

PD AAJ-199

5110451005315

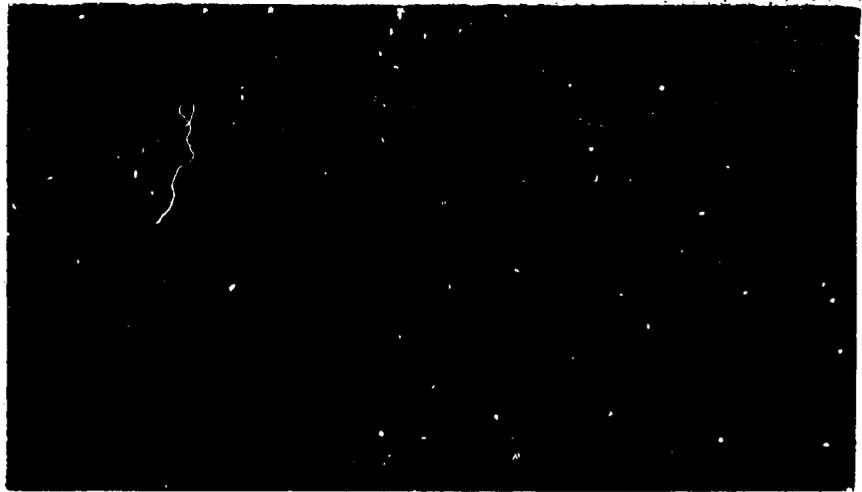
CONSORTIUM FOR INTERNATIONAL DEVELOPMENT



ADMINISTRATIVE REPORT No.
INFORME ADMINISTRATIVO No.



Colorado State University
New Mexico State University
Oregon State University
Texas Tech. University
University of Arizona
University of California
University of Idaho
Utah State University
Washington State University



LA PAZ, BOLIVIA

02/81

SEMIANNUAL PROGRESS REPORT

Contract GOB/AID 053-007-HCC

between

The Ministry of Rural Affairs and Agriculture

and

The Consortium for International Development

Period: July 1 - December 31, 1981

SECTION I

INTRODUCTION

This Sixth Semiannual Progress Report and Plan of Work is considerably more brief than previous ones. This being the seventh and final year of the contract, the field work in agricultural research has been reduced somewhat to allow more time for writing publications and required reports during the final few months of the contract. Readers will note, however, that projects requiring elaboration over a long time, e.g. potato breeding and soil fertility, have been continued uninterrupted. It is assumed that these activities will be continued by IBTA/MACA when the contract ends June 30, 1982.

Sections, headings, and numerical order of this report is the same as in the third, fourth, and fifth semiannual reports, and the format is consistent in them all for ease in recovery of data by years and making comparisons between years.

SECTION II

SUMMARY OF CONTRACT STATUS AND PLANS FOR 1981-82

General

The contract has completed 6.5 years of the planned seven-year contract which started in 1975. The contract activities which occurred during this 6-month reporting period reflect "last year" planning and several field programs were reduced from former levels of activity or eliminated. A summary of the results and plans during the reporting period follow.

Extension and Publication Plans

Original contract plans were changed when funding was reduced and the extension position was eliminated. In the absence of this service and expertise, it was decided that concrete plans for the extension information produced would be essential during the last 6 months. Accordingly, short term consultants in economics, extension, and publications were programmed near the end of the contract to prepare, present, and publish generated information. The medium of transfer is planned as regional seminars in which CID staff and their counterparts will present the information and hold discussions and workshops. Summary materials will be prepared giving reference to the more lengthy published reports and technical bulletins. Each CID technician will write one or more bulletins in his discipline and have the final draft ready for publication by March 15, 1982. These will be published by IBTA and USAID for later distribution.

The seminars are planned as follows:

<u>Date</u>	<u>Location</u>	<u>Region</u>
March 25-26	Cochabamba	Cochabamba
April 1-2	Sucre	Sucre, Potosí, Tarija
April 15-16	Patacamaya	Oruro, La Paz, Coroico
April 22-23	Saavedra	Santa Cruz, Yacuiba

Potato Breeding - Toralapa (CIP)

Several accessions collected in 1980-81 were grown in the greenhouse to produce botanical seed for the germplasm bank and for distribution. About 100 additional clones from the bank are being evaluated for wart disease under the general supervision of Ing. Israel Avila.

Crossing will take place in January, 1982. Yield and quality evaluations continue on two promising clones and several segregating hybrids. The two Peruvian clones mentioned are in their third year of critical tests and are potential varieties.

Late blight resistance trials were established at Escalante. CIP and Cornell clones have showed good resistance to date. New crosses involving these materials are planned for January.

A frost resistance trial was established at Koari. This zone frequently has damaging frosts in January. Good growth is reported to date. The materials being tested are selections from previous frost damage trials, some of which are frost resistant only with few, if any, other redeeming characteristics, but some are high quality, high yielding varieties or clones. If frost occurs, quality tests will be performed on promising lines.

Material with potential resistance to PVY, previously tested by a becario, is being tested again for confirmation in the greenhouse at Toralapa.

Genetic lines potentially resistant to cyst nematode were received from CIP, but were lost in the greenhouse problems. Similar lines are ordered and will be added to the on-going breeding program for resistance to this pest.

Potato Agronomy - Variety Trials

Two variety trials were planted. One at Comarapa and one at Pocona. The Comarapa trial should yield good results, but the trial at Pocona is planted in an orchard and differences in yield between varieties may be questionable.

Potato Agronomy - Soil Fertility

Sixteen fertilizer experiments have been established. Each experiment has 16 treatments, including checks and "local" treatments. These will be sprayed regularly for insects and diseases.

Correlations will be run between yield and measured soil fertility (from soil samples taken from each site).

Residual effect will be measured on last year's experiments where suitable second year crops have been planted this year. To date, of the 12 possible sites, 6 have been planted to broad beans, one to wheat, one to potatoes and 4 to barley. Additionally, one 1979 experiment was planted to barley for a second time, e.g., potatoes with fertilizer: barley: barley. Second and third year residual effects will be measured.

San Benito soils laboratory is analyzing 152 soil samples taken last year. The analysis will include pH, EC, OM, P, K.

Computer Programming

A package of computer programs to analyze experimental results of IBTA technicians is now complete and "bug" free. These programs are augmented by another set of programs to "print" field books in anticipation of data collection. Computer produced field books will further reduce analysis time 50%.

Three manuals to facilitate use of the programs have been written. They are (1) User's Manual, (2) Support Manual, (3) Program Manual.

Agro-Economic Survey

The survey completed in 1979 has yielded considerable information from which several publications have been or are being written.

Systems of Production Survey

This survey was completed in July of 1980. The data summary will be published in 1982 as a CID working paper and one student's thesis will use information from the survey.

Potato Storage Research

Fungal and bacterial diseases of stored potatoes are being investigated in several locations. Results show that "common" storage facilities used by campesino producers are good up to 50 days. Beyond that time, losses increase and additional control techniques need to be developed.

Erwinia (soft rot) in potatoes was identified previously. A survey showed this disease to not be of much importance in the highland areas of Bolivia, i.e. above 3,000 m elevation, but lower elevations have a significant incidence of Erwinia. Two experiments involving seed with low and high incidence of Erwinia have been established using two commonly grown varieties of potatoes. Plots with high Erwinia had poor emergence at Comarapa (low elevation) and good emergence at Toralapa (high elevation), establishing an altitude effect of Erwinia.

Three experiments on Hacobbus (root knot nematode) have been established using Telone treated soil, and healthy and infested seed. Preliminary results show Telone treated plots have fewer nematodes.

Plant Pathology Clinic

The clinic at San Benito is struggling to maintain a good level of activity. Few samples are submitted. Pre-addressed sample envelopes have been distributed throughout Bolivia to Extension Agents with instructions on how to take, preserve, and send the samples.

National Insect Museum

Collection, identification and curation of important insect species in Bolivia has continued. Increased work and emphasis is anticipated with the addition of Ing. David Villarroel to the National Staff. Collecting trips in the altiplano, valleys and tropical areas are planned.

National Pest Management Program

Several coordinating and planning meetings have been held in anticipation of a National Pest Management Program. To date, funding for a coordinator position has not been granted by IBTA. Major emphasis will be on potato and fruit production.

Pest Control in Potatoes

Producers have begun using soil insecticides for pest control applied during the growing season. Although this a logical procedure, there is some danger of excessive residual insecticide in the soil to be picked up by plants late in the growing season and being present in consumed product. Experiments with Temik and Currater were seeded at Belen to determine control of potato tuberworm moth and the Andean potato weevil. Residuals will be measured in harvested material by "Sanidad Vegetal" in La Paz.

Corn Pests

The biology of Astylus lineatus and Euxosta masorca (thrips) will continue this year. Reared adults should emerge in January.

SECTION III

ANNUAL HISTORICAL REVIEW

Contract Progress

Only six months remain in the contract which will terminate as planned on June 30, 1982. Contract activities during the six months July 1 - December 31, 1981 were interrupted significantly by the uncertainty of budget renewal was prohibited under section 620Q of the U.S. foreign assistance act.

Funding for the final 11 months of the contract was broken into two time periods; one of 5 months, \$326,000, and one of 6 months, \$474,000. Rather than cut program during the 5-month budget (August 1 - December 31), a deficit budget was prepared with the knowledge of USAID, USU, and CID. When 620 Q came into effect over a lengthy time and renewal prior to important contract notification dates seemed impossible, many contract protective measures were implemented in case closure was inevitable or was ordered by MACA. These measures included a 90-day termination notice by MACA, termination notices to all local employees with 90 days anticipation, termination letters to all expatriate personnel with 30 days notice, notification to USAID and the Ministry of Labor of pending termination.

