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SUMMARY RESEARCH PROGRESS REPORT FOR 1990

Submitted to:
SLV Research Center Committee
and the
Area II Potato Administrative Committee

TITLE: POTATO GROWTH ANALYSIS UNDER FIELD CONDITIONS

PROJECT LEADERS: Kenneth W. Knutson - Horticulture
Frank D. Moore - Horticulture

PROJECT JUSTIFICATION:

This research is designed to provide fundamental information about growth characteristics of potato varieties under San Luis Valley field conditions. This information will improve our ability to develop more precise and efficient crop management strategies to include seed handling, planting; fertilizer application; irrigation; pesticide application scheduling; disease control and crop maturation practices.

PROJECT STATUS: Ongoing; first funded in 1989; funded again in 1990.

SIGNIFICANT ACCOMPLISHMENTS FOR 1990:

1. The 1990 experiment was essentially a repeat of 1989 with the exception that 6 replications were used instead of 5 and the feasibility of using a new instrument to gather leaf area index information was explored. The new instrument is a LICOR Model LAI 2000 Plant Canopy Analyzer which was purchased with funds provided by the Department of Horticulture.
2. Ten sets of weekly data on leaf area, top dry weight, and tuber dry weight were collected on the three potato varieties-- Sangre, Centennial, and Russet Nugget. In addition a final tuber harvest was taken to provide total and market yield data.
3. The data clearly show differing developmental dynamics for the three varieties with regard to foliage growth, time of tuber initiation and rate/duration of tuber growth. The information indicates that the most recently released Colorado variety---the late maturing Russet Nugget, needs to be very carefully managed to reduce the risk of yield reduction resulting from an early fall frost. The growth cycle of Sangre seems to be ideally suited to the short season San Luis Valley conditions----in fact the growth patterns of Sangre could serve as a model for gauging the adaptability of new varieties to this area. The data also point out why the Centennial variety has proven to be a successful potato in the SLV.
4. The combined two years of results verify that plant growth analysis can identify a "time course" of growth stages that are unique and individual for the varieties grown by SLV potato producers. Our mathematical delineation of growth stages should enable growers to improve the timeliness of most field management practices.
5. The feasibility of using the LICOR plant canopy analyzer to measure the leaf area index looks encouraging. A series of 4 separate field readings were made and compared with the actual leaf area measured by removing each leaflet and passing them through a leaf area meter. The plant canopy analyzer offers a potentially important means of reducing the amount of time and expense required to conduct growth analysis research.
6. The data collected during the past two years will be essential for calibrating the computer growth simulation model SUBSTOR for SLV conditions. SUBSTOR is a computer model developed by scientists located at Washington State University; Dr. Moore attended a special 10 day workshop in Florida last fall at which the basics of SUBSTOR was demonstrated and training provided for workshop participants.

SUMMARY COMMENTS:

The project leaders are very encouraged by the results obtained from the past two growing seasons. The growth analysis approach should enable us to learn a great deal regarding how different varieties respond to the unique SLV environment. If we can eventually expand the data base to include all of the varieties we should be able to provide an information resource that will encourage more precise crop management and profitable production of potatoes for SLV growers. Furthermore, if growth analysis information of new varieties can be obtained prior to release to growers the likelihood of success with new clones should be considerably enhanced.

Quite frankly, however, we are somewhat uncertain how to best proceed with this research program. While we are very convinced of the value to the SLV industry we realize that the funding resources required to properly develop this research will be considerably greater than that requested the past two years.

