April 2004

Red River Valley Agricultural Research Center

RESEARCH NEWS FROM THE VALLEY

USDA-ARS-RRVARC Fargo, ND

Inside this issue:

From the Director

Welcome to spring 2004! After a long winter I think all of us are happy to see our lawns beginning to green up, leaves coming out on the trees, and tractors in the field. It's always a good sign that warmer weather is on the way when you can drive our highways and see field preparation and planting activity underway. I hope everyone has an exceptional year!

This edition of the "Research News From the Valley" will again highlight some of the numerous research activities underway at the Center. Our research programs continue to grow. We were fortunate to receive additional funds in the 2004 budget for continued expansion of our cereal molecular marker laboratory and for establishment of a research program to study the genetics of Canada thistle. As most of you from North Dakota and Minnesota already know, Canada thistle has become probably the number one weed problem for the region. By developing a better understanding of the population genetics of this invasive weed we hope to be able to effectively assist individuals developing biological and chemical-based weed control tactics. Understanding the genetic diversity of this wide spread plant can help tailor control efforts, such as release of biological control agents, to provide more precise management of the weed. The Plant Science Research Unit will provide more information about this effort in the coming months. Our other programs continue to make significant scientific advances. You'll read about several innovative and unique programs from each of our Units.

In November 2003 the Agricultural Research Service kicked off activities to celebrate the 50th Anniversary of the agency. We invited former Secretary of Agriculture Bob Bergland to come to the Center at that time and visit with former and current employees about his experiences during his tenure in the Carter Administration. This was an excellent way to be reminded of our past accomplishments and provided an opportunity for all of our staff to begin thinking toward the future. Anniversary activities for the Agency will continue throughout the year. In July we are planning a week-long celebration of ARS within North Dakota. All three ARS locations, Mandan, Grand Forks, and Fargo, will host an event during the week of July 19th to showcase our research activities and say thank you to all of our friends for their support. The tentative date for the Center event is July 21. You'll be hearing more about this activity in the next couple of months.

Finally, please give us some feedback on the content of this research update. We always appreciate hearing directly from you. Your comments, ideas, and general support of our location are important to the entire staff. You are our customers and we want to make sure that we listen to your concerns. I wish you the best for the remainder of the year! We hope to see you soon.

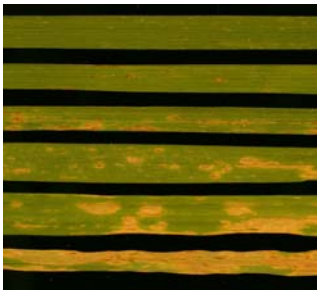
Larry Chandler

Center Director

PASS IT ON!!!!

Feel free to pass on this issue of *News from the Center* to others interested in agricultural research in the Northern Plains Area. To be added to our mailing list contact Alicia Thompson by phone (701-239-1370), fax (701-239-1395), or e-mail (thompsoa@fargo.ars.usda.gov).

Seedling Resistance to Tan Spot and Stagonospora nodorum Blotch in Synthetic Hexaploid Wheats



Range of reaction of wheat leaves to *Stagonospora nodorum* (top leaf is resistant).

The hexaploid genome of hard red spring wheat (bread wheat) is actually a composite of three genomes (designated A, B, and D) derived from three different progenitor species. Tetraploid wheats, such as durum, have genomes that are composites of two progenitor genomes (A and B). Synthetic hexaploid wheats (synthetics) can be developed by combining the AB genomes from tetraploid wheats and the D genome from goat-grass (*Aegilops tauschii*) through crossing. Synthetic hexaploid wheats have the same chromosome constitution as bread wheat and the desirable genes in synthetics can be directly transferred into bread wheat by conventional breeding approaches. The Wide Hybridization Program at the International Maize and Wheat Improvement Center (CIMMYT) recently developed two sets of elite synthetics. The systematic characterization of the important traits in these synthetics will facilitate effective exploitation of useful traits by breeding programs. Previously, some important traits related to agronomic performance, quality, and disease resistance had been evaluated, but resistance to tan spot and Stagonospora nodorum blotch (SNB) had not been evaluated. Tan spot and SNB have the ability to cause serious yield losses and are thus important foliar diseases of both bread wheat and durum wheat. Because the majority of current bread and durum wheat cultivars are susceptible to these diseases, there is a need to find new sources of resistance to tan spot and SNB, and to transfer this resistance to cultivars adapted to the upper Midwest. In this study, we evaluated 120 elite CIMMYT synthetics and their durum wheat parents for seedling resistance to the two diseases. The data showed that 56 (46.7%) and 36 (30.0%) synthetics were resistant to tan spot and SNB, respectively, whereas resistance was almost absent in the durum parents. This suggests that the elite CIMMYT synthetics are an excellent source of new resistance to tan spot and SNB, and provides additional guidance for selection of parental lines in developing new resistant cultivars and genetic mapping populations.