CID is a non-profit corporation and it is illegal for such a corporation to overspend budgets and recuperate losses from other projects. It was

necessary, therefore, to anticipate all termination costs and obligations and plan to terminate employees early enough to cover costs. With a deficit budget and short notice time, it became problematical as to whether to wait until the last possible moment or pre-empt and close.

When it became obvious that, under pressure from the U.S. Government and USAID/B, GOB was making serious attempts to remove the 620 Q restriction, a "wait-and-see" strategy was taken. Some final hour pressure by USAID/B lifted 620 Q in time to prevent closure and the amendment was prepared and signed. Termination notices were nullified and plans to continue were re-instituted.

The field work of the contract suffered the most because some experiments were not planted due to potential lack of funds and uncertainty of the future. All staff were extremely demoralized by the events.

Nevertheless, the important field work continued with individual staff using private resources to fund contract activities during the critical periods. Contract termination would have meant the private loss of those expended funds.

No budgetary problems are anticipated during the final 6 months and it appears the contract can now be brought to a successful conclusion.

Termination activities

All parties to this contract have identified and expressed the need for termination activities which include transfer of knowledge, research findings, technology, and recommendations. CID and IBTA developed a plan to do the above

which includes seminars, workshops, and publications. The seminars' presentations will involve all counterparts and will be given to Administrators, Technicians, and Extension Agents. CID will provide research results and information references in summary form and IBTA will provide meeting rooms, and per diem and travel for participants. Approximately 200 participants will attend in 4 or 5 locations. Presentations will be arranged to indicate the technical and economic significance of the research results produced by CID and counterpart activities.

Additional end-of-contract activities will include short term consultants in Economics, Communications and Publications, and Extension.

CID/Tucson will fund and send a team to make a final evaluation of the contract activities, and USU will provide a final protocol visit by the president of the University in May, 1982.

University Relations

The universities of Bolivia re-opened in April-May, 1981. Drs. Foster and Otazú taught classes and laboratories in their disciplines during the first session, and Dr. Otazú is programmed for a laboratory class the second term, but all CID participation at the university will cease during the final months of the contract.

CID continues to work with UMSS faculty in the scholarship programs in preparation of Ingeniero Agrónomo theses and conducting the required research.

Scholarships

A current list of "becarios" is found near the end of this report.

All "becarios" have been informed that they must terminate their activities by March 31 or continue on their own. The program has been very successful and alternate methods of continuing the program need to be explored.

Personnel

No changes in personnel were made during the 6-month reporting period. None are anticipated. (See CID Administrative Report # 06/80 for current list.)

SECTION IV

ACCOMPLISHMENTS

A. ADMINISTRATION

A.1 Chief of Party

A.1.1 Contract Negotiations

Amendments No. 9 and 10 were negotiated and signed during the reporting period. A total of \$800,000 was added to the budget for these two amendments divided into \$326,000 and \$474,000 for five and six months respectively. (See Summary Section for discussion.)

A.1.2 Contract Activities

During the reporting period, contacts between the Chief of Party and MACA/IBTA officials increased considerable in

anticipation of contract termination. This was in spite of the fact the relations between the U. S. and GOB had not been normalized. During November and December, normalization was achieved, and further increase of contacts is anticipated.

Working relations continue to be excellent with the Administrators of MACA/IBTA and USAID.

A.2 Director of Research

A.2.1 Research Activities

Given all the administrative problems during the past 6 months, active participation in research direction was minimized.

A.2.2 IBTA

Visits were made to Belen, Patacamaya, San Benito, Toralapa, and La Tamborada stations.

B. AGRICULTURAL ECONOMICS

B.1 No Agricultural Economics activity was performed during this reporting period. A CID Economist will serve the contract during March of 1982 to help prepare materials for extension and help other technicians with economic analysis of results.

C. POTATO BREEDING

by

Robert H. Hoopes, Potato Breeder

C.1 Project: To-1-P-1-a, Bolivian Germplasm Bank

Leaders: Israel Avilés, with Robert Hoopes collaborating

Introduction: Bolivia is a center of origin and diversity of cultivated potatoes as well as many wild potato species. Native varieties and wild species have made important contributions to germplasm banks and breeding programs throughout the world. CID has collaborated over the last two years in collecting trips which have added significantly to the amount of wild material available to breeders in Bolivia and the rest of the world. In addition, CID scholarships have aided several students to obtain their Ingeniero Agrónomo degree by doing thesis projects which involved the classification of parts of the Bolivian Germplasm Bank.

Objectives

1. Continue to expand the Bolivian Germplasm Bank and send more Bolivian material to botanists and germplasm specialists in England and Germany.
2. Maintain the present Bolivian Germplasm Bank.
3. Continuation of the work of evaluating varieties in the Bolivian Germplasm Bank for specific characteristics.
4. Utilize varieties in the Bank with valuable characteristics as parents in crosses.

Activities

1. Plants were grown in the Toralapa greenhouse from several collections of 1980 and 1981 in which botanical seed had not been obtained. Because of quarantine regulations, it was not possible to send tubers to England or Germany (although it has now been approved in some cases to Germany). Seed was obtained of the species S. phureja, S. achacachense (tentative classification), and possibly S. yungasense (berries were not mature at the time of this report). If true seed collections of the species S. achacachense and S. yungasense are confirmed, they will be the first botanical seed collections of these species and of great interest to potato taxonomists and breeders.
2. The Bolivian Germplasm Bank is being maintained on the Toralapa Station entirely under the direction of Ing. Avilés.
3. About 100 more clones of the Germplasm Bank are being evaluated for resistance to wart disease, principally by Ing. Gerardo Caero. A follow-up of the thesis work of Freddy Caballero is also being done to confirm or refute the apparent resistance of some 40 clones which he found in his study.
4. No activity in crossing will take place until January.

C.2 Project: Breeding for Yield and Quality

Leaders: Ing. Israel Avilés and Robert W. Hoopes

Introduction: Although the breeding effort has placed emphasis on resistance to various diseases and physiological stresses, yield and

quality are really the central objectives of the program. Some of the breeding lines are not being tested for resistance to anything, and so their evaluation falls under this heading. Others are being evaluated for frost, late blight, etc., and are listed under other sections even though they are also being considered for yield and quality.

Objectives

1. Continue agronomic evaluation of the Peruvian clones S11-15 and S15-72, which have survived two previous years' tests.
2. Evaluate progenies of inter-specific crosses involving S. tuberosum x S. phureja and S. stenotomum.
3. Produce seedlings of some progenies of high quality local varieties x CIP varieties supposedly with frost resistance.
4. Grow seedlings of the progenies obtained by crossing local, high-quality varieties x Cornell late-blight resistant clones.
5. Continue taste preference tests of varieties which perform well agronomically.

Activities

1. The two Peruvian lines are planted in the field on the Toralapa Station and are growing well.
2. This aspect of the program is being done by Ing. Avilés.
3. Seedlings of several of these progenies are now growing in the Toralapa greenhouse.
4. This work will begin after the harvest in March and April.

C.3 Project: To-I-P-1-d, Breeding for Resistance to Late Blight

Leaders: Ing. Israel Avilés and Robert W. Hoopes

Introduction: Late blight, caused by the fungus Phytophthora infestans and favored by humid environmental conditions, is among the most important of plant diseases in the world. The extremely high-altitude areas where much of Bolivian potato production takes place are too cool and dry for late blight to be a major problem. However, a great deal of potato land at slightly lower elevations, especially along the eastern slopes of the Andes, is very vulnerable to this disease. Effective chemical controls are available, but not always used by the farmers. Resistant varieties would constitute another alternative to the control of this disease.

Objectives

1. Continue to evaluate material from several sources for late blight resistance, yield, and quality.
2. Continue the crossing program, utilizing imported resistant varieties, local varieties of high quality, and hybrids of these two groups, to obtain high-quality, well-adapted resistant varieties.

Activities

1. A trial has been established in Escalante, a region where late blight has been very severe every year for the past five years. In this trial are CIP varieties which have demonstrated good resistance and yields, Cornell clones which have also yielded well and been resistant to blight, hybrids of these resistant varieties and high-quality local varieties, and some Bolivian germplasm which has shown at

least low levels of blight resistance in the past. In addition, seedlings of crosses made to combine late blight resistance with good adaptation and quality are now being grown in the Toralapa greenhouse to produce tubers which can be planted and evaluated in the field next season.

2. The crossing program will take place in January and February.

C.4 Project: Breeding for Resistance to Frost

Leaders: Ing. Israel Avilés and Robert W. Hoopes (Material for this work came from the CIP program through Drs. Nelson Estrada and Juan Landeo).

Introduction: Frost is one of the most severe and least controllable hazards of potato production in the highlands of Bolivia. Frost resistance, however, is one of the most difficult traits to manage in a breeding program because of the complexity of inheritance and the difficulty of evaluating varieties at early stages of development. The Bolivian program has had the benefit of being able to collaborate with the International Potato Center, which has generously provided over 200 clones for evaluation under Bolivian conditions. These clones have been tested for three years at Toralapa and the Belen experiment stations. Most of them have been discarded, and a few most promising retained. After the past two seasons of work at Toralapa, a number of clones appeared very promising from the standpoint of yield and quality. But in both of the last two years, the frost has come so late that it

was not possible to evaluate the material for ability to produce under really adverse conditions.

Objectives

1. Establish another trial at Koari (elevation 3500 meters) of the CIP clones which have shown the best performance in yield and quality in two previous trials.
2. Grow the most promising of these clones on a larger scale to begin multiplication of seed.
3. Continue to evaluate the quality of the clones that have shown best performance in other areas.

