DAVIDSON

CSU

Colorado State University
Fort Collins, Colorado
80523

Department of Entomology

April 4, 1985

Carl Worley, Chairman
San Luis Valley Research Center Committee
0249 East Rd 9 North
Center, CO 81125

Dear Mr. Worley:

In regard to your letter of March 25 I am submitting a modified, and expanded, 1985 research proposal for entomology studies.

The enclosed proposal includes a fairly extended introduction which you may wish to skip over. I have written it to help establish what I feel are leafroll research priorities and how they should be addressed.

Major changes in the proposal are the addition of follow-up studies recently started by Livingston/Klein. These were not in the earlier proposal because I did not know that Clark was not going to make a proposal. Since then I have discussed a number of these projects with him and we will be working together on them.

The overall budget (last page) can be reduced somewhat by eliminating certain projects. However, I urge that you accept the package because it is far more efficient in time and money for me to conduct multiple studies at one time. I would be glad to discuss any individual items with you.

Please note that I have deducted $2,500 from this year's budget. This is money received from the Potato Administrative Board after last summer's field season. Since I was not given any prior notice of the amount or certainty of this grant I was not able to use it last season.

A final point I want to make regards the "traditional role of the university" to help provide some funding for a research assistant. I have redrawn the proposal. However, as you may not be aware, my position at C.S.U. is non-traditional. I have a 3:2:1 Extension:Research:Teaching split appointment. My responsibilities cover all aspects of horticultural entomology for Colorado (greenhouse, turf, ornamentals, gardens, commercial vegetables). The limited funding I do have from the Experiment Station, I have at present largely directed into support studies for the Urban I.P.M. program, which I am in charge of. I am scrambling for money to support potato insect studies. I do very much want to work in potatoes because I see many interesting challenges there. Also, I have worked on potato insect problems for 10 years now and enjoy it.

I hope that you will give this proposal favorable consideration. If you need to discuss anything, my phone # is 491-6781.

Sincerely,

Whitney Cranshaw

Whitney Cranshaw
Assistant Professor/
Extension Entomologist

WC/kh
Enclosure

Research Questions - Potato Leafroll

A number of research questions need answers to allow coordinated potato leafroll management. Among the most important, in my opinion, are:

1. What aphid species are transmitting potato leafroll in the San Luis Valley and how important are they?

2. What are the overwintering sources of the aphids in the San Luis Valley?

3. What are the overwintering sources of the potato leafroll virus in the Valley?

4. How important is spread of leafroll by winged migrant aphids (primary spread) versus in-field plant-to-plant spread by wingless aphids (secondary spread)?

5. When is spread of leafroll occurring?

6. What pesticide approaches are most effective and efficient for leafroll control in the San Luis Valley?

7. How do cultural practices affect leafroll management?

8. How can survey techniques for potato insects be standardized for efficiency?

Research Questions - Current Status

Many of the above questions have been answered or proposals were made to study them at the research reporting meeting:

Question 1 - Bob Klein clearly has demonstrated that green peach aphid and potato aphid can transmit potato leafroll in the San Luis Valley. It is much more difficult to determine how important each species is. A study on transmission efficiency would provide one clue. The relative abundance of the two species could provide another clue in field surveys. Correlation of flights with periods of leafroll spread would also indicate importance of aphid as a vector.

Question 2 - Information on what plants serve as overwintering hosts for the aphid vectors is needed to better target efforts of the host tree spray program and, ultimately, to provide needed background for a Prunus eradication effort. Gene Nelson reported on a survey of this type in his 1975 report. Since that time more Prunus has been planted. Also, questions have arisen about the suitability of various Prunus not included in Gene Nelson's survey.

I feel that a new survey of overwintering host plants would be useful. I also feel that it would be most appropriate for someone in the San Luis Valley to conduct this study. This would save much money in travel expenses.

An auxilliary study might also check for overwintering host plants of the potato aphid in the San Luis Valley, which has never been done.

Question 3 - I feel that Bob Klein has quite effectively shown that wild weed hosts provide little, if any, of the overwintering virus sources. Infected potatoes appear to be the sole source of the virus. Minor questions still remain to conclusively test field bindweed and 4-winged saltbrush as hosts of the virus.

Question 4 - The question of in-field versus primary spread is important since it determines whether a preventative insecticide treatment or a "treat when aphids detected" treatment approach is best for leafroll control. Rob Davidson's studies during 1984 and his 1985 proposal will largely answer this.

Question 5 - Rob Davidson's studies also address this question. From a different approach, Bob Klein's use of indicator/trap plants were able to identify very accurately when spread by winged forms was occurring. Both studies need to be continued. In addition, some technique questions (primarily what indicator plant to use) need to be answered in the use of indicator/trap plants for this type of study.

Qustion 6 - Insecticide treatments can vary widely in how well they manage potato leafroll depending on active ingredient, rate used, application timing, etc. Very little information on this subject is available under the unique conditions of the San Luis Valley. This is a high priority, in my opinion.

Question 7 - Even under the best conditions, chemical approaches alone can not provide complete control of potato leafroll transmission. What can contribute to overall management are techniques which limit the colonization of the plants by aphids. Included in this are effects of variety, crop color, crop "background", and crop spacing. Some information on varietal differences (Centenniel versus Russet Burbank) comes from Rob Davidson's studies. An expanded effort looking at how aphid landing rate is affected as well as population levels on plants, is needed.

Question 8 - Many, many researchers have dealt with sampling methods of aphids. These studies have demonstrated that all sorts of factors can affect sampling efficiency. Unfortunately, diverse systems are used in the San Luis Valley for insect sampling and it is difficult to compare their results. Development of an acceptable, standard insect sampling method is needed.