For more information, contact Dr. Michael C. Edwards, Research Leader, Cereal Crops Research Unit, at edwardsm@fargo.ars.usda.gov

Using Cassava to Better Understand Leafy Spurge Genomics

Cassava roots in the tropic.

Dr. Anderson standing with Cassava plants grown in the Plant Science Research Unit's greenhouse.

Dr. James Anderson recently attended the 6th International Scientific Meeting of the Cassava Biotechnology Network (CBN-VI) held at CIAT (International Center for Tropical Agriculture) in Cali, Columbia on March 8-14, 2004. The mission of CBN is to maximize the contribution of modern biology to the agronomic improvement of cassava, a crop of central importance to food security in the tropics. Approximately 120 scientists ranging from Latin America, Africa, Asia, Europe, and North America presented 160 papers related to cassava improvement.

Cassava is the 6th leading source of food calories in the world and is eaten by 600 million people daily. Cassava belongs to the genetically diverse *Euphorbiaceae* plant family that includes other globally important agricultural species such as: rubber tree, an important source of rubber; poinsettia, an important horticultural crop; and leafy spurge an important perennial pest weed that affects range, recreational, and right of way lands in North American plains and prairies.

Dr. Anderson has shown the potential for using genetic resources from both cassava and leafy spurge to develop a genomics-based approach to monitor gene expression profiles in *Euphrobiaceae*. He is currently collaborating with scientists at the International Institute for Tropical Agriculture (IITA) in Ibadan, Nigeria, at CIAT, and at the University of Illinois to develop an Expressed Sequence Tag (EST)-database for cassava and leafy spurge. The EST-database will be an I mportant step towards the fabrication of *Euphorbiaceae*-specific DNA microarrays. These research collaborations are funded, in part, by a USAID-Linkage grant through IITA, a CGIAR Challenge Program for Unlocking Genetic Diversity in Crops for the Resource-Poor, and by the USDA. The resources generated by these collaborative efforts will provide a valuable tool for breeding programs working on improving genetic stocks of desirable species such as cassava and for scientists involved in developing methods to control the growth of undesirable species such as leafy spurge.

For more information, contact Dr. Michael E. Foley , Research Leader, Plant Science Research Unit, at foleym@fargo.ars.usda.gov

Diapause-Regulated Gene Expression for Pollinator Bees

Megachile rotundata (alfalfa leafcutting bee) is a gregarious, cavity-nesting, leaf-cutting bee that has been extensively cultured as a superior pollinator of alfalfa. At present, *M. rotundata* is the pollinator of choice for alfalfa seed production on more than 70,000 ha in western North America, and is the most widely used commercially managed pollinator, after the honey bee, *Apis mellifera* L. *M. rotundata* is also increasing in importance as a pollinator of fruit and nut trees as *A. mellifera* colony numbers continue to decrease. The alfalfa leafcutting bee survives the extreme environmental conditions of winter by entering a decreased metabolic state known as diapause. For alfalfa leafcutting bees to be effective pollinators, it is vital to time the termination of its diapause so that the bees are present at the peak blooming time of the targeted crop. The peak blooming period for any given crop will vary from year to year depending on the weather, complicating the management of the bees. Since diapause plays such a critical role in the management of these bees, an investigation was undertaken to develop molecular markers to monitor diapause under field conditions. The results of this study clearly demonstrated that gene expression at the time of diapause termination differs between bees maintained under field and laboratory conditions. This is the first study to show this difference in diapause-regulated gene expression between field and laboratory maintained insects. Insights from this investigation are currently being used to design experiments to improve the management of this important pollinator. This research is being conducted by Dr. George Yocum, Res. Physiologist, Fargo, in collaboration with Dr. W.P. Kemp at the USDA–ARS Bee Biology and Systematics Laboratory, Logan, UT.

