicians in the areas of Belén and Patacamaya. The Globodera rostochiensis and Nacobbus aberrans

types were found. This is part of the International Meloidogyne collection program in which Bolivia is participating.

CIMMYT representatives visited Bolivia and reviewed the corn research program with Ing. Torrico and CID technicians.

Dr. Ward attended the annual meeting of the American Society of Entomology. Enroute he toured the facilities at CIMMYT and CIAT and discussed research needs and areas of possible collaboration with Bolivia.

A review of the Entomology program at San Benito was made by Dr. Ward in collaboration with Ing. David Villarroel. Plans were discussed for a National Entomology Conference.

With the assistance of George Hoover, USAID Engineer, progress has been made on establishing the electrical line to Toralapa and improving the entrance road to the station. Calculations were made of the electrical requirements of the station and the line distance from Tiraque. The line will be extended to Toralapa when the main line reaches Tiraque.

Dr. Hagen Lippke, Animal Scientist from Texas A&M, reviewed annual research programs in Cochabamba and Santa Cruz and University teaching programs. He recommended a sequential research strategy and suggested increased emphasis on University training.

#### Supplemental Research

Soil Fertility. Harvest of all plots related to the national fertility trials was completed as were the residual fertilizer rotation study at Toralapa. Data analysis is still in progress.

Insects and Diseases. Collection and labeling of insects in the project area continued. Some insects sent to the U.S. for identification were returned. However, progress on the National Insect Collection has been slow since the necessary space, equipment, and financial support has not been forthcoming.

The progress on pest management research was reported in earlier sections of this report.

Slides for insect identification and preparation of extension publications and oral presentations have been sorted and labelled. These will be duplicated for agent use and then screened for extension publications.

The final draft of a publication by Dr. Ellis and Ing. Segundo Alandia on potato diseases was submitted for publication. Also, the initial draft of an index of identified crop diseases in Bolivia was submitted to the Ministry by Dr. Ellis.

### Extension Technology

#### 1. Administration and Policy

CID extension advisor reviewed all of the five volumes of the proposed programs, and policies and procedures handbook being prepared by IBTA with the assistance of IICA and gave his suggestions.

The CID Advisor participated in an extension supervisors meeting held in Sucre. The meeting was concerned with extension policy matters. The final draft of the recommendations resulting from the meeting is expected next quarter.

#### 2. Training and Supervision

The CID advisor participated in the following training and supervisory activities during the quarter:

a. Assisted Lucio Antezana of MACA Extension, and Guido Mansilla, Faculty of Agronomy, San Simón University, in a training workshop in Cochabamba for agents, researchers and regional directors of IBTA. The workshop discussed the roles of extension and research, program planning and determination of work priorities.

b. Worked with Extension supervisors in both Cochabamba and Santa Cruz at least once each month. In addition, he spent several days in field work with agents in Cochabamba.

c. Participated in a farm management and credit workshop for BAB and Extension agents organized by Isaac Torrico, USAID. Approximately 50 were in attendance.

A list of subject matter topics was received from Bolivian research technicians which could be used for presentation at campesino short courses. However, a definite policy has not been made by the Ministry with respect to whether or not research technicians will serve also as subject matter specialists. This decision needs to be made before this program phase can go forward.

### 3. Dissemination of Information

No new research or extension bulletins were published this month. None of the manuscripts submitted to IBTA last quarter have cleared the review process. Three manuscripts on potatoes submitted previous to last quarter were returned to the authors for final revision.

One issue of the monthly extension newsletter was published. A major factor in publication delays this quarter was the absence of the Ministry Editor who took leave for several weeks and then left Bolivia for additional training.

About 100 tape cassettes were received this quarter and information will be recorded for presentation to campesinos.

a. Technical reference manuals

- 1) Farm management. Four chapters were published as a CID Working Paper for use at the Farm Management and Credit Workshop. The manuscript has been given to IBTA for final publication and distribution to extension agents.
- 2) Weed control. Dr. Robert Frans prepared a weed control manuscript which was published as a CID Working Paper for use in his short courses. The manuscript is being reviewed by IBTA for publication by their agency.
- 3) Insects. This work was delayed at the request of the CIAT Director. He has given first priority to summarizing and publishing the station research results.
- 4) Crop diseases. The preliminary draft of a manuscript which lists crop-diseases identified in Bolivia was given to IBTA for review.