Activities

1. The Koari trial has been established and good growth was evident at the time of this report. No frost had yet occurred.
2. The most promising clones were being grown on a somewhat larger area, also in Koari.
3. Quality tests will take place after harvest in April and May.

C.5 Project: Breeding for Resistance to Virus

Leaders: Ing. Carlos Alarcón, Robert W. Hoopes, Ing. Israel Avilés, Ing. Victor Alvarez, and Ing. René Torrico.

Introduction: Virus diseases are among the principal causes of decreased potato yields in developing countries which have no organized seed production programs. Worldwide, leafroll virus is the most important, but in the Andes, it appears that Potato Virus Y (PVY) is in first

place. The work of CID becaria Rosario Vargas indicated that PVY is very widespread in potatoes in all areas of Cochabamba department. We have received material in the form of botanical seed and tuber families from several sources (Cornell, Max-Planck Institut, and Wageningen) which is segregating for PVY resistance. CID becario Victor Alvarez tested much of this material for resistance as a thesis project. A considerable number of varieties were discarded for apparent susceptibility to the virus, but many were apparently resistant. Many of the varieties from these sources have not yet been evaluated for virus resistance but have been evaluated for yield and/or late blight resistance and found promising.

Objectives

1. Confirm the resistance or susceptibility of material tested by Victor Alvarez the past growing season.
2. Test the most promising Cornell clones which have survived a previous test for virus resistance, and have also shown good yield and late blight resistance, once more for PVY resistance.
3. Continue to plant seedling progenies and evaluate individual plants for PVY resistance.

Activities

1. Apparently resistant material has again been planted by Mr. Alvarez but has not yet been inoculated or evaluated for virus resistance.
2. These clones have been planted in the Toralapa greenhouse but not yet inoculated or evaluated for resistance.

3. Several seedlings families have been planted and transplanted in the Tonalapa greenhouse. They have been inoculated with PVY but not yet evaluated with indicator plants.

C.6 Project: Breeding for Resistance to Cyst Nematode

Leaders: Ing. Carlos Alarcón, Dr. Robert Hoopes, Ing. Gerardo Caero, and Mr. Fernando Pivas.

Status: New materials were received from CIP and started in the greenhouse for evaluation along with local germplasm. Due to numerous technical and scheduling difficulties, these new materials were lost and a new order has been placed with CIP. If they arrive in time, they will be grown, tested and evaluated.

C.7 Project: Introduction of Vegetable Varieties

Leaders: Robert W. Hoopes, Thomas C. Stilwell, Dr. Alvin Hamson of Utah State University

Introduction: Ing. Carlos Cossío of UHSS requested the collaboration of CID to obtain seeds of vegetable varieties which had never been tested in Bolivia. Seed was obtained from Northrup King Co. of tomatoes, cucumbers, cauliflower, cabbage, radish, onions, squash, carrots, beets, and lettuce. By the time the seed arrived, the university had been shut down for a prolonged period and other outlets for it had to be sought.

Objective: Distribute vegetable seed to people willing to plant it and try to get information on any varieties which could prove useful to Bolivia.

Activities: Seed was distributed to the following people: (1) Ing. René Gómez of the San Benito Experiment Station. (2) The San Benito Station. (3) The Extension Agent for IBTA in Capinota. (4) Mr. Bernardo Encinas of Centro de Desarrollo Social de Cochabamba Tropical. (5) Ing. Nancy Lizárraga of UMSS and the Technical School of UMSS. (6) Mr. Salgues of a technical school in the Chapare. (7) Mr. Freddy Villazón of the Toralapa Station.

Very little information has been returned to CID regarding the performance of the vegetable varieties. The extension agent in Capinota reported that the cool-season crops had been planted and were doing well. The imported radish varieties planted on the Toralapa station look promising, but the season is not finished. Because vegetables are not a primary area of CID's work, it has not been possible to spend the time that would be necessary to supervise the trials or ferret out the information.

C.8 Project: Student Advisory Activity

C.8.1 Victor Alvarez - Classification of Segregation Families with Respect to Resistance to Potato Virus Y. Victor has finished his beca with CID and is now working as a technician on the Toralapa Station and virologist and seed production specialist. His thesis has passed through one revision in the Faculty of Agronomy and is being corrected.

C.8.2 Freddy Caballero - Identification of Physiological Races of Synchytrium endobioticum and Screening Clones of the Bolivian Germplasm Bank for Resistance. Freddy has finished his beca

with CID and is working as a technician in the quinoa improvement project at the Patacamaya Experiment Station. His thesis has passed through one revision with the Agronomy Faculty and is reported to be almost ready to present.

- C.8.3 Fernando Rivas - Screening the Bolivian Germplasm Bank for Resistance to the Potato Cyst Nematode Globodera rostochiensis. Fernando's beca with CID terminated. He is employed with Sanidad Vegetal of MACA in Santa Cruz. He has written a draft of about half of his thesis, but has not returned to Cochabamba for some time.
- C.8.4 Ignacio Huayta - Chemical Soil Treatments and Their Yield Effects of Potatoes in Three Locations in Cochabamba. His beca with CID having terminated, Ignacio is now working as a technician at the Belén Experiment Station. He has not returned to the CID office since the completion of his thesis work, but it is our understanding that he is making some progress on the writing of the thesis.

D. POTATO AGRONOMY

by

Dr. Robert Kunkel, CID Potato Agronomist

D.1 Project: Potato Variety TestingLeaders: Dr. Robert Kunkel and Ing. Gonzalo Claire

Status : Two variety trials were planted this year; an early planting at Comarapa and a later planting at Pocona. The first should be a good variety test even though seed size will increase variability. The second was planted interspersed among fruit trees and results will likely be questionable. The Comarapa test will be harvested in January.

D.2 Project: To-I-P-3a, Soil fertility and plant nutritional relationships of potato production in BoliviaLeaders: Dr. Robert Kunkel, Ing. Gonzalo Claire, Dr. James Thomas, Ing. Famiro Montecinos, Ing. Luis Aguilar, and Ing. Walter CarrerasCooperators: County agents and farmers

Justification: The Bolivian potato crop is a major source of farmer income. Growing potatoes requires a major expense in seed, fertilizer and pest control if the farmer is to receive the maximum return on his investment. Profit is closely related to yield. During the past three years, it has been demonstrated that farmers on the average are producing far less potatoes per hectare than is possible with the climate available to them. It has also been demonstrated that there is a general deficiency of nitrogen and phosphorus. In 1981, a deficiency

of potassium was discovered at a large majority of the experimental sites. This could be related to the method of fertilizer application.

The most practical approach to determining if a farmer needs a certain kind of fertilizer and how much is needed is by use of a dependable soil analysis. Unfortunately, the relationship of the results of soil analysis and potato yield have been discouraging and, therefore, not usable by the farmer for predicting his fertilizer needs.

For the last three years, soil samples have been taken from the experimental sites which have been in diverse areas of Bolivia as well as on various soil types. Soil subsamples taken for the past two years are being analyzed at La Tamborada and at San Benito. The 1981-82 samples are now being collected for analysis.

If the yield soil test correlations continue to be low, an intensive laboratory study to discover the cause may be justified. The soil samples that have been collected are relatively large and repeated analysis could be made of the same sample on aliquots.

It has been estimated that there are 230,000 potato patches in Bolivia. It is utterly impossible to conduct an experiment or even a demonstration on more than about 20 locations in any one year, but many soil samples could be collected by an extension agent, analyzed in a competent laboratory in a relatively short time.

The residual value of fertilizers applied to potatoes is an important part of assessing the economic value of a potato fertilizer program.

Objectives

1. To conduct potato fertilizer experiments in various parts of Bolivia.
2. To collect soil samples from each experimental site for chemical analysis to establish soil test and yield correlation on which to predict farmer fertilizer needs.
3. To obtain data for estimating the residual value of a good fertilizer program.
4. To develop a grower-oriented brochure on potato production.

Status

1. A total of 16 fertilizer experiments have been established in various locations. Each experiment consists of 16 treatments and 4 replications. Eight soil samples have been taken from each of eight of the experiments. The remaining 8 experiments will be soil sampled at the time of the first spraying for insects and disease. Three additional experiments like those already in progress are anticipated for the Pocona area. The fertilizer treatments are ready and the county agent is seeking suitable locations for the experiments.
2. Of 12 potato fertilizer experiments conducted last year, from which it might be possible to obtain residual fertilizer data, six have been planted to broad beans, one was planted to wheat, one was planted to potatoes, and four were planted to barley. One 1979 potato fertilizer experiment was planted to barley for the second time.

3. The San Benito soils laboratory has provided the analysis of 152 soil samples which were collected last year. The analysis included pH, electrical conductivity organic matter, phosphorus, and potassium. The San Benito laboratory is doing the analysis in exchange for laboratory chemicals.

D.3 Students: Since 1979, of the original six students receiving becas, five have now received their Ingeniero Agrónomo degree. One student, Felipe Cantuta has not been heard from in over a year. Currently, seven students are working on thesis projects. Three of these have completed their becas and two of them are rewriting their thesis for the second time.

D.4 Other: The writing of a seminar presentation and the preparation of Visual Aids is about to begin.

E. CEREAL AGRONOMY, COMPUTER PROGRAMMING AND ANALYSIS,
AND CEREAL PRODUCTION SURVEYS

by

Dr. Thomas Stilwell, CID Agronomist

Projects E.1 through E.7 as reported in CID Administrative Report # 01/81 were discontinued due to the lack of project funds in IBTA to conduct off-station testing and the IBTA technicians' subsequent refusal to locate suitable cooperators and plant the tests. The Cereals Agronomist, therefore, concentrated on the surveys and computer programming work.