Alfalfa leaf-cutting female collecting pollen and nectar from 'tripped' alfalfa flowers.

For more information, contact Dr. James S. Buckner, Acting Research Leader, Insect Genetics & Biochemistry Research Unit, at bucknerj@fargo.ars.usda.gov

Herbicide-resistant Sunflower Developed

Broad-leaf weeds in sunflower fields are difficult to control because most herbicides designed to eradicate broad-leaf weeds also kill sunflower. In 1996 a sunflower grower in Kansas discovered that his efforts to control a population of wild weedy sunflower with the herbicide imazethapyr were unsuccessful. The wild sunflowers were not killed by the herbicide. Dr. Kassim Al-Khatib from Kansas State University was contacted, and he collected seed from the herbicide-resistant wild sunflowers.

Dr. Khatib sent the seed to Dr. Jerry Miller, a geneticist in the Sunflower Research Unit at the Northern Crop Science Laboratory in Fargo. Dr. Miller crossed the herbicide-resistant wild sunflower with cultivated sunflower and, after several generations of selection, developed and released parental sunflower lines called IMI sunflower. These lines are used by seed companies to make hybrid sunflower seed that can be planted by sunflower growers who can now treat their sunflower fields with the IMI herbicide Beyond™ to kill broad leaf weeds without harming the sunflowers.

Based on these new sunflower germplasm releases, the sunflower Industry has created IMI-resistant sunflower hybrids which will be planted on approximately 350,000 acres in 2004. The impact of these new germplasms will be about $500,000 in 2004 to the seed industry alone, and growers will benefit from increased yields due to better weed control, and in significant savings from reduced chemical costs for weed control.

For more information, contact Dr. Brady A. Vick, Research Leader, Sunflower Research Unit, at vickb@fargo.ars.usda.gov

New Horizons in Sugarbeet Rhizomania Resistance

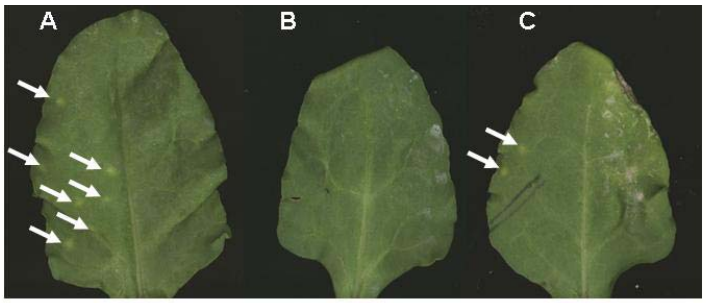


Figure 1. Left side half-leaves were inoculated with BNYVV after right side halves were treated with no resistance inducer (A) or two different resistance inducers (B and C). The arrows denote lesions caused by BNYVV