A meeting was held with the Director of the Mennonite Extension Program and available published materials were distributed.

4. Program Planning and Evaluation

The CID technician has been asked to collaborate with Gonzalo Romero of the Planning Office to develop a system for personnel evaluation and program planning for IBTA personnel. Forms previously developed by the CID technician will be used as a basis for this program.

The socio-economic survey of Santa Cruz planned for this quarter had to be postponed. Extension agents were used by USAID and the Ministry Statistics Office to collect data for their farm survey.

### Other Programs and Activities

#### 1. Seed Cleaning

Considerable interest has been expressed in this program for the coming season. Extra hand screens for wheat are being made for use by Extension agents in the Cochabamba area.

#### 2. Range Trials

Several sites were visited this quarter to see the range cages. Some campesinos are willing to cooperate in fencing larger areas for controlled grazing. This program is suffering because of lack of Bolivian support since it is not included in the priority projects as defined in the IBTA/IICA program documents.

#### 3. Youth Programs

A youth program planned for May was not held for lack of support from the National Office. Supervisors for youth programs have been appointed in three departments.

#### 4. Other

The CID technician visited the San Julian Colonization project. The project has its own agents. CID will continue contact with Harry Peacock to develop means of collaboration.

The CID technician is collaborating with an extension agent in the study of potentials for tuna production in Cochabamba. The plant grows well, the

product is well priced and the plants can serve as fencing to control grazing and erosion.

Selected vegetable seeds have been ordered from the U. S. for distribution to campesinos for home consumption.

#### Sector Management

The CID technician has completed all required phases of the 1976-77 work plan, has authored or co-authored several additional reports, three of which have been translated and released by OPS, MACA (three more are in process).

#### Agricultural Planning

1. Work on the sector model progressed during the quarter. An English summary of an initial linear programming model was published and was reviewed by MACA, USAID, and CONEPLAN. A Spanish version of the summary was submitted to the Director, OPS, but the final translation has been delayed. A decision was made to extensively revise the model with the consultant help of Mr. Bruce Brown, who worked on the initial model. Suggestions were received from Mr. Lee Johnston, USAID advisor on the rural survey currently in progress. In-country computer programming will be assisted by Mr. Lawrence Greenberg, Computer Programming Specialist, on a consulting basis. Revision of the linear programming model will begin next quarter. Contacts were also initiated with Dr. T. Carroll and Dr. H. Riley of the sector simulation group at Michigan State University. Suggestions were obtained for evaluating the Michigan State approach for use in Bolivia.

2. Nothing new to report.

3. The CID economist reviewed the agricultural policy study and associated section of a draft report by the Harvard Mission (Musgrave) on fiscal reform. He also assisted R. Sanz Guerrero of CONEPLAN and J. Rodríguez of Finances in the preparation of a written and taped response which they carried to a seminar with Dr. Musgrave in Cambridge.

#### Economic Studies

1. All studies have been previously identified.

2. Work plans were previously developed for technicians of the Office of Planning. Included were a study of corn, an analysis of crop comparative advantages, and projections of supply and demand. The first two of these have not progressed satisfactorily due, in large part, to continual shifting of personnel assignments within the Office.

3. The wheat substitution study was previously completed by the CID economist and submitted to the Director, OPS, for his review. No response has been received.

4. No OPS study manuscripts, except those prepared under partial authorship of the CID economist, have been submitted for CID technician review.

#### Statistics

1. Nothing new to report.

2. The CID technician held several meetings with H. Nogales, Head of MACA Statistics Section and with USAID consultants regarding proposed computer capacity for the Ministry. This work will progress further next quarter with work on the sector model and discussions with computer specialists. It is obvious now that a first requirement is the services of a Bolivian, full-time

programmer. The alternative for "hardware" capability are: (1) a "smart" terminal and a line printer (if the Ministry decides to connect with the central capability of CENACO) or (2) an independent Ministry system based on the outright purchase of a mini computer.

### Training

Training activities continue to be an important part of CID/Bolivia technician relationships. The following are some of the specific activities which are reflected in the summary in Table 1 (excluding the extension activities already reported):

1. Two formal short courses in Weed Science were presented at the University of San Simón and the University of Gabriel René Moreno by Dr. Frans. He was assisted in Santa Cruz by Mr. John Tollervey and Ing. Roberto Unterladstatter of the Faculty of Agronomy. Approximately 50 students and faculty members attended in Cochabamba and 30 in Santa Cruz.

