

Western IPM Center Project Report Form

How to submit: Please submit this completed form electronically, as an attached Microsoft Word file, to Frank Zalom at fgzalom@ucdavis.edu. **Content:** Complete each section below, and include responses to as many of the questions listed in Attachment A as are relevant to your project. *These are guidelines.* Provide your readers with enough detail that someone who is not familiar with your project can understand what you were trying to achieve, how you went about it, and what you accomplished, but please keep it concise.

A. Report Data

Date: 12/15/10

Reporting Period:

Report Type (please check one):

Progress Report Final Report

B. Grant Data

- Grant Agreement #: NM-112816
- Title: Seasonal Phenology of the Beet Leafhopper in Relation to its Weed Hosts and Beet Curly Top Virus Infection
- Grant Type: Western Region IPM Grant
- Lead investigator:
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- Team members (name, title, institution): C. Scott Bundy, Associate Professor, NMSU
- Jill Schroeder, Professor, NMSU
- Leigh Murray, Professor, Kansas State University
- State(s) involved: New Mexico and Kansas

C. Nontechnical Summary. An overview of the project, briefly outlining the problem(s), how your project addresses them, and your results, *written to a lay audience*. (500 words)

Curly top virus (BCTV), which is transmitted by the beet leafhopper, *Circulifer tenellus* (Baker) [Hemiptera: Cicadellidae], has caused significant problems to irrigated agriculture in the western US since 1899. In New Mexico, curly top disease causes substantial (over 50% in some years) losses to chiles. Since the crop is often grown with a small profit margin, growers are not able to grow chile profitably with that level of loss. Growers often attempt to control the problem by insecticide application, but the vector can transmit the virus more rapidly than an insecticide can be effective. As such, insecticide use for control of curly top is not sustainable from an IPM, environmental, or economic perspective. Little is known about the seasonal development of the beet leafhopper in New Mexico. A better understanding of the phenology of this insect (number of generations, timing of nymphal and adult development, etc.) and its interaction with weed hosts and chile are critical for proper timing and implementation of management strategies. Thus, a better understanding of how the beet leafhopper interacts with important weeds, such as London rocket, will allow commercial growers and gardeners in the general public not only the advance warning of likely high disease pressure, but also a necessary tool to implement effective disease management.

Beet leafhopper populations (adults, nymphs, and eggs) were evaluated for two years (samples taken weekly) at two field sites from southern New Mexico. There is a single, distinct generation of the beet leafhopper on weed hosts in agricultural regions of southern New Mexico, with some evidence that the insect could be bivoltine; this is considerably fewer generations than previously speculated in the literature. During the two years, eggs were found in abundance primarily in the months of April and May and nymphs in abundance primarily during the months of May, June, and July. Adults were present on weeds throughout the year, but sustained the largest populations on kochia from late May through the end of June. Adults were reduced on weeds during late summer and fall, possibly due to adult mobility to the desert. To complement phenological information for the management of this pest, the possible effects of site characteristics upon *N. tenellus* populations were also investigated. Probability of nymph presence was found to be greater in fallow field type sites containing larger patches of weeds during both years. In 2009, the occurrence of pecan orchards, ditch banks, road sides, and fallow fields were all found to predict nymph presence, while the occurrence of desert scrub, residential areas, and agricultural field edges were not predictors. Adults exhibited a great degree of mobility, so that the effect of site characteristics on their numbers was undetermined. Based on the developmental phenology of the insect and weed hosts, we now have a better picture of the system in New Mexico and are now able to begin adjusting management strategies for this pest and the virus.

D. Objectives and Progress. List your objectives and describe your progress for each objective.

The overall objective of the proposed research is to determine the seasonal phenology of the beet leafhopper in southern New Mexico and its relationship to weed host phenology and habitat. These data will be used to better implement management strategies, including when and where the weed hosts should be removed for optimum disease control. Specific objectives include:

1. Establish the seasonal phenology of the beet leafhopper in southern New Mexico, using London rocket and Kochia scoparia as key winter and summer hosts, respectively and assess the effect of habitat of London rocket and Kochia on suitability for beet leafhoppers.