E.8 Project: Computer Analysis of Experimental Results

Leader : Dr. Thomas Stilwell

Justification: At present, each experiment station technician spends a total of 2-3 months analyzing the results from his experiments, arranging them in a useable format and writing the results and interpretations for various reports. If results ever do get to a farmer, they are 3-4 years old. This project is designed to greatly speed up and standardize technician report writing and the consequent reporting of results to farmers.

Objectives:

1. Develop a series of computer analysis programs for use by technicians without previous computer experience.
2. Distribute these programs and instruct the technicians in their use.

Status: The program package is now "bug" free and operating. A complete copy of the programs and manuals has been delivered to Galindo y Compañía with the agreement that they will transfer the programs to an Apple II. In return, ICTA will receive the right to make two copies of the programs on floppy disc for free.

In addition, the programs are being transposed to another micro-computer (Osborne). This micro-computer has the popular CP/i operating system which will enable larger numbers of computers to use the package without modification.

In addition to the main program package, an additional set of programs has been developed to manage field books. During use of the analysis package, it was found that the principal problems of the users occurred during experiment planning. To help resolve this problem, a set of programs has been developed to print complete field books for use by the technicians. These programs are linked into the main analysis package so that a technician can use a computer generated field book to record his data and in the analysis phase reduce his time spent in analysis by approximately 50%.

As support of the system, a User's Manual, a Support Manual, and a Program Manual have been prepared.

A paper was presented at the general meetings of the American Society of Agronomy in Atlanta describing these programs. Some requests were received for the micro-computer versions.

E.9 Project: SB-I-Th-C-Av-4-a, Agro-Economic Survey

Leaders: Dr. Thomas Stilwell and Ing. Agr. René Gómez

Collaborators: Ing. Gerardo Ramirez and Dr. Edgardo Moscardi

Justification: There currently exists no base of reliable data about the production practices used by wheat, barley and oats producers in Cochabamba. This data is necessary to guide the planning and execution of on-farm experiments. This survey will provide this data.

Objectives:

1. Describe the problems of farmers in the production of wheat, barley and oats for the purpose of establishing the priorities of research in these crops.
2. Define farmer practices so that on-farm experiments can be done in a similar manner.
3. Estimate costs of production to be used in estimating profitability of new practices.
4. Gain knowledge of the economic problems of these farmers to aid in the formulation of rational and effective national policies affecting wheat, barley and oats.

Status: The formal survey was completed and the data published in 1979. Several other publications have been prepared since then. During the period covered by this report, one more report based on this data has been published, Dominios de Recomendación para Trigo, Cebada y Avena en Cochabamba (Recommendation Domains for Wheat, Barley

and Oats in Cochabamba). Two other publications are in rough draft form or being printed at this time. They are:

- Economía de la Producción de Trigo, Cebada y Avena en Cochabamba (Economics of the Production of Wheat, Barley and Oats in Cochabamba).
- Relación entre Factores Agro-Económicos y Tecnología Utilizada por Agricultores que Cultivan Trigo (Relationship Between Agro-Economic Factors and the Technology Utilized by Farmers who Cultivate Wheat).

This nearly completes the analysis and publication of results of this survey. The major benefits were realized during the first year after the survey. The major impact was in the definition and functioning of the on-farm experiment program.

E.10 Project: Systems of Production Survey

Leaders: None

Collaborators: Dr. Thomas Stilwell, Dr. Edgardo Moscardi, and Dr. Gonzalo Avila

Justification: In spite of many fragmented studies, there exists no reliable data about production practices and their interactions within the small farm system. This data is necessary to guide the planning and execution of on-farm experiments. This survey will provide this data.

Objectives:

1. Define the principal systems of production being used by small farmers in Valle Alto.

2. Describe in detail representative systems of production.
3. Form priorities for research programs of UBMS Faculty of Agronomy on the basis of these results.

Status: Due to drastic changes in the Faculty of Agronomy, all UBMS leaders of this project were discharged. The supervision and daily leadership was undertaken by Dr. Stilwell.

The formal survey was completed in July, 1980. Since this time, there has been little progress apart from the completion of a rough draft of the data summary. This data summary will be published during the first part of 1982 as a CID working paper.

One thesis draft has been prepared based on the data of this survey (see Mario Altamirano), but after many months of faculty revision, it still has not been approved.

E.11 Project: Publication of Research Results

Leaders: Ing. Jaime Salamanca, Ing. Luis Hermosa, and Dr. Thomas Stilwell

Justification: Presently, there is a lack of printed technical materials for farmer and extension use. Research results are available and more are constantly being developed but their distribution to farmers remains a problem.

Objectives:

1. Develop and print quantities of informational materials directed towards farmers.
2. Distribute these materials to farmers.

Status: During the latter part of 1981, the printing operations were reduced in part due to lack of paper and other supplies to back up the printing process. Much of the printing work was focused on publications for CID and the annual reports of the San Benito station.

The lack of an IBTA budget for this facility plus the refusal of IBTA to grant an item for the person in charge of the printing facility has greatly hindered the expansion of this activity.

E.12 Student/University Projects

Student Advisees: In this listing of students, there are two general groups. The first group consists of students who are working on San Benito Projects. The second group consists of students who were originally working on projects of the UBMSS Faculty of Agronomy. Nearly all of the original advisors of this group have been fired from the university and I am the sole remaining advisor.

San Benito Projects

- Raúl Nuñez: Interaction Between Variety and Planting Density of Oats. These experiments have been harvested and Raúl is now continuing his data analysis. Progress on the writing of his thesis draft has been slow.
- Gregorio Pinto: Interaction Between Lime and Fertilizer in Barley. Gregorio has now finished his laboratory analysis and is in the process of writing his rough. Results of the analysis show large increases due to lime application plus a definite interaction between lime and fertilizer.

- Emilio Ormachea: Socio-Economic Study of Wheat Producers in the Sub-Tropical Zone of Santa Cruz. The field work of this survey has been completed and Emilio is now finishing the rough draft of his thesis. He is being actively supervised by Lic. Simon Maxwell of the British Mission in Santa Cruz.
- José Ríos: Survey of Small Scale Millers in Valle Alto. All data collection is finished and José now has a completed rough draft of his thesis in review. In addition, he has completed a CID working paper which is an extract of his draft.
- Rosario Medrano: Socio-Economic Analysis of Tiraque as a Barley Production Center. Rosario has completed her field work and is now completing the analysis and rough draft of her thesis.

UBMSS Faculty Projects

- Mario Altamirano: Factors Affecting the Election of Varieties of Wheat, Potatoes and Alfalfa in Valle Alto. Mario has completed his thesis rough draft and a CID working paper which summarizes his thesis. His thesis is still being reviewed by UBMSS faculty.
- Esteban Antezana: Interaction Between Levels of Moisture and Fertilization in Onion. The field work is finished and Esteban is now writing his draft.
- Freddy Corrales: Sources and Levels of Organic Fertilizer in Cabbage. All field work has been completed and only some parts of the thesis draft remain to be completed.

- Luis Pedrazas: Soil Moisture Levels in Maize for Choclo in the Valle Central. All field work has been completed, and the rough draft of his thesis is now being finished.
- Juan Arana: Study of the Effect of Ferrous Sulfate on the Addition of Cotton Seed Meal to Diets of Pigs. Juan has completed his thesis and has received the title of Ingeniero Agrónomo.

E.13 Project: Professional Presentations

Status: During the month of December, two professional papers were presented by Dr. Stilwell at the annual meetings of the American Society of Agronomy in Atlanta, Georgia. The topics presented both concerned work done under the CID-IBTA program in Bolivia. The papers were:

- DSTAT - A Statistical Analysis System for Developing Countries. The authors were A. Stambuk and T. Stilwell.

- Establishing Research Priorities Using Experimental Data. The author was T. Stilwell.

Both presentations were very well received. The first paper was presented in poster format and over 200 persons received information about the presentation during the 4 hour presentation. The second paper was a slide presentation to a group of approximately 150 persons. Questions and comments showed interest and several working papers on the subject were distributed.

Major Time Allocations Programmed for January-June 1982

- January -- Revision and publication of pending research results.
- February -- Major emphasis on transfer of ESTAD computer programs to micro-computer. Planning of proposed extension/research seminar.
- March -- Continued transfer of ESTAD programs to micro-computer. Preparation of extension/research seminar.
- April -- Continued transfer of ESTAD programs to micro-computer. Presentation of extension/research seminars.
- May -- Preparation of final reports and publications.
- June -- Termination of contract.

F. ENTOMOLOGY, PEST CONTROL, AND NATIONAL MUSEUM OF ENTOMOLOGY

by

Dr. Donald R. Foster, CID Entomologist

F.1 Project: National Museum of Entomology

Leaders: Ing. David Villarroel, Mr. Jaime Silva, and Dr. Donald Foster

The work of building the National Museum of Entomology will continue and the numbers of new insects added to the museum should increase now that Ing. Villarroel has been added to the staff. Major collecting trips are planned for collecting crop pests in the Altiplano, tropical areas, Potosí-Sucre, and the intermountain valleys. Request for identification of several pests which are not in the museum collection demonstrate that much work remains to be done before the museum staff can identify with ease the insect pests discovered in the field by agricultural workers. Collections will be made of insects in the three following areas: insects damaging crop plants, beneficial insects, and storage pests. Insects in the larval stage attacking plants will be returned to the laboratory and reared to adults. Insects not previously identified will be curated in the museum and send to expert taxonomists for identification.

F.2 Project: National Program of Pest Management

Leaders: Ing. David Villarroel and Dr. Donald Foster

Special funding has not yet been received to properly initiate this project as outlined in the previous progress report, but contacts and

initial cooperation has begun. This project will only be able to draw entomologists from different parts of the country into a cooperating unit if funds can be obtained to provide materials and travel expenses for a coordinator. We will continue to promote the unification and coordination of entomology projects so that when funds are received, a national coordinated effort can be made to solve the pest problems which are present in potato and fruit production.