2. Dr. Ellis assisted in the presentation of a formal course in Plant Pathology at the University of San Simón. He collaborated with a member of the University staff.

3. Mr. Walker consulted with members of the Soil Department Faculty at the University of San Simón. He reviewed two student thesis projects; initiated a project outline for drainage and reclamation of soils on La Violeta and discussed course materials with various faculty.

4. Dr. Ward presented a two-hour seminar at Gabriel René Moreno University on pests of sorghum and corn.

Table 1. CID training activities - April 1, 1977 to June 30, 1977.

	Formal Credit Courses		Short-Term Courses		Seminars		Informal Training		In-Service Training		Supervisory Training		Campesino Meeting & Short Courses		Exp. Station Field Days	
	No. Attend.		No. Attend.		No. Attend.		No. Tech.		No. Tech.		No. Tech.		No. Tech.		No. Held	
	TQ	YTD	TQ	YTD	TQ	YTD	TQ	YTD	TQ	YTD	TQ	YTD	TQ	YTD	TQ	YTD
Tech. Development & Sector Mgt.	-	-	-	22	-	26	52	212	20	79	-	91	-	-	-	-
Extension	-	-	-	-	52	237	27	628	106	207	-	3	20	79	-	2
University	20	167	80	80	40	60	-	-	11	11	-	-	-	-	-	-

TQ = This quarter  
YTD = Year to date

OTHER ACTIVITIES

<u>Number Student Thesis Supervised</u>		<u>Studies Conducted in Collaboration with University Professors</u>		<u>Studies Recommending Improved University Curriculum</u>		<u>New or Substantially Improved Courses</u>	
TQ	YTD	TQ	YTD	TQ	YTD	TQ	YTD
10	13	4	5	1	1	-	-

5. Dr. Ward also participated in training session for CIAT Extension agents in which he discussed the identification and control of pests in soya, wheat, and rice.

6. CID technicians assisted in thesis direction of 10 students during the quarter. One student thesis was completed.

7. One weekly seminar was held at Saavedra, and two at San Benito during the quarter. However, both seminars suffer from lack of interest on the part of Bolivian technicians. The San Benito seminar was cancelled due to lack of attendance which reflects an absence of professional interest. The Saavedra seminar is still scheduled but is experiencing problems.

8. CID personnel assisted in nomination and preparation of Francisco Paz to go to CIAT/Colombia for short term training. He is being supported by a CIAT/Colombia beca. Plans were also formalized for the three-month training program for Simeón Rodríguez to work with Dr. Anthony Hatch in Colorado.

Response to IBTA/CID invitations to prepare articles for the proposed Journal of Bolivian Agriculture has been disappointing. To date, only five of the nine articles requested have been received.

#### Project Related Publications

1. George A. Root and Robert Voigt. Pesticide Control and Plant Quarantine in Bolivia. Short Term Consultant Report. CID Working Paper 006/77.
2. Robert Frans. A Short Course on Weed Science. CID Working Paper 009/77.
3. Hagen Lippke. Short Term Consultant Report. CID Working Paper 010/77.
4. Larry K. Bond. Farm Management - A Guide for Extension and Credit Agents. CID Working Paper 011/77.

5. Kenneth Ellis and E. Boyd Wennergren. Five-Year Work Plan for the Bolivian Center for Potato Research. CID Working Paper 012/77.

6. LeBaron, Allen, B. Brown and R. Ortiz. Estimaciones de la Distribución de Ingresos Familiares Rurales y Urbanos en Bolivia. Documento de Trabajo Serie E: Estudios sobre Estructuras Económicas y Sociales No. 1. OPS, MACA, Mayo, 1977.

### PROBLEMS ENCOUNTERED

#### Administrative

1. We continue to experience serious problems with the Aduana as reported last quarter. No solution has yet been found.

2. We have been informed by the Minister of Interior that all incoming technicians will be required to have local physical examinations and a statement of good conduct from the local Police. Both requirements seem unnecessary for newly arriving personnel who have just received medical checks in the U.S. per contract specifications and could not have a record with the local police since they are just arriving.

#### Program

1. The problem of counterpart funding in the Planning Office persists. We have heard that the funds have been approved but to date we have received no official notice.