PROGRESS: The project is now complete. Beet leafhopper populations have been evaluated each week in southern New Mexico at multiple locations from January 2008 through December 2009. Sampling consisted of weekly sweep and bucket samples and plant stem/leaf samples to determine adult/nymph and egg populations, respectively. Based on field research consisting of weekly samples over nearly two years, we find that the beet leafhopper completes 1 distinct generation (and a possible 2nd) on weedy hosts in southern New Mexico; this is considerably fewer generations than previously speculated in the literature. Our data give us an excellent picture of the timing of adult and nymphal populations, as well as egg laying periods. We have shown that the beet leafhopper will complete its development on the weeds London rocket and Kochia, confirming that these weeds are important hosts of the leafhopper. Evaluations of site characteristics upon *N. tenellus* populations showed that nymph presence was found to be greater in fallow field type sites containing larger patches of weeds.

2. Determine the natural incidence of curly top on London rocket in different months of the year.

PROGRESS: Weeds were processed and evaluated for presence of virus at several locations throughout southern New Mexico.

3. Refine management recommendations for curly top based on the results obtained.

PROGRESS: Our data on the timing of leafhopper generations and developmental timing within generations and the relationship to plant phenology and host suitability are key to developing a management strategy. This combination of data give us a better starting point for managing the key weeds in the system and resulting leafhopper/virus populations. London rocket appears key to managing the system. Seedlings begin development in the fall and beet leafhoppers are ovipositing in late winter. Therefore, the weed should be targeted in fall while it still may be managed and before the leafhoppers have a chance to build populations.

E. Outputs. List your project's outputs, which might include publications, information, data, meetings held, attendance at meetings held, etc.

Davis, G.M., C.S. Bundy, R. Creamer, J. Schroeder, and L. Murray. Seasonal Phenology of the Beet Leafhopper, *Neoliturus tenellus* (Ball) (Hemiptera: Cicadellidae), on Cool and Warm Season Weed Hosts in Southern New Mexico. Environmental Entomology [in review].

Davis, G.M. 2010. Seasonal Phenology of the Beet Leafhopper, *Neoliturus tenellus* (Ball) (Hemiptera: Cicadellidae), on London Rocket, *Sysimbrium irio* L., and Kochia, *Kochia scoparia* (L.), Schrader, in Southern New Mexico. Master's Thesis, 104 pp.

Davis, Graeme and Scott Bundy. 2010. Phenology of the beet leafhopper, *Neoliturus tenellus* (Baker) (Hemiptera: Cicadellidae), in southern New Mexico. Oral presentation, 2010 Annual Meeting of the Southwestern Branch of the Entomological Society of America. Cancun, MX, April 11-14.
[WON 2nd Place in Master's Oral Competition]

Davis, Graeme and Scott Bundy. 2010. Phenology of the beet leafhopper, *Neoliturus tenellus* (Baker) (Hemiptera: Cicadellidae), in southern New Mexico. In Proceedings 58th Annual Meeting of the Southwestern Branch of the Entomological Society of America.

Davis, G. and Scott Bundy. 2009. Seasonal phenology of the beet leafhopper, *Neoliturus tenellus* (Baker) (Hemiptera: Cicadellidae), in southern New Mexico. poster presentation, ESA National Meeting, Indianapolis, IN (Dec. 13-16).

Davis, G. and C. Scott Bundy. 2009. Phenology of the Beet Leafhopper in the Mesilla Valley of Southern NM. invited talk, Curly Top Regional Working Group Meeting, Tucson, AZ, (Aug. 20, 2009).

Davis, G. and Scott Bundy. 2009. Seasonal development of the beet leafhopper, *Neoliturus tenellus* (Baker) (Hemiptera: Cicadellidae), in southern New Mexico. oral presentation, Rocky Mountain Conference of Entomologists, Silverton, CO (Aug. 3-4).

Davis, G. and C. Scott Bundy. 2009. Seasonal phenology of the beet leafhopper, *Neoliturus tenellus* (Baker) (Hemiptera: Cicadellidae), in southern New Mexico. poster presentation, Annual Meeting of the Southwestern Branch of the ESA, Stillwater, OK (Feb. 23-26).

Davis, G. and Scott Bundy. 2008. Seasonal phenology of the beet leafhopper, *Neoliturus tenellus* (Baker) (Hemiptera: Cicadellidae), in southern New Mexico. poster presentation, ESA National Meeting, Reno, NV (Nov. 16-19, 2008).