Potato Leafroll Research Proposals - Entomology

Research proposals were outlined in my proposal to the committee made at the research reporting meeting last month. When this proposal was made, it was not known that Clark Livingston was not going to make a proposal. Since then, I have discussed research needs with him and others. Consequently, I submit the following expanded proposal:

Study 1. Indicator/Trap Plant Studies

Purpose: Three and possibly four pieces of information can be gathered in this study: 1. determination of when spread by winged aphids is occurring; 2. correlation of time of leafroll spread with flights of specific aphid species; 3. improvement in the indicator/trap plant technique; and 4. determination of the relative resistance/susceptibility of various potatoes and indicator plants to potato leafroll infection.

Methods: Yellow pans containing indicator plants will be established at five locations. Four pans will be placed at each site. Each pan will contain one plant each of the following indicator plants: "Russet Burbank" potato, "Centenniel" potato, Physalis, and Datura. There will also be a trap pan at each site used for collecting aphids.

Once a week, beginning the last week of June, indicator plants and the trap pan will be placed at each site. At the end of each week, the contents of the pan will be collected and the indicator plants replaced. This will continue until the end of August.

Aphids collected in the pans will be identified to species. Indicator plants will be incubated in a green house at Ft. Collins for one month then tested for leafroll infection by ELISA.

(Note: The budget submitted for this project assumes a trip to the Valley every other week. On alternate weeks someone living in the Valley will make the exchange of plants. John McCrady has agreed to work together with me on this project. Extra plants will be temporarily housed in a screen house.)

Study 2. Vector Efficiency Studies.

Purpose: To compare the efficiency of various aphid species and strains to transmit potato leafroll.

Methods: This will be a greenhouse study conducted after the growing season. Strains of green peach aphid, potato aphid, and any other suspect vector species will be given acquisition feeds on potato leafroll source plants. They will then be transfered to potato seedlings. After a suitable inoculation period the plants will be assayed using ELISA.

Study 3. Comparison of foliar insecticide treatments on leafroll spread.

Purpose: To evaluate various foliar applied insectcides for ability to control potato leafroll.

Methods: A modification of the indicator/trap plant study will be used. Russet Burbank seedlings treated with various foliar insecticide treatments will be used as trap plants. Plants will be maintained in five trapping locations at 2-week intervals before being returned to Ft. Collins for incubation and testing with ELISA

Study 4. Comparison of soil applied systemic insecticide treatments on leafroll spread.

Purpose: To evaluate how various soil applied systemic insecticides control leafroll spread.

Methods: Four different systemic insectcides applied at varying rates and two application times will be included. Insect populations will be counted at 2-week intervals. A sub sample of the tubers will be collected and submitted to the winter test to evaluate percentage leafroll infection.

Study 5. Cultural practice/Aphid interaction studies.

Purpose: To see how various cultural practices affect colonization of potatoes by aphids and spread of potato leafroll.

Methods: Potatoes will be grown using various cultural practices. Aphid landing rates, aphid colonization, and leafroll infection will be measured on these plantings. Specific cultural practices that will be studied include:

a. differences in plant spacing;
b. differences in fungicide use;
c. differences in crop background.

Study 6. Aphid trap efficiency studies.

Purpose: To determine how various aspects of trap design and placement affect capture of winged aphids.

Methods: Primary emphasis will deal with evaluating the water pan traps. Various aspects of the trap use will be investigated:

a. Use of different trap pan sizes.
b. Use of different trap pan colors.
c. Use of different additives to the water.
d. Using different water volumes.
e. Using different trapping intervals.

In one other study, trap pans will be compared for trapping efficiency with 1-2 designs of sticky traps.

A side benefit of this study will be to gather information on how well various trap designs can be used for monitoring potato psyllid.

Potato Psyllid Research Proposals

Potato psyllid is a sporadic but serious pest of potatoes grown both for table stock and processing as well as for seed. Because this insect occurs over a fairly limited area of the country, recent research is lacking and serious information gaps exist. Two initial studies are proposed. Ultimately the aim is to develop "economic thresholds" for this insect and methods to determine when threatening populations do (or do not) Pexist.

Study 7. Insecticide Efficacy Trials

Purpose: To determine how well various insecticides control potato psyllid. At present few insecticides are labelled for control of this insect and information on comparative effectiveness is lacking.

Methods: Trials will be established in two locations. Attempts (so far unsuccessful) will be made to locate one of these under sprinkler irrigation in the Valley. Plants will be treated at 2-week intervals and plots will be evaluated three days and two weeks after treatment.

Study 8. Psyllid Varietal Trials

Purpose: There is some evidence that potato cultivars vary in susceptibility to potato psyllid. This will be investigated.

Methods: 8-10 potato varieties will be included in the study, which will be planted at two locations. Within each replication, varieties will be paired so that one now is maintained free of insects with insecticides, the other left untreated. Numbers of insects on the untreated rows will be counted at 2-week intervals. Yields of treated vs. untreated potatoes will be taken to compare the response to psyllid injury.

1985 BUDGET PROPOSAL
POTATO STUDIES - ENTOMOLOGY

Travel (to San Luis Valley)	$1,350
Travel (other sites)	250
Labor (Summer)	4,000
Labor (Laboratory, Statistical, Greenhouse, Reporting)	1,200
Supplies, equipment	650
TOTAL	$7,450
1984 Funding received after field season	-2,500
Total 1985 Request	$4,950

Submitted by:

Whitney S. Cranshaw
Department of Entomology
Colorado State University
Ft. Collins, CO 80523