F.3 Project : Chemical Control of Insect Pests in Potatoes

Leaders: Ing. David Villarroel and Dr. Donald Foster

Recent literature has shown that the improper use of soil insecticides can result in the presence of harmful insecticide residues in products harvested for food. Farmers have begun to use the practice of applying soil insecticides in potatoes during the middle of growing season. This is a logical practice since the majority of pest problems occurring in potatoes takes place in the second half of the growing season. While this practice should provide a practical solution to late season insect attack, it may also create the very serious problem of insecticide residues in potatoes in the market.

Test plots have been established at the Belen Experiment Station to develop data which can be used to make intelligent judgements in the timing of soil insecticide applications. The two commonly used soil insecticides, Temik and Currater, were applied in the following ways: (1) at planting only; (2) at planting and at mid-season; and (3) at mid-season only. Insect infestation levels in these plots will be

determined, especially the populations of the Andean potato weevil, Premnotrypes lattithorax and potato tuber worm moth, Phythoremia operculella, and at harvest potato and soil samples will be taken, frozen and held for residue analysis in the new Pesticide Analysis Laboratory of Sanidad Vegetal in La Paz. Results of these analyses should indicate whether the practice of mid-season application of these soil insecticides is safe or needs to be modified and should serve as a positive guideline for farmers and agricultural workers. This same kind of experiment should be repeated in each potato growing region of Bolivia, since very good evidence has been developed in other countries to show that changes in soil type and climate have an effect on the residual duration of these soil insecticides.

F.4 Project: Biology and Control of the Corn Pest Astylus lineatus and Euxosta masorca

Leaders: Mr. René Andrew, Mr. Armando Ferrufino, and Dr. Donald Foster
Data are being collected now on the final plot work in these two studies. Biological data on E. masorca is complete, but adults have still not emerged from the colony of A. lineatus started about a year ago. Since adults are now appearing in the field, it is hoped that adults will soon emerge from the laboratory colony also.

F.5 Project: Publications

Work continues on refining existing manuscripts and developing those which are only in the preliminary stage. Much emphasis in the coming

months will be placed on developing quality illustrations for the present manuscripts and for the CID seminars which are to be presented in March and April.

G. PLANT PATHOLOGY

by

Dr. Víctor Otazú, CID Plant Pathologist

G.1 Introduction

Some of the work planned for the 1981-82 season was not started due to the uncertainty of the contract continuing beyond December 31, 1981. After the contract was renewed, most of the work was recovered but not all.

G.2 Toralapa

The main change in this station was the official appointment of Gerardo Caero as my counterpart. Mario Tórres, my former counterpart, was transferred to Belén.

G.2.1 Potato storage problems

G.2.1.1 Fungal diseases

- a) Project leaders: Víctor Otazú, Teófilo Villarroel, and Gerardo Caero
- b) Justification: The presence of rotted potato tubers is usually evident after a period of storage. Most of these show symptoms of dry rot although some of them appear to be caused by other organisms. To the present time, there has not been any study in Bolivia related to the study of fungal diseases in potato storage. This project was undertaken with the following objectives in mind:

- To examine the incidence of dry rot in storage.
- To determine economic importance of dry rot to determine the feasibility of further studies on control.
- To determine etiological agents involved in dry rot in Bolivia.
- To test three types of storages to determine which ones can store potatoes with a minimum weight loss and dry rot incidence.
- To determine the resistance of the four most commonly cultivated potato varieties (Imilla blanca, Sani imilla, Alpha, Radosa) to dry rot.

c) Results: The incidence of dry rot in various storages was in general low. Potato growers usually select out rotted and damaged tubers before storage; therefore, it was difficult to assess dry rot incidence in these storages. However, in Toralapa, we observed dry rot in about 10% of the tubers. This figure is high in a potato production system, and control is economically justifiable. Some results are reported in figures 1-7 as follows:

Figure 1 shows that the storage commonly used by the campesino was the most effective up to 50 days of storage giving the least percent of weight loss.

Figure 2 shows that the Dutch potatoes Alpha and Radosa lost the least weight during storage as compared with

the native Imilla blanca and Sani imilla varieties. Figure 3 shows results according to Fig. 2, i.e. the Dutch varieties had also the lowest percent of dry rotted tubers. Figure 4 shows similar results as in Fig. 3 but expressed as percent of dry rot per tuber. Sani imilla seems to be the most susceptible at the end of the storage season. Figure 5 shows that the storage used by the campesino seems to be slightly better than the industrial or semi-subterranean storage in controlling dry rot incidence. Figure 6 shows similar results as Fig. 5 but in percent of dry rot per tuber. Figure 7 shows dry rot development during storage, considering only rotted tubers. The percentage of dry rot per rotted tuber was consistently higher in the native cultivars.

- d) Future work: We have isolated the fungi involved in dry rot. We are obtaining single spore cultures to properly identify the species. Isolates will be sent to the Fusarium Research Center in Pennsylvania, USA, for species confirmation. Data analysis will also be performed.

G.2.1.2 Erwinia related problems in potatoes

- a) Project leaders: Victor Otazú, Mario Coca, Gerardo Caero.