There are essentially two major areas of effort that should be pursued: First--The experience of the past two years clearly indicates that we need a graduate student to provide the type of expertise that hourly student help cannot supply. Furthermore this area of research is new and represents an excellent opportunity for student training. The data gathered the past two years has enabled us to identify some areas of investigation that are not only high priority but will enable us to further validate the conclusions we see emerging from the previously completed experiments. For example, the growth characteristics of Sangre compared to Russet Nugget represent a very interesting situation. Here we have two potato varieties--- developed in the same breeding program--- that have quite different patterns of growth and development. If we can dig a little deeper into this comparison and start to understand how each of these potatoes produces a crop under a relatively short season we should gain a much better insight into the way potatoes grow in the SLV. In the course of completing this phase of the work we would also be developing the possibilities of using the plant canopy analyzer and refining the other methods of conducting plant growth analysis research. Fundamentally we need to determine the physiological components of crop yield. Concurrently the graduate student would be calibrating the SUBSTOR computer model.

The estimated cost of a graduate student is outlined below:

ITEM	1ST YEAR	2ND YEAR
Graduate student*	\$ 15350	\$11740
Travel	3000	3000
Supplies	1000	1000
Totals	\$19350	\$15740

*1st year student would require out of state tuition

Second-- we need to get the computer simulation model SUBSTOR calibrated for SLV conditions. We feel that we have enough "baseline" data to get the model functional. As we continue to gather data it can be used to fine tune the model--- this will be an ongoing effort that will continually improve the validity and accuracy of the output. The SUBSTOR model(developed by Tom Hodges-Cropping Systems Analyst-USDA/ARS: Prosser, Washington) is adapted for use on a PC thus when the calibration is complete the model will be available for anyone who has a PC and will take the time to be trained. We are currently estimating that about three months of computer technician time would be needed to do the job; this would require about \$4000.00. Validation will continue.

SUMMARY OF BUDGET REQUEST FOR 1991

1. Graduate student:	
Stipend and tuition	\$15350--
Travel	\$ 2500--
Supplies	\$ 1000--
subtotal	\$ 18850--
2. Validation of SUBSTOR	\$ 4000--
<u>TOTAL</u>	<u>\$ 22850--</u>

RESEARCH PROPOSAL FOR 1991

TITLE: REACTION OF POTATO VARIETIES TO FUSARIUM SEEDPIECE DECAY AND EVALUATION OF FUSARIUM ISOLATES FOR DEVELOPMENT OF RESISTANCE TO MERTECT

PROJECT LEADERS: Kenneth W.Knutson and Borghild Glorvigen

PROJECT JUSTIFICATION: Fusarium fungi are well known to be an important causal factor of seedpiece decay but they also can promote the severity of Erwinia bacterial decay. There are two major species of Fusarium that can cause seedpiece decay: Fus. solani- "Coeruleum" and Fus. roseum "Sambucinum". Although varietal differences in susceptibility to fusarium seedpiece decay have been observed, we do not have reliable information about the reaction of Colorado potato varieties to fusarium fungi. A better understanding of the susceptibility of such varieties would aid growers in overall management of seed cutting, choice of chemical treatment and preparation for planting.

Recent research in North Dakota indicates that some Fusarium isolates may have developed resistance to thiabendazole (Mertect). Since Mertect is widely used in the SLV it is of interest to know whether such fungal resistance may have developed among fusarium isolates occurring on local potatoes.

PROJECT STATUS: New

OBJECTIVES FOR 1991

1. Evaluate the relative susceptibility to fusarium seedpiece decay of the following potato varieties: Centennial, Sangre, Russet Nugget, Russet Burbank, Russet Norkotah, and Frontier Russet. The reaction will be evaluated on tubers held in storage as well as seedpieces inoculated and planted in the field.
2. Determine if fusarium cultures isolated from SLV potatoes during the storage survey conducted in the fall of 1990 are resistant to Mertect. Preliminary efforts are underway; a limited number of San Luis Valley fusarium cultures are currently being tested at North Dakota State University which will be an indication of possible resistance. Additional and more extensive testing will be necessary to verify possible fusarium resistance.

FUNDING REQUEST

Travel; 5 trips to SLV @ \$400/trip	\$2000--
Student Hourly Help	\$1200--
Supplies	<u>\$1000--</u>
Total	\$4200--