



Red River Valley Agricultural Research Center

RESEARCH NEWS FROM THE VALLEY



Red River Valley
Agricultural Research Center
Fargo, ND & East Grand Forks, MN

USDA-ARS-RRVARC

Fargo, ND

Special points of interest:

- Composting
- Pearling
- Cryopreservation
- Leafy Spurge
- Potato Germplasm
- Oleic Acid
- Sclerotinia
- History
- New Scientists

From the Director

Welcome to the first *Research News From the Valley*, a biannual update of research activities at the Red River Valley Agricultural Research Center here in Fargo. Hopefully you will find the content useful and informative. The staff here at the Center conducts research on a wide variety of topics. We plan to present a brief glimpse of our programs with each update. You will also find information on upcoming meetings and activities involving our staff.

For those of you who are not familiar with the Center let me give you a quick overview of our programs and facilities. The Center is composed of six research units which are primarily housed in two USDA-ARS buildings on the campus of North Dakota State Univ. We also have staff located in NDSU's Harris Hall and at our potato worksite in East Grand Forks, MN. Our scientists conduct research that covers the effects of foreign chemicals in animals, explores new

methods to control perennial weed and insect pests, tests wheat and oats to enhance quality, and improves the storage characteristics of potatoes and sugarbeets. We also develop improved germplasm for wheat, barley, sugarbeets, and sunflowers. We currently have 120 federal employees and similar numbers of university and other cooperators working in our facilities.

This update highlights recent accomplishments of each of our research units which should give you a better understanding of our research mission. In coming editions we will focus on particular research activities to provide you with more detailed descriptions of our programs.

Finally, I would like to encourage everyone to visit the Center whenever you are in the neighborhood. We welcome the opportunity to give you a first hand look at our programs. Also, please

give us some feedback on this research update. Let us know if it is useful and how we can do it better to fulfill your needs.

We look forward to hearing from you.

Larry Chandler
Center Director



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Composting to Reduce Hormones in the Environment

Concerns about the occurrence of natural or synthetic hormones found in animal wastes have increased with larger amounts of manure stored or used on or around the farm. Estradiol and testosterone are two of the more common hormones associated with manure. Manure composting could be an efficient method to reduce the levels of these two hormones in the environment. To test this hypothesis Center scientists, cooperating with Patricia

Millner, USDA-ARS in Beltsville, MD, mixed chicken layer manure with plant material to form a compost. Initial concentrations of testosterone and estradiol in the manure averaged 212 and 96 ppb, respectively, but fell gradually over 19 weeks to 13 ppb for testosterone and 16 ppb for estradiol. These results show that both hormones can be efficiently degraded under composting conditions, but were not totally eliminated. However, this work

suggests that composting may be an environmentally friendly technology suitable for reducing the concentrations of these hormones at concentrated animal operation facilities and may prevent their transport into surface or groundwater systems.

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

Pearling to Improve Baking and Noodle Quality



Hard Red Spring Wheat ready for harvest.

Preharvest sprouting in wheat is caused by excess moisture which results in an increase in alpha-amylase enzyme activity. Increased enzyme activity ultimately decreases the material value and potential final quality of baked and noodle products made from the flour. Scientists at our Wheat Quality Lab investigated the effects of pearling (sequential removal of bran integuments) on hard spring wheat samples exhibiting various levels of preharvest sprouting. Preharvest sprouting is

typically measured using a falling number test which is the time in seconds for a stirrer to fall through a hot slurry of ground wheat. The greater the amount of alpha-amylase in the wheat, the faster the plunger will fall through the slurry. A high falling number indicates the wheat is sound for most baking processes. Our research found that pearling resulted in numerous positive improvements to quality of moderately sprouted wheat. For example, pearling decreased alpha-amylase

activity; increased falling number measurements; improved starch pasting properties, and improved brightness of yellow alkaline noodles. Commercial millers can use this technique to add value to moderately sprouted wheat.

