

Number: WCC-066

Title: Integrated Pest Management of Russian Wheat Aphid and Other Cereal Aphids.

Duration: October 1, 2001 through September 2006 (5-yr extension).

Description and Justification: Aphid pests including Russian wheat aphid (RWA), *Diuraphis noxia*, and Greenbug, *Schizaphis graminum*, are occasionally serious pests of cereal crops in the U.S. Since being introduced into the United States in 1986, RWA has spread throughout the western Great Plains cereal production area, the Pacific Northwest, and the desert Southwest. The total economic damage in the United States caused by RWA has exceeded \$1 billion since 1986, considering crop loss (approximately \$394.3 million), cost of pest control (approximately \$95.6 million), and lost revenue to rural economies (indirect costs of approximately \$517.6 million). Annual losses attributed to greenbug average \$12 million per year in the central and western Great Plains and parts of the inter-mountain basin, but can increase to over \$100 million per state during severe outbreaks. RWA is a chronic annual pest of cereals in southeastern Colorado and causes localized periodic damage throughout the rest of its distribution range of the western continental U.S. Crop losses from aphid pests are most common on stressed plants grown in marginal soils. Damage from RWA is most common in low rainfall, dryland cereal production areas, where growers tend to have the narrowest profit margins. Damage from greenbug occurs throughout the Western Region, but is most severe when rainfall is low.

WCC-066 has coordinated research since 1988 with the original goal of developing integrated management strategies for RWA and other aphid pests that aid in maintaining the economic viability of cereal crop production in the western U.S. Research and extension groups participating in WCC-066 have made significant contributions in addressing crop loss problems associated with cereal aphids through establishing the scientific basis for sound integrated use of biological control, crop management including treatment thresholds, and host plant resistance. From these efforts, research and extension personnel have made significant advances toward reducing crop loss and unnecessary pesticide application through rapid implementation of research. Despite these important accomplishments in biological

control, host plant resistance, and economic assessment, regional research and extension efforts on cereal aphids needs to continue.

We need to develop a more comprehensive understanding of aphid and natural enemy ecology, and aphid-host plant interactions in order to improve biological control and host plant resistance within sustainable and economically viable crop production systems.

Quantitative information on (1) a regional assessment of cereal aphid pest impact, (2) the ecological linkages and impact of aphidophagous insects in agroecosystems (in particular at the landscape level), (3) aphid population genetics among crop and non-crop habitats, and (4) aphid movement throughout the region will allow for more holistic approaches towards cereal aphid management. Integration of this information with currently studied ecological-based management approaches (natural enemy thresholds and resistant cultivars) and previously devised insect control tactics (thresholds and insecticide use) must be considered if growers are to recognize and adopt these technologies across the diverse environments of the western U.S.

The committee's expansion in the last five years into considering other cereal aphids has provided the seed to encourage further joint research in the common areas of plant-aphid-natural enemy associations. This expansion was stimulated, in part, because of overlaps with other cereal aphid pests (e.g. *Rhopalosiphum padi*, *Sitobion avenae*, and *Schizaphis graminum*), and because of the importance of aphidophagous natural enemies throughout the region. The committee has also focused on aphid-borne viruses such as BYDV that cause chronic yield loss in the western U.S. and worldwide (approx. 3% of wheat and barley). Strategies for BYDV control can be integrated with cereal aphid control plans with the goal of establishing effective, environmentally sound integrated pest management programs. Such comprehensive multi-pest multi-tactic approaches can lead to sustainable long-term management of the cereal aphid complex.

Exchange of information and coordination of effort, between and among research and extension communities, has occurred in our attempts at cereal aphid management. There has been an active multi-agency participation in WCC-066 that includes State Agricultural

Experiment Stations, USDA Agricultural Research Service, USDA Animal and Plant Health Inspection Service, Cooperative Extension Service, State Departments of Agriculture, National Plant Board, National Association of Wheat Growers, National Barley Growers Association, National Agricultural Chemicals Association, state Wheat and Barley Commissions and grower groups, Agriculture Canada, Alberta Agriculture, Saskatchewan Agriculture, International Maize and Wheat Improvement Center (Mexico), International Center for Agricultural Research in the Dry Areas, Instituto Nacional de Investigaciones Agropecuarias (Chile), International Institute of Biological Control, Small Grains Institute (South Africa), Plant Protection Institute (Hungary), University of Alicante (Spain), Hebrew University of Jerusalem (Israel), and many other cooperating institutions for the exploration of biological control organisms. With our recent expansion into addressing comprehensive cereal aphid management, our committee welcomes and solicits exchange among other cereal aphid workers, particularly Greenbug workers in the central and western Great Plains. This broadening approach by WCC-066 is well considered relative to needed coordination of research activities among personnel stationed in multiple agencies and locations.