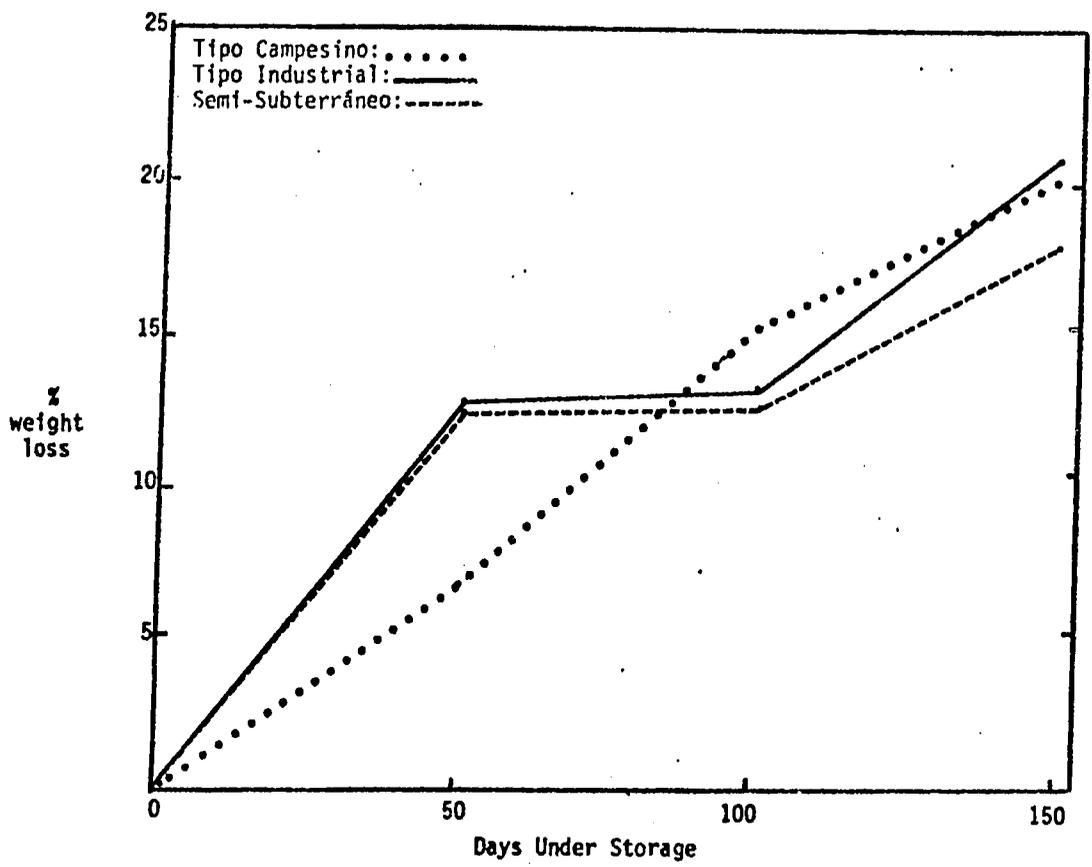


Figure 1. Weight loss of potatoes in 3 types of storage systems

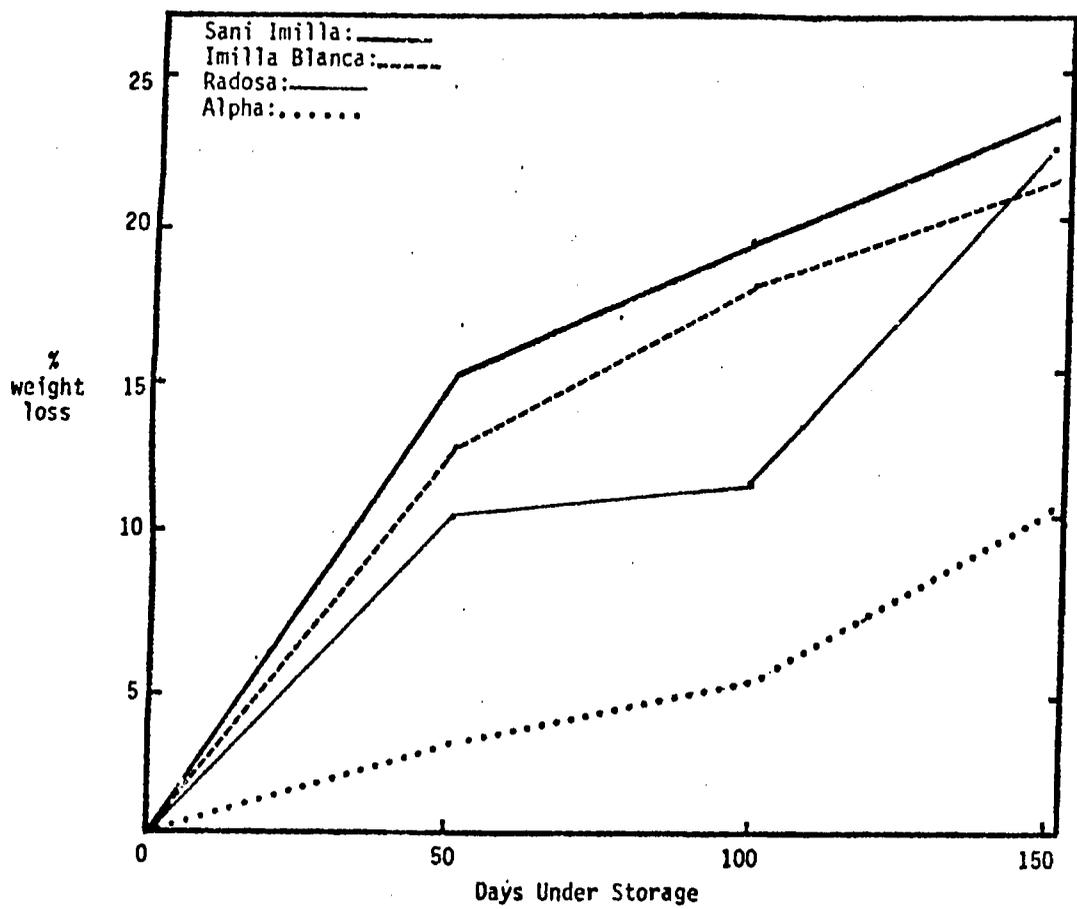


Figure 2. Weight loss of 4 potato cultivars during storage

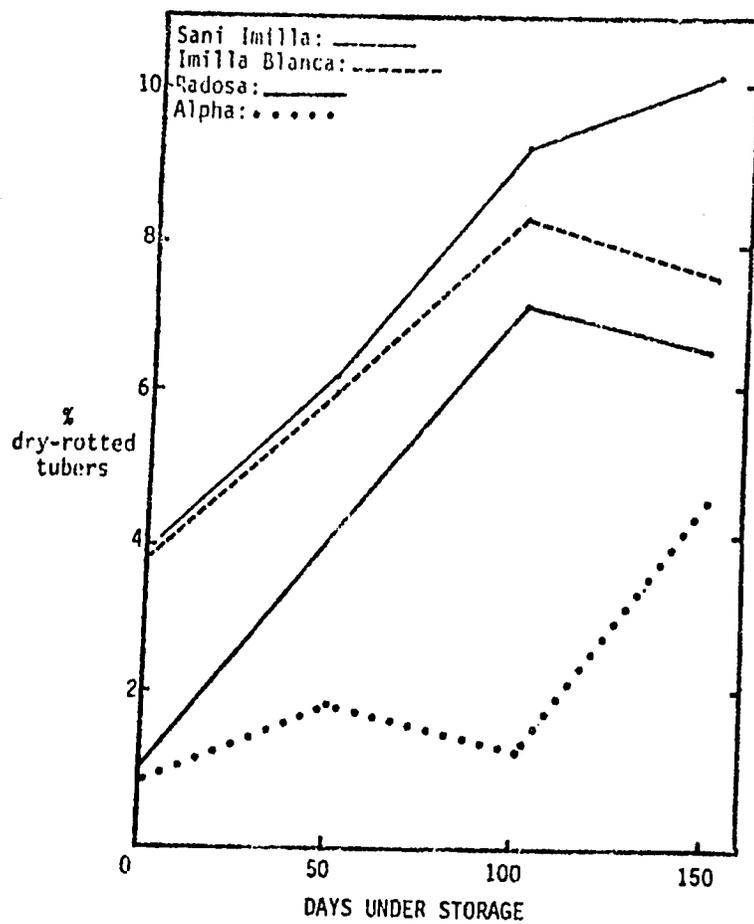


Figure 3. Dry-rot incidence in 4 potato cultivars during storage.

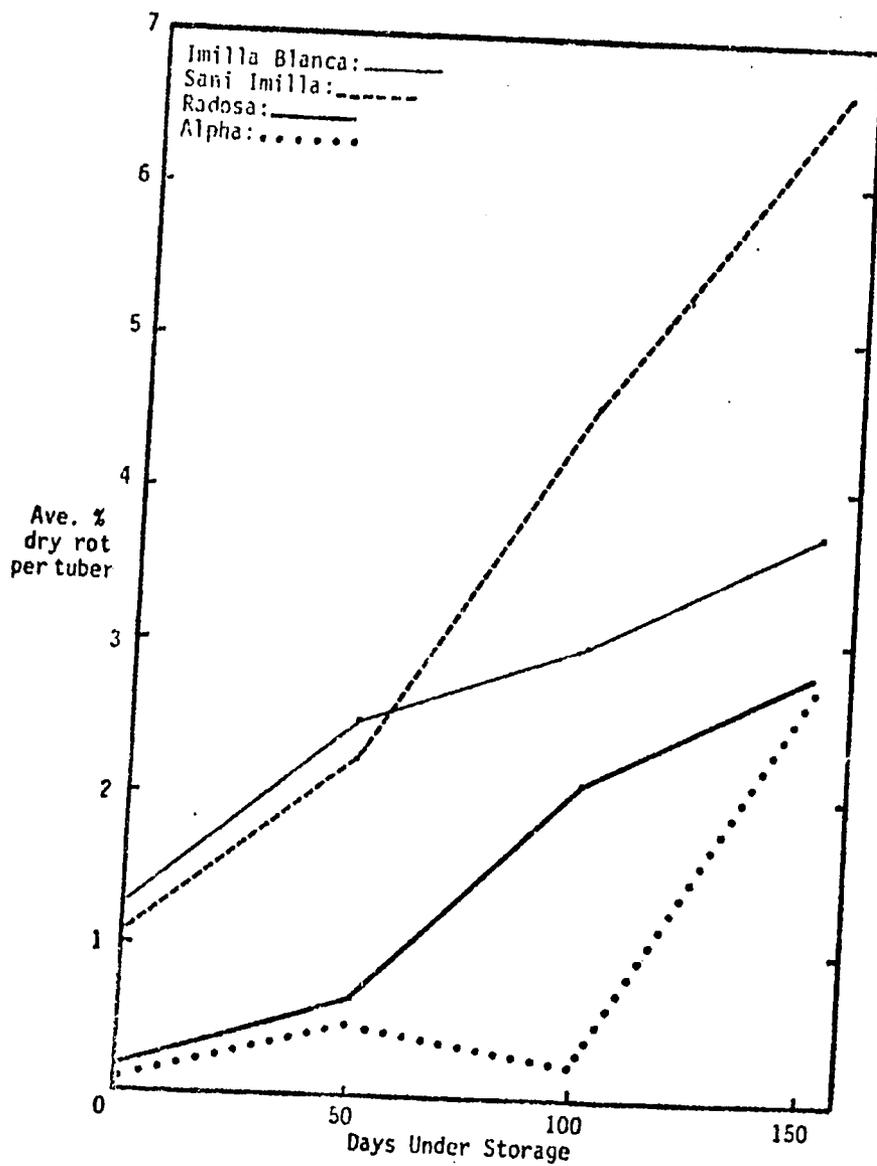


Figure 4. Average percent of tuber affected by dry rot in 4 potato cultivars during storage.