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

Using Cryopreservation to Aid Insect Management Programs

“Cryopreservation is a physical/chemical means for long-term storage”

Cryopreservation is a physical/chemical means for long-term storage of insects at liquid nitrogen temperature. Using cold storage techniques for various insect species involved in biological control, sterile insect techniques, etc. can assure users that insects of a synchronized stage will be available and that there will be flexibility and efficiency in their mass production. One of the main criteria in order for cryopreservation of insect

embryos to be accepted, is that the genetic and physical composition of the insects recovered from liquid nitrogen not be altered from that of normal individuals. Scientists at the Center conducted a Mediterranean fruit fly field competitiveness study with Todd Shelly, Susan McCombs and Nathan Peabody of USDA-APHIS. This study demonstrated that cryopreserved Med-flies reared in Waimanalo, HI, had

life cycle and reproductive rates comparable to flies not experiencing cryopreservation. These findings indicate that the behavioral attributes of flies necessary for a successful sterile insect release program are not lost or diminished when using these protocols for storage in liquid nitrogen.

For more information, contact Dr. Dennis R. Nelson, Research Leader, Insect Genetics & Biochemistry Research Unit, at nelsond@fargo.ars.usda.gov

Understanding the Regulation of Leafy Spurge Growth and Development



Crown buds of leafy spurge in October.

Leafy spurge continues to be a major perennial weed in rangeland, recreational areas, and highway right-of-ways. Current management strategies involve the use of chemical, cultural, and biological control measures. Vegetative propagation through the growth of underground adventitious buds on the root and crown is the primary characteristic responsible for the weed's invasive potential. Each root or crown bud has the capacity

to regenerate a new plant after the shoot is damaged or removed. Dormancy is a key characteristic of weeds and is the reason leafy spurge may evade many control measures. In a recent study at the Center numerous genes in spurge crown buds were shown to have induced (up regulated) or repressed (down regulated) dormancy patterns depending on the time of year they were measured. Several cell cycle regulating genes appeared to play a role in the

dormancy status of developing crown buds. This is the first step of developing a knowledge base that will allow us to understand the fundamental mechanisms regulating growth and development which will give rise to new biologically based management systems for the pest.

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

Potato Germplasm Processing and Storage Characteristics

Variations in potato process product quality for chips and fries due to disease and sugar accumulation result in large storage losses each year. These losses cost producers and processors hundreds of millions of dollars annually. Studies at the Potato Research Worksite in E. Grand Forks, MN in cooperation with University (ND, MN, MI, OH, NE, WI, ID, MA, CO) potato breeding programs evaluating post harvest storage and product processing quality of potato germplasm have assisted the selection of

promising new germplasm with improved storage characteristics. During the past year, over 14,000 individual quality evaluations were performed on elite potato lines following storage under defined conditions. These evaluations were part of a selection process that will speed the introduction of new potato cultivars with superior processing characteristics into U.S. production areas.

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



Storage/processing trials have identified potato cultivars with superior chipping characteristics

Predicting Oleic Acids Concentration in Sunflowers

The ability to predict the oleic acid concentration of the NuSun sunflower crop in any given year or location would be of great benefit to the sunflower industry in preparation to meet the NuSun oleic acid quality standards. Center scientists conducted a study to determine if oleic acid percentage in harvested seed could be predicted by measuring the oleic acid content of immature seeds sampled a few days after flowering or by weather data. Results showed that the best

predictor of final oleic acid concentration was the content in the seed collected 28 days after flowering. Weather data were highly variable and correlations were not of value to be accurate predictors. This knowledge will help sunflower oil processing plants organize their crushing schedule to meet or exceed the established 55% minimum oleic acid content requirement by distributing seed from southern production areas or mixing high oleic seed during crushing.

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

“the best predictor of final oleic acid concentration was the content in the seed collected 28 days after flowering.”

Sclerotinia Initiative Update

White mold caused by *Sclerotinia sclerotiorum* is an economically devastating disease of numerous broad leaf crops throughout the U.S. Research to manage this disease is now being addressed under the umbrella of the Sclerotinia Initiative. The Initiative received \$864,000 in FY2002 for use in high priority research activities. A steering committee representing ARS

(RRVARC Fargo, ND and National Program Staff, Beltsville, MD) and five national commodity organizations (canola, dry bean, pea, lentil & chickpea, soybean, and sunflower) developed overall program guidelines and research problem areas to be funded. A total of 16 specific cooperative agreements were established with 10 land-grant universities and the National

Sunflower Association of Canada, and 6 ARS programs were funded to accomplish the numerous research goals. Research began in June 2002. Additional funding is expected in FY2003.

For more information, contact Dr. Laurence D. Chandler, Center Director, at chandlel@fargo.ars.usda.gov



Wilted sunflower plant caused by Sclerotinia. Photo source: NDSU Ext. Bulletin 25.