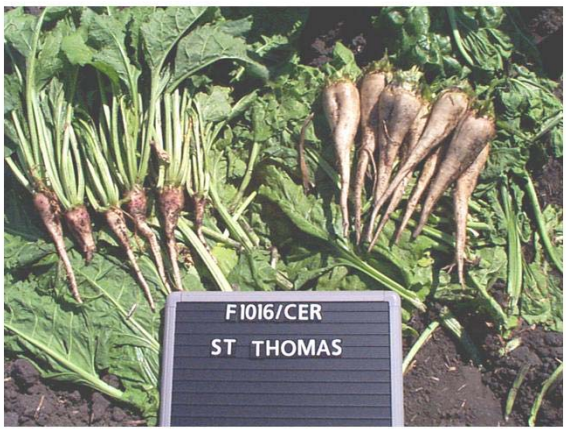
Rhizomania, caused by Beet Necrotic Yellow Vein Virus (BNYVV), is a devastating disease of sugar beet not only in the Red River Valley, but worldwide. Viral infection reduces growth of the taproot, the sugar storage site of the crop, imparting economic loss to sugar beet producers. BNYVV is transmitted by a fungal-like organism that is persistent in the soil rendering classical chemical control measures and cultural practices ineffective in reducing disease severity. Although genetic resistance against BNYVV exists in sugar beet, the ability for plant viruses to overcome host resistance is well-known. A new approach for controlling Rhizomania is being investigated that focuses on shutting down virus multiplication. A modified barley virus, that produces only a mild infection in sugar beet, has been engineered to contain a short segment of BNYVV genetic sequence. In theory, application of this modified virus to beet leaves triggers a form of host-plant immunity and partial to full resistance to BNYVV. Preliminary investigation involves the determination of which BNYVV sequence to use and optimum application time for the development of maximum resistance. To date, two of the four sequences tested show potential for controlling BNYVV, provided sufficient time is allowed for induction of resistance to occur. This was determined in tests where either both viruses were applied simultaneously or where BNYVV was applied four days after the modified barley virus. Only the latter resulted in a visible reduction in BNYVV lesion count (Figure 1). Future investigations seek to determine the mechanisms underlying the control of BNYVV in this system.

For more information, contact
Dr. Jeffrey C. Suttle, Research Leader,
Sugarbeet & Potato Research Unit, at
suttlej@fargo.ars.usda.gov

Sugarbeet Root Maggot Resistance

The sugarbeet root maggot is a serious insect pest on approximately 40% of the US sugarbeet acreage. Insecticides applied at planting time are the primary control method. Without insecticides, sugarbeet production in portions of the northern Red River Valley would not be profitable. Very few insecticides are available to growers and these could become unavailable if they are removed from the market because of environmental concerns or if the root maggot developed resistance to the insecticides. The development of commercially useful root maggot resistant germplasm is a major objective of the ARS sugarbeet breeding and genetics project at Fargo. To date, two resistant germplasm lines have been made available to the sugarbeet industry. While these lines provide a source resistance, they are lacking in sugar content and of resistance to diseases. To overcome this, the root maggot resistance has been incorporated with Cercospora leaf spot resistance by selecting within populations formed by crosses between the maggot resistant lines and Cercospora resistant lines from the ARS breeding program at Ft. Collins, CO. We also have been selecting for improved sugar concentration. We are constantly searching for additional sources of root maggot resistance. Two globe-shaped red beet lines have been identified as resistant and have been crossed with sugarbeet. Eventually, selections from these crosses will provide sources of resistance that are unrelated to the sources already released.

For more information, contact
Dr. Jeffrey C. Suttle, Research Leader,
Sugarbeet & Potato Research Unit, at
suttlej@fargo.ars.usda.gov



ARS Research Chemist Awarded OECD Fellowship

On February 3, 2004, Weilin Shelver, Research Chemist, ARS Red River Valley Agricultural Research Center, Fargo, ND, was awarded a fellowship by the Organization for Economic Co-operation and Development (OECD). Dr. Shelver will conduct research to develop an immunosensor method for analysis of the beta-adrenergic agonist zilpaterol, a veterinary drug used in animal production. From June 7th to August 9th, Dr. Shelver will work in Dr. Christopher Elliott's laboratory at the Department of Agriculture and Rural Development, Veterinary Sciences Division, Belfast, Northern Ireland, designated as a European Reference Laboratory for the control of drug residues in farm animal production. This research will use optical biosensor technology, pioneered by Dr. Elliott, to detect drug residues and will be instrumental in the development of new technologies to assure global food quality and safety.