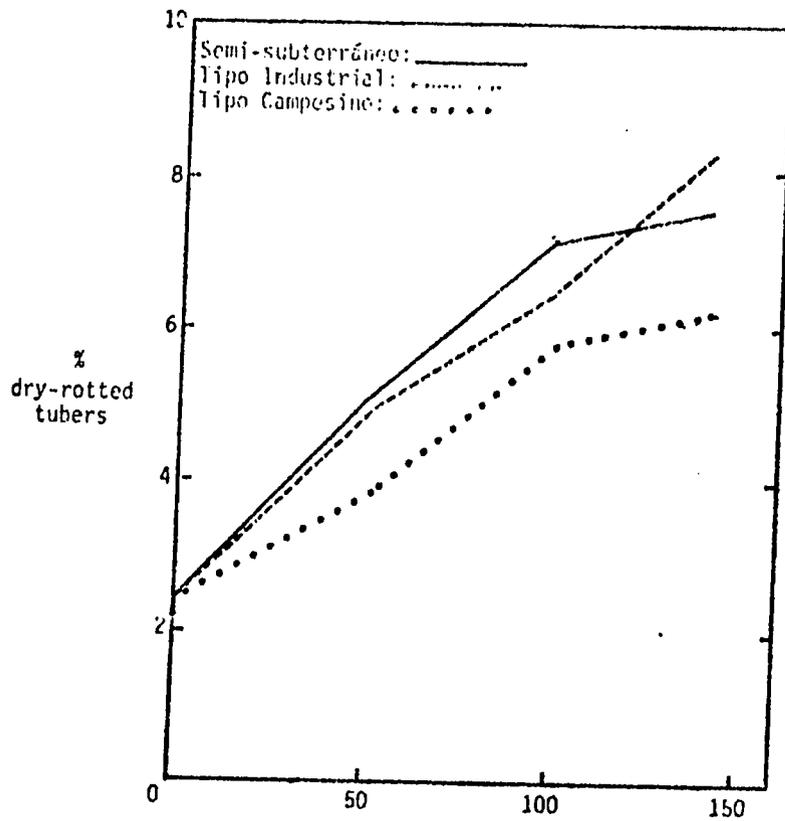


Figure 5. Percent of dry-rotted tubers in 3 types of storage systems

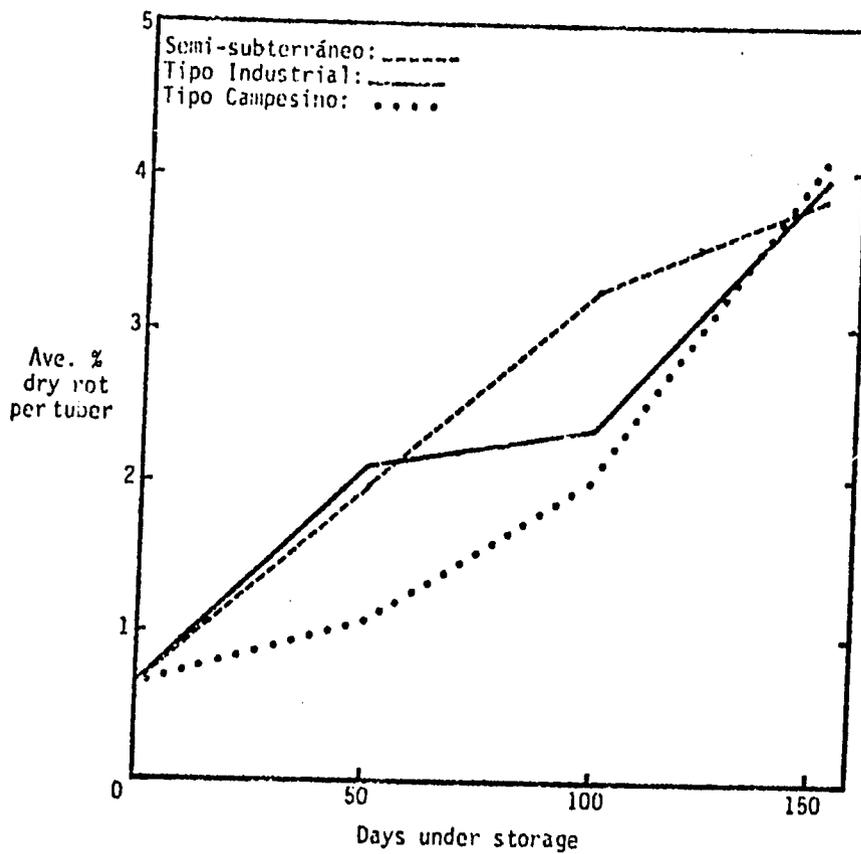


Figure 6. Average percent of tuber affected by dry rot in 3 types of storage systems.

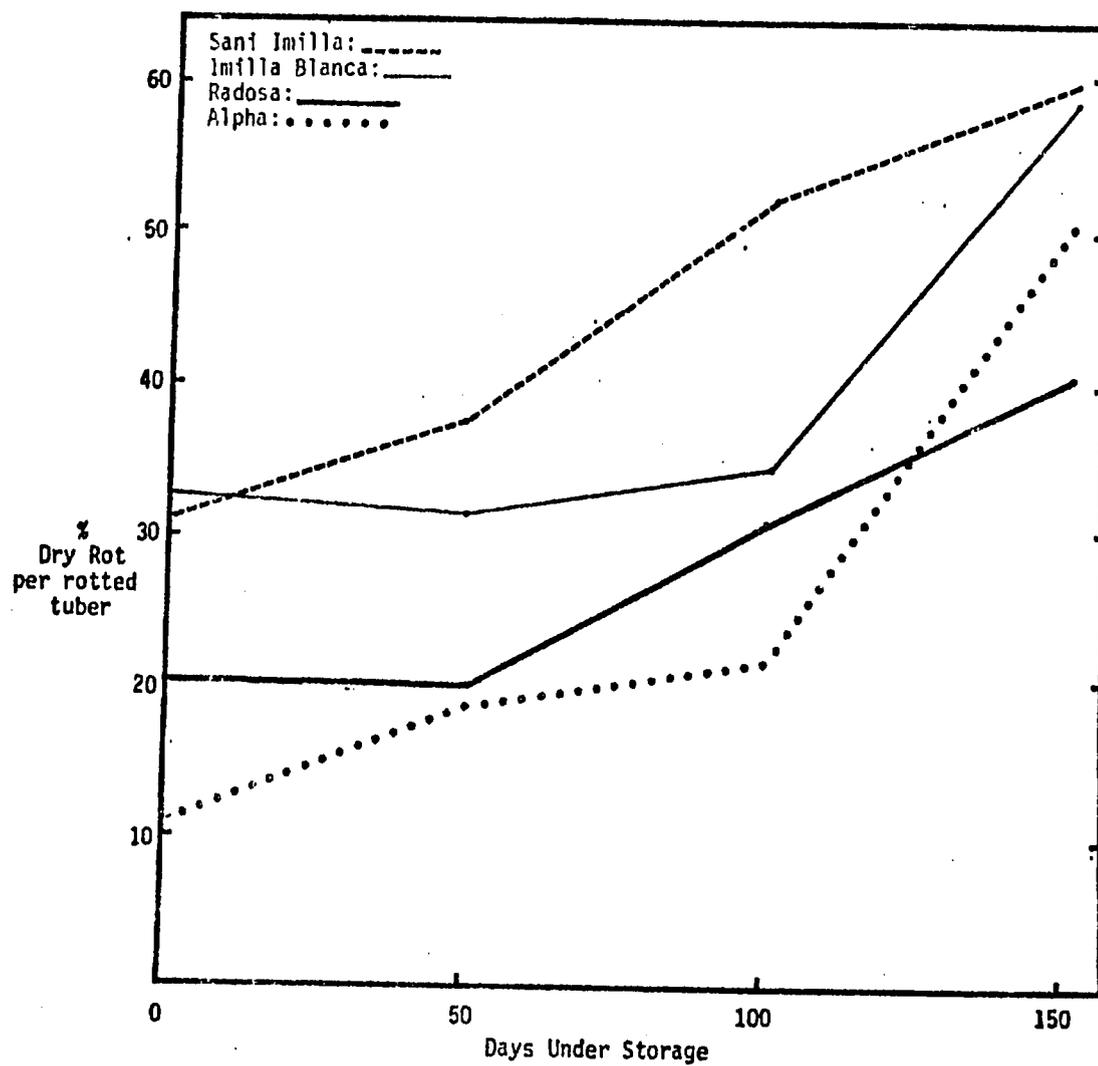


Figure 7. Average percent of tuber affected by dry rot in 4 potato cultivars during storage (only rotted tubers considered).

- b) Justification: M.D. Harrison and W.N. Brown detected Erwinia carotovora var. carotovora and var. atroseptica in potato stems in Bolivia. The symptoms produced by these bacteria can be: black-leg of the stems, non-emergence of plants and soft rot of tubers. The high incidence of symptomless plants having Erwinia made us suspect that this disease may be a problem especially in "seed" potatoes. Prior to Harrison and Brown's study there was no other information on Erwinia in Bolivian potatoes. There was a need to know more about this disease in Bolivia and determine its importance for economical appraisal. The project was started to fulfill the following objectives: (a) to determine the presence of Erwinia or soft rotted tubers in storages; (b) to determine the effect of this disease in a potato production system (Toralapa); (c) to estimate losses caused by this disease in Bolivia.
- c) Results: Potato storages of the following areas were surveyed and sampled: Highland (3.000-3.850 m altitude)--Altiplano, Toralapa, Chinoli, Morochata; lowland (below 3.000 m altitude)--Escalante, Tarija, Comarapa, Capinota, Vallegrande. Although we still have to tabulate the data, we observed little Erwinia incidence in potatoes obtained from the highlands

whereas samples from the lowlands had considerably more Erwinia infection. This was especially true in samples obtained from Comarapa and Vallegrande. In this last location, we also observed tubers affected by ring rot caused by Corynebacterium sepedonicum. To date, this pathogen has not been reported in Bolivia. In view of the danger this pathogen presents to any potato production system, IBTA technicians must become aware of it. One experiment in Toralapa (3,500 m altitude) and another in Comarapa (2,000 m altitude) were established with seed obtained from fields with different infestation levels of Erwinia. Treatments included: Sani imilla with low Erwinia incidence, Sani imilla with high Erwinia incidence, Alpha with low Erwinia incidence, Alpha with high Erwinia incidence. Although the treatments at both locations were exactly the same, the plots with high Erwinia incidence had poor emergence at Comarapa and good emergence at Toralapa. This shows the effect of environment on the expression of this disease.

- d) Future work: We need to: (1) harvest field experiments to obtain yield data, (2) identify the E. carotovora varieties using biochemical tests in the laboratory, (3) tabulate and analyze our data.

G.2.2 Nacobbus research

- a) Project leaders: Victor Otazú, Robert Hoopes, Gerardo Caero
- b) Justification: False root knot nematode of potatoes is a problem only in the highlands of the Andean countries of South America. Because of this, there is very little information on this pest. In Bolivia, there is no information on yield losses caused by this nematode, seed transmissibility, etc. This project was designed to answer the following questions:
(i) How much Nacobbus reduces yield? (ii) What is the effect of infested seed on the following crop?
- c) Results: We have established three experiments with four treatments each: soil treated with Telone C and planted with healthy seed, soil treated with Telone C and planted with infested seed, soil non treated and planted with healthy seed, and soil non treated and planted with infested seed. Two locations had Nacobbus infested soil and one had no Nacobbus in it the previous year. Although sampling is not complete, it appears that there are less Nacobbus nodules per plant in plots treated with Telone C.
- d) Future work: We need to finish sampling plants to complete Nacobbus population data analysis and obtain yield data at harvest time.