Promoting research necessary to make risk assessments regarding cereal aphids in the Western Region is a primary goal of WCC-066. Continuation of the interdisciplinary approach taken by members of WCC-066 will provide the principal mechanism to further stimulate interaction and coordination among workers to address comprehensive management of cereal aphids in small grains cropping systems.

Objective:

The main goal of this committee is the development of integrated management strategies for cereal aphid pests and their natural enemies in small grains, thus improving economic viability of small-grain cropping systems while maintaining environmental quality.

Subobjectives:

1. Facilitate integrated pest management approaches at the field and landscape level to manage cereal aphid pests in the western U.S.

2. Coordinate biological control, host plant resistance and cropping system research including evaluation of natural enemy performance and resistant cultivars alone and in combination in order to identify complementary management systems.
3. Coordinate research in genetics, physiology, taxonomy, and ecology of cereal aphids that aids in facilitating implementation of integrated management strategies in diverse agricultural systems.
4. Coordinate research in genetics, physiology, taxonomy, and ecology of cereal aphid natural enemies that will aid in defining the role and enhancing the impact of cereal aphid predators and parasitoids in diverse agricultural systems.
5. Enable Cooperative Extension personnel to exchange information, provide current knowledge of regionally adapted integrated pest management tactics, have input in research prioritization, and evaluate adoption of recommended management strategies.

Expected Outcomes:

1. Identify and evaluate complementary integrated management strategies (principally biological control, host plant resistance, cropping system practices, and habitat manipulations) that are principal factors in the regulation of cereal aphids at the field and landscape level.
2. Revise previously implemented strategies (principally economic thresholds and insecticide use strategies) to optimize implementation of longer-term more sustainable approaches.
3. Meet jointly every other year with the Greenbug Research Consortium to enhance exchange among workers in cereal aphid pest management.
4. Publish research findings, stressing joint publication of articles among committee participants from multiple agencies.

Educational Plan:

1. Through participation of Cooperative Extension and other cooperating agencies, enhance implementation of integrated cereal aphid management strategies within states and throughout the western region.

- a. Develop a regional aphid IPM web-site that includes aphid management guidelines, research results, and WCC-066 accomplishments.
- b. Develop aphid IPM extension bulletins and support release of popular press articles.
- c. Present WCC-066 research results and management guidelines at state and national grower meetings.

2. Assess impact of educational plans on adoption and implementation of cereal aphid pest management strategies. This educational objective is based on a funded 5-yr USDA-ARS Areawide Pest Management Program developed by WCC-066 participants.

- a. Within several Great Plains states, establish grower focus groups, and gather preliminary pest, economic, and agronomic data.
- b. Over a 5-year period, monitor dissemination of pest management information, and adoption of pest management strategies.

Participants: (See attachment)

Operational Structure:

Committee chair

Subcommittees

Chair-Elect

Biological Control (with chair)

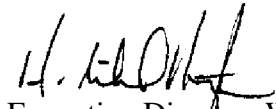
Secretary

Aphid - Plant Interaction and Ecology (with chair)

Signatures:

Administrative Advisor

Date



Executive Director, Western Directors Association

July 18, 2001

Date

Attachments:

—Accomplishments (during period of last extension)

1. The committee provided interaction among biological control and host plant resistance workers to coordinate research on the integration of control tactics for cereal aphids.
2. Initial work has documented establishment of natural enemies, and the complementary nature of many biological control organisms and sources of plant resistance. Five RWA resistant cultivars have been released to date; initial work has documented that resistance to RWQ (Dn5 gene) does not confer resistance to other cereal aphids under field conditions.
3. Initial work has demonstrated genetic relatedness among populations of cereal aphids, and parasitic hymenoptera.
4. Proceedings of a symposium published, titled Greenbacks to Genebugs: The centennial celebration of the greenbug's landing, held at the 1994 national meeting of the Entomological Society of America.
5. Thomas Say Proceedings. Response Model for an Introduced Pest - The Russian Wheat Aphid. Thomas Say Misc. Publ. in Entomol., Entomol. Soc. Amer., Lanham, MD.
6. There has been incorporation of integrated management strategies of cereal aphids (including availability of aphid resistant cultivars, recognition of biological control

organisms, and use of economic thresholds and natural enemy thresholds) into Cooperative Extension materials (publications and non-published release of information).

7. Development of Regional Cereal Aphid Management Guides.

8. Development of funded USDA-ARS Areawide Pest Management project 'Biologically intensive areawide IPM of the Russian Wheat aphid and greenbug'.