For more information, contact Dr. Gerald L. Larsen, Research Leader, Animal Metabolism & Agricultural Chemicals Research Unit, at lareng@fargo.ars.usda.gov

Chlorate to Help Eliminate Pathogens in Feed Animals

"SILVER BULLET"
CHLORATE
eliminates pathogens

Dr. David J. Smith, of the Animal Metabolism – Agricultural Chemicals Research Unit in cooperation with R. C. Anderson of the ARS Food Safety Lab in College Station, TX has been conducting food-safety studies with a promising new technology designed to selectively eliminate pathogens from the gastrointestinal tracts of live animals. Sodium chlorate administered in feed to animals prior to slaughter selectively hills pathogens in the animal's gut. Use of such technology could significantly enhance the percentage of animal carcasses in packing plants that are free of pathogens. Studies conducted to date indicate that a high percentage of the feed additive, sodium chlorate, is converted to "chloride ion". Because the chloride ion is identical to that present in table salt (NaCl), it is considered by the FDA to be safe when present in edible tissues. These preliminary results suggest that further development of chlorate as a feed additive should be pursued.

For more information, contact Dr. Gerald L. Larsen, Research Leader, Animal Metabolism & Agricultural Chemicals Research Unit, at lareng@fargo.ars.usda.gov

RRVARC Takes Part in MarketPlace for Entrepreneurs

Marketplace for Entrepreneurs (formerly Marketplace of Ideas) was held on Thursday, January 15, 2004, at the Alerus Center in Grand Forks, ND. As in past years, the Center took part in this activity. The booth highlighted Center research and outreach activities.

For more information, contact
Dr. Laurence D. Chandler, Center Director,
Red River Valley Agricultural Research Center, at
chandlel@fargo.ars.usda.gov

North Dakota Senator Conrad drops by the Center's booth.

East Grand Forks Worksite Coordinator discusses potatoes with interested customers.

The Red River Valley Agricultural Research Center booth at the MarketPlace for Entrepreneurs.

Cereal Crops scientist talks with an interested visitor about Center activities.

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RED RIVER VALLEY AGRICULTURAL RESEARCH CENTER

Vision Statement

An internationally recognized center of excellence for integrated agricultural research on high priority problems to ensure a safe and abundant food supply.

USDA Nondiscrimination Statement

Upcoming Events:

EVENTS AT THE CENTER

JUNE 2004

22: Sunflower Research Unit Focus Group Meeting - Ramada Plaza Suites

JULY 2004

13: Dr. Steven Xu Seminar, "Molecular Cytogenetic Characterization of Novel Germplasms and Genetic Stocks in Wheats", 2 pm, NCSL-LCR.

21: ARS & Center 50th Anniversary Celebration.

AUGUST 2004

4: Drs. Tom Gulya and Gerald Seiler Seminar, USDA-ARS Sunflower Research Unit, TBA

Aug. 29-Sept. 2: 16th International Sunflower Conference, Holiday Inn & Convention Center, Fargo, ND.

OCTOBER 2004

12-15: Animal Metabolism & Agricultural Chemical Research Unit Expert Review.

EVENTS ELSEWHERE

MAY 2004

16-21: 5th Mtg. of the Working Group on Fruit Flies of the Western Hemisphere, Ft. Lauderdale, FL.

25-28: 3rd International Symposium on Plant Dormancy Wageningen, The Netherlands.

JUNE 2004

6-9: Third International Workshop on Brominated Flame Retardants in the Environment 2004, Toronto, Ontario, Canada.

6-11: 5th International Post Harvest Symposium, Verona, Italy.

23: National Sunflower Association Summer Seminar, Ramada Plaza Suites, Fargo, ND.

JULY 2004

24-28: American Society of Plant Biologists, Plant Biology 2004, Lake Buena Vista, FL.

25-29: American Society of Animal Science Mtg., St. Louis, MO.

July 31-Aug. 4: American Phytopathological Society Meeting, Anaheim, CA.

AUGUST 2004

8-12: Potato Association of American Annual Meeting, Scotts Bluff, NE.

15-21: XXII International Congress of Entomology, Brisbane, Queensland, Australia.

SEPTEMBER 2004

6-10: 24th International Symposium on Halogenated Environmental Organic Pollutants and POPs, Dioxin 2004, Berlin, Germany.

15-17: International Institute for Beet Research, Germany.