G.3 San Benito

Only about 20% of my time was devoted to the San Benito Experiment Station. Most of this time was spent at the diagnostic clinic. The

clinic still lacks activity. Some of the diagnosis work requires pathogenicity tests which should be performed in a greenhouse, but there is not a suitable greenhouse at the station. In order to increase the activities at the diagnostic clinic, I have sent pre-addressed envelopes to extension agents all over Bolivia with instructions on how to send samples to the clinic.

A compilation and appraisal of tarhui (Lupinus mutabilis) diseases in Bolivia was finished and it will be presented at the II International Congress of Andean Crops in La Paz (Feb. 8-12, 1982).

Future work

- Routine diagnosis activities at the clinic.
- Involvement on a chemical control program against mites and powdery mildew in peaches.
- Compilation and publication of an index of plant diseases in Bolivia.

G.4 San Simón University

Because of administrative problems, I was asked to be in charge of the lab sessions of the Plant Pathology course offered at La Tamborada (UMSS).

I was also invited to participate in a Ridomil workshop organized by IBTA and CIBA GEIGY at La Tamborada. My topic was "Control of Phytophthora root rot of soybeans".

G.5 Becarios

- Manuel Echalar - Chemical Control of Powdery Mildew in Peaches (Advisor: Mery Quitón, San Benito). This becario has not finished writing his thesis. Results showed great variability in leaf infections

because his experiment was not properly designed. However, in fruit infections, he found good responses to Benlate and Karathane for powdery mildew control in peaches.

- Eloy Sanabria - Chemical Control of Barley Yellow Rust (Advisor: Vidal Velasco, San Benito). Although this becario did a good job in his field experiments, he has not finished writing his thesis. He obtained a good control of barley yellow rust using Bayleton at 300 g/Ha, 400 g/Ha, and 500 g/Ha. These results were especially apparent in the susceptible variety Criolla. Promesa 76, a tolerant cultivar, showed symptoms late in the growing season, but its yield was still increased by using Bayleton for yellow rust control.
- René Santa Cruz - Etiology of enanismo amarillo (yellow dwarf) in barley (Advisor: Vidal Velasco, San Benito). The beca allowance of this student was cut temporarily after he failed to demonstrate the etiological agent of yellow dwarf in barley. He was supposed to start another project, but he did not show up again.
- Edwin Callardo - Chemical Control of Downy Mildew of Onion (Advisor: none). This becario started without a proper guidance. The disease he was dealing with is very serious during the rainy season in the Cochabamba valley. We now know that this disease is not a downy mildew. It is caused by a pathogen (*Heterosporium allii*), difficult to control. However, we have test trials using five different fungicides for its control. We have no results to report at the present time. The student has not showed up since last October; the work is being done by CID pathologist.

- Mario Coca - Erwinia Related Problems in Potato Storages (Advisors: Victor Otazú, Gerardo Caero, Toralapa). His results are summarized in the Erwinia subdivision of this report's section.
- Teófilo Villarroel - Fungi Related Problems in Potato Storages (Advisors: Victor Otazú, Gerardo Caero). His results are summarized in the dry rot subdivision of this report's section.
- Mario Jaimes - Biological Control of Peach Crown Gall (Advisors: W.M. Brown, Mery Quitón, San Benito). This becario works now for the San Benito Experiment Station. He revised his thesis and it is now approved by members of his committee. His thesis defense should be scheduled for March, 1982.

G.6 Publications

- Lehman, H.F., M.D. Rumbaugh, R. Zambrana, L.P. Spiaggi, and V. Otazú. 1981. Collecting alfalfa and other plants in Bolivia, Perú, and Ecuador. Proceedings U.S. Western Alfalfa Improvement Conference.
- Otazú, V., G.A. Secor. 1981. Soft rot susceptibility of potato tubers with high reducing sugar content. *Phytopathology*, 71:290-295.
- Otazú, V., A. Epstein, H. Tachibana. 1981. Water stress effect on the development of brown stem rot of soybean. *Phytopathology*, 71:247 (Abstract).
- Tachibana, H., V. Otazú, C.C. Kusek, and A.H. Epstein. 1981. Interaction of Corynespora cassicola and Phialophora gregata in soybean. *Phytopathology*, 71:908 (Abstract).

SECTION V

TRAINING ACTIVITIESStudent Scholarship

Bolivian Universities were open for classes during the reporting period. As a result, several students who were working on a thesis project decided to reduce their effort and some discontinued work until their courses could be completed. Those reducing their effort received a reduced stipend and those returning to the university full time postponed their stipend to a later date.

Several changes at UMSS delayed the review of thesis by University committee members and only two students were able to take their exams and receive their degrees. Several visits to the Faculty of Agriculture at La Tamborada helped to "streamline" the process and there should be many more theses reviewed, approved and degrees granted during the next reporting period.

During the reporting period, the students on scholarship, their names and status are as follows:

Student	Location	Date Started	Anticipated Ending Date	CID Advisor
Fernando Rivas Arce	Cochabamba	7/15/80	7/14/81	Hoopes
Andrés Gregorio Mejía Escalera	Cochabamba	8/1/80	7/31/81	Kunkel
Edwin Fructuoso Gallardo Torrico*	Cochabamba	9/1/80	8/31/81	Stilwell
Pené Eduardo Andrew Cardozo	Cochabamba	10/1/80	9/30/81	Foster
Juan Humberto Arana Iriarte	Cochabamba	9/1/80	8/31/81	Thomas
Armando Ferrufino Coqueugniot	Cochabamba	10/1/80	9/30/81	Foster
Ignacio Huayta Colquehuanca	Cochabamba	10/1/80	9/30/81	Hoopes
Raúl Nuñez Cruz	Cochabamba	10/1/80	9/30/81	Stilwell
Gregorio Pinto Vega	Cochabamba	10/1/80	9/30/81	Stilwell
Eloy Sanabria Ortuño	Cochabamba	10/1/80	9/30/81	Stilwell
José Roberto Terceros Hermosa*	Cochabamba	8/1/80	7/31/81	Stilwell
Claudio Ticona Martínez**	Cochabamba	9/1/80	8/31/81	Thomas
Raúl Velásquez Arias	Cochabamba	10/15/80	10/14/81	Foster

José Luis Ríos Antezana	Cochabamba	10/1/80	9/30/81	Thomas
Rosario Medrano de Aparicio	Cochabamba	11/1/80	10/31/81	Stilwell
Eduardo Sarmiento Jaldín	Cochabamba	10/15/80	10/15/81	Kunkel
José Villarroel Coca	Cochabamba	11/1/80	10/31/81	Stilwell
Rubén Tito Aranibar Iriarte	Cochabamba	12/1/80	11/30/81	Kunkel
Juan Manuel Echalar Torricos	Cochabamba	12/1/80	11/30/81	Kunkel
Eybar Gorena Donoso	Cochabamba	12/1/80	11/30/81	Foster
Hortencia León Hurtado	Santa Cruz	8/15/80	8/15/81	BTAN
Nelson A. Rodríguez Méndez	Santa Cruz	8/15/80	8/15/81	BTAN
Rubén Herbas Canelas	Santa Cruz	10/15/80	10/15/81	Thomas
Elías Rojas Ricaldez	Santa Cruz	10/15/80	10/15/81	Thomas
Mario Coca Morante	Cochabamba	3/15/81	3/14/82	Otaquí
Teófilo Villarroel	Cochabamba	5/1/81	4/30/82	Otaquí
Filemón Iriarte Montaña	Cochabamba	6/1/81	5/31/82	Kunkel
José Prado Crespo	Cochabamba	6/1/81	5/31/82	Kunkel
Gustavo Franco Maldonado	Cochabamba	6/1/81	5/31/82	Kunkel
Carlos Padilla Irigoyen	Cochabamba	7/1/81	6/30/82	Thomas
Alberto López Valencia	Cochabamba	8/1/81	6/30/82	Kunkel
José Modestino Rojas Rojas	Cochabamba	9/1/81	6/30/82	Thomas

* Beca suspended.

**Beca suspended June 30, 1981. He will be under our beca program again starting February 1st, 1982.

Summary of advisees per staff member during this period:

Dr. Robert W. Hoopes	2
Dr. Robert Kunkel	8
Dr. Thomas C. Stilwell	7
Dr. Donald P. Foster	4
Dr. James H. Thomas	7
Dr. Victor Otaquí	2
British Mission	2

Total 32 students

SECTION VI

PUBLICATIONSAdministrative Reports

01/81 - Semiannual Progress Report for period January 1 - June 30, 1981.

Working Papers

- 03/81 - Manual de Soporte del Sistema de Estadística Agrícola by Thomas C. Stilwell, July, 1981.
- 04/81 - Factores que Influyen en la Elección de Variedades de Trigo, Papa y Alfalfa en el Valle de Cochabamba by Mario Altamirano Orosco, July, 1981.
- 05/81 - Manual del Usuario del Sistema de Estadística Agrícola para el Digital PDP 11/45 by Thomas C. Stilwell, July, 1981.
- 06/81 - Relación entre Factores Agro-Económicos y Tecnología Utilizada por Agricultores que Cultivan Trigo by Oscar Omonte M., October, 1981.
- 07/81 - Una Encuesta sobre Sistemas de Producción en el Valle Alto (Cochabamba) by Ing. Orlando Claros and Dr. Thomas C. Stilwell, December, 1981.
- 08/81 - Elección y Utilización de Variedades de Trigo para la Molienda en el Valle Alto by José Luis Rfos Antezana, October, 1981.
- 09/81 - Encuesta sobre Sistemas de Producción de Valle Alto (Cochabamba) by Ing. Agr. Orlando Claros Rivero and Dr. Thomas C. Stilwell, December, 1981.