F. Impacts and Potential Impacts. The “impacts” and “potential impacts” sections of your report will help the Western IPM Center highlight the value of IPM research and education by detailing the real-world impacts of Center-funded projects. We will use the information in news articles, reports, and informational brochures to showcase the impacts of projects that our program supports. *See Attachment A at end of form for questions to assist you in describing the impacts of your project.*

1. Impacts. Describe any impacts of your work. *Impacts* are specific changes in condition for those affected by your work. Impacts include adoption of technology, creation of jobs, reduced cost to the consumer, less pesticide exposure to farmers, access to more nutritious food, and a cleaner environment and healthier communities.

The results of this research will provide New Mexico growers with critical information on the associations among the beet leafhopper, beet curly top virus, and key weed populations and the seasonal timing of these associations, providing management tools to better deal with this pest complex.

2. Potential impacts. Describe your project's potential impacts. *Potential impacts* are the ways that your project's outputs could directly lead to changes in condition that will unfold in the future.

ECONOMIC BENEFITS -

Better management strategies developed due to an increased understanding of the seasonal relationships of the beet leafhopper, weed hosts, and beet curly top virus should result in better yields and increased profits.

ENVIRONMENTAL BENEFITS -

Our data should offer the potential to reduce insecticide applications (and resulting environmental exposure) due to a better understanding of the timing of the seasonal development of the beet leafhopper.

G. Appendices

1. With your report, please attach *at least two (2) photographs* that illustrate your project. Please describe the photo and indicate the name and institution of the person who took the photo. (If you submit more than two photographs, please include those additional descriptions and photo credits under "H. Additional Information," below.)

Photo #1 description:

Photo #1 credit (photographer's name and institution):

Photo #2 description:

Photo #2 credit (photographer's name and institution):

2. Also attach any printed fact sheets or other publications resulting from your work that will enhance our understanding of your project and its impacts. Please provide a description of each attached publication below.

Document #1 description:

Document #2 description:

Document #3 description:

H. Additional Information

Credit: Some of the language about impacts and potential impacts was adapted from a PowerPoint presentation by H. Michael Harrington, Executive Director, Western Association of Agricultural Experiment Station Directors, Colorado State University.

Attachment A

Questions to Help in Reporting Impacts and Potential Impacts

Below are some questions that will guide you in assessing and then describing the impacts and potential impacts of your project. The relevance of each question may vary depending on whether yours is a research or extension project. Please answer as many as you can to the best of your ability, and feel free to describe any additional types of impacts not mentioned below. Remember to identify any potential impacts.

1. Innovations in IPM:

Are there new IPM practices that have been (impacts) or could be (potential impacts) adopted as a direct result of your project? What is the total number of acres (or homes, schools, greenhouses, nurseries) on which these practices could realistically be implemented?

2. Safeguarding human health and the environment:

- a. Has the project reduced risk (or could it potentially do so) by changing the use of pesticides on farms, in homes, in schools, etc.? For example, could it result in fewer sprays per season or a switch to lower-risk pesticides? If possible, quantify the changes in condition. (Since there is no unanimous definition of *high* and *low risk*, investigators selecting this indicator are asked to categorize the pesticides they are reporting on as *high* or *low risk* according to the particular situation [e.g., lower risk to natural enemies]).
- b. Are there any other impacts or potential impacts on human health or the environment as a result of your project?

3. Economic benefits:

- a. What is (or could be) the economic benefit (e.g., dollars saved) for clientele who adopt IPM strategies and systems you studied? Do you envision potential commercialization or mass production of these systems?
- b. How many clients are satisfied with IPM results (such as improved yield, improved quality of yield, reduced pest populations, more effective pest control, greater preservation of nonpest species)?
- c. Are there other financial benefits that might be realized (potential impact) as a result of your project?

4. Implementation of IPM:

- a. How many IPM strategies and systems have been validated through this project (e.g., through on-farm trials, large plot tests, or other methods used to confirm efficacy)?
 - b. How many educational materials were delivered? To whom? And what are the impacts or potential impacts?
 - c. What is the number of growers/personnel trained? And what are the impacts or potential impacts?
 - d. For a Web site, what volume of traffic and type of use has the site experienced? (For example, number of visitors per day or month; number of page views; number of unique user sessions; change in volume during growing season; average viewing time.) And what are the impacts or potential impacts?
 - e. How many more people adopted IPM practices as a direct result of your project, or how many people adopted new IPM practices?
 - f. Are there other ways in which your work will result in improved use or increased implementation of IPM strategies in your region or across the West?
5. Has your project or study increased collaboration among stakeholders interested in the development and implementation of improved IPM strategies and systems?