2. Delays in construction and procurement of vehicles and other equipment under the 053 Loan continue. The effectiveness of the contract will be significantly reduced unless these physical needs are forthcoming this year. Furthermore, CID personnel are not being informed of the programming requests related to the 053 Loan.

3. We have received word that the State of California will accept up to four Bolivian technicians for training in Plant Quarantine and Residue Analysis. There will be no cost for the training. The costs of travel and in-country living will have to be paid by Bolivia. No nominees have been proposed by the Ministry.

4. Publication of research and extension materials continues to be a problem. The MACA editor has been away for about four months and no one else is available to supervise the work. We need immediate attention to this problem since the planting season will soon be here.

5. There is a critical problem in much of the agronomic research being conducted at the research stations under CID concern which relates to the control of agronomic variables. Quality agronomic research requires control of all variables possible in order that the true response of the variable under study can be observed. Among the critical (and controllable variables) are soil moisture, disease, insects, and weeds. In the past we observed corn lodging trials invested with corn stem bore which weakened the corn and negated the trials. Similar uncontrolled conditions were observed with potato research a year ago. Consequently, this season all potato trials at Toralapa were treated with TEMIK for nematode control. Interestingly, average station yields this year appear to be higher than last year despite the poor growing season and lack of rain. Recently, new land has been cleared at Saavedra for agronomic trials. However, the land is not level and is not suitable for quality research since the soil moisture cannot be held constant (this is a problem in several other areas at Saavedra). This land must be levelled for suitable research. Also

irrigation facilities must be developed at both Saavedra and San Benito to insure adequate and consistent moisture availability. At issue is the quality of agricultural research. In order to develop accurate research information, improved control of the agronomic variables is required and this will necessitate adequate and timely annual budgets plus investments in station development.

6. With respect to item # 5, the 053 loan construction and procurement program is desperately behind schedule. We also learned for the first time this quarter that materials were being ordered for irrigation systems at the stations without consulting CID personnel and without a planned system of irrigation. This request has been delayed pending the design and specification of the proposed systems but one agronomic year will be lost.

7. The seminar series at San Benito has been discontinued due to lack of interest and attendance by Bolivian technicians.

8. After approximately two years of experience, we feel the program strategy of the CID contract should be refined and given a narrower focus. Within a few weeks, we will submit such a proposal for Ministry consideration.

9. The fiber glass donated by CIP for the Toralapa greenhouse still has not been cleared by MACA through customs.

10. The transportation problem at Saavedra continues. Only limited numbers of motorcycles were available for three weeks during the quarter.

11. An adequate seed storage facility at Saavedra is still a critical need if quality seed is to be maintained.

12. The delivery of funds through the new IBTA system has improved but there are still problems. CIAT has experienced delays in the arrival of funds and

technicians have not been paid on time. Stations in Cochabamba report delays in receiving funds from the sub-treasury who appears to disburse funds to IBTA.

13. Electrical supply problems continue at both Saavedra and Toralapa. No electricity was available at Toralapa for three weeks this quarter. Hopefully, the Toralapa problem will be solved with the extension of the electrical line from Tiraque. The access road at Saavedra remains a problem with another rainy season approaching.

14. There is an urgent need to identify and dispatch Bolivian technicians scheduled for Master's degree programs unless the September 1979 fund disbursement date can be extended.

15. The wheat disease research at San Benito cannot be carried out due to inadequate physical facilities. The existing greenhouse does not provide adequate control of temperature and humidity. CID has ordered minimal laboratory supplies for virus and rust identification work. The 053 Loan calls for construction of a new greenhouse. Fabian Crespo has training in Plant Pathology and can work effectively with the CID Plant Pathologist. But already two years work has been lost and unless attention is given by IBTA and USAID to these physical needs, no work will be accomplished this year.

16. The lack of coordination and stability in the assignment of technician responsibilities at Saavedra make it impossible to maintain adequately directed research programming.

17. In recent evaluations of the CID contract by USAID and CID Central Office personnel, it was recommended that the Co-Director concept, which was previously accepted and made a working part of this project, be redefined or

abolished as a working procedure. In verbal discussions with the CID evaluation team, both USAID and MACA representatives concurred. This leaves contract technicians without clear guidance as to their responsibility and authority relative to program matters. A statement on this matter by USAID and MACA is urgently needed for effective contract operation.