New Scientists at the Center

Dr. Timothy L. Friesen—Cereal Crops Research Unit

In July of 2002, Dr. Timothy L. Friesen joined the Cereal Crops Research Unit as a Research Plant Pathologist. He completed his undergraduate studies at Minnesota State University at Mankato and received his Ph.D. from the Department of Plant Pathology at North Dakota State University, where he studied the importance of a fungal-produced toxin as a virulence factor in tan spot of wheat under Dr.'s Jack Rasmussen and Len Francl. Following his Ph.D. studies, Dr. Friesen joined the laboratory of Dr. John Weiland in the RRVARC Sugarbeet and Potato Research Unit as a post-doctoral research scientist. His work involved

the genetics of the sugar beet pathogen *Cercospora beticola* and the development of molecular markers for sugar beet powdery mildew and beet mosaic virus.

Dr. Friesen's new assignment is broad and may include characterization of host-pathogen interactions; analysis and development of pathogen variation to identify resistance genes and increase durability of resistance; development of new techniques/technologies for disease evaluation and management; and collaboration in identification of sources of resistance and development of resistant germplasm. Initially his research will focus on host

resistance, pathogen virulence, and virulence diversity within fungal pathogen populations.

Many stakeholders are concerned about the impact of Fusarium head blight, but also recognize that more research is needed to develop solutions to other significant foliar and head diseases of barley and wheat. The conceptual basis for this position arose from those concerns, and the creation of both this position and the Research Geneticist position held by Dr. Steven Xu directly resulted from the efforts of our stakeholders.



Dr. Jinguo Hu—Sunflower Research Unit

In March 2002, Dr. Jinguo Hu joined USDA-ARS as the Sunflower Research Unit's new molecular geneticist. Dr. Hu is a native of China, and received his B.S. and M.S. degrees from Central China Agricultural University in Wuhan, China. His Ph.D. and postdoctoral studies were conducted at the University of California, Davis, where he worked on genetic mapping and DNA marker development of rapeseed. Prior to his arrival at the Sunflower Research Unit, he worked at the Unilever-Lipton Tomato Technology Center in Stockton, CA, where he conducted a tomato breeding program that integrated modern DNA-based markers into the selection process.

Dr. Hu's expertise with tomato marker development is a valuable asset to his work with sunflower. With sunflower, his work will encompass two research areas: 1) the study of sunflower genomics, which is expected to reveal new information on structure and function of genes of agronomic interest, and 2) the development of DNA markers for important traits to assist breeders in rapidly incorporating them into commercial cultivated sunflower.

Initially, Dr. Hu is focusing on the development of markers for traits such as disease and herbicide resistance, and fatty acid composition of the oil. This requires close cooperation with several

scientists of the Sunflower Research Unit, including Tom Gulya (disease resistance), Jerry Miller (herbicide resistance), Brady Vick (fatty acid composition), Gerald Seiler (DNA fingerprinting of wild sunflower species), and Chao-Chien Jan (expansion of sunflower gene maps).

The establishment of a sunflower molecular geneticist position in Fargo has been a long-sought goal. Dr. Hu will occupy a central role in the future of the unit as it incorporates modern methods of molecular genomics into its development of superior cultivated sunflower germplasm.



New Scientists at the Center

Dr. Steven S. Xu—Cereal Crops

Dr. Steven S. Xu is a new Research Geneticist in the Cereal Crops Research Unit, arriving in July 2002 from MSCI/LASON, Inc., Rantoul, IL. He received his B.S. degree in agronomy from Laiyang Agricultural College in Laiyang, China and his M.S. in plant genetics and breeding from the Chinese Academy of Agricultural Sciences in Beijing, China. Dr. Xu came to the U.S. in 1990 and received his Ph.D. in wheat cytogenetics at North Dakota State University under Dr. L.R. Joppa (ARS retired). Dr. Xu then joined Dr. T. Hymowitz's lab at the University of Illinois, where he participated in construction of the soybean universal genetic map, and developed a number of soybean aneuploids used in classical and molecular mapping of the soybean

genome. Dr. Xu also has a M.S. in computer science from the University of Illinois, Springfield and developed imaging and microfilming programs while at MSCI/LASON, Inc.

Dr. Xu now conducts research on the genetics of bread wheat, durum wheat, and related species, with emphasis on hard red spring wheat. Research areas include: 1) developing elite germplasm with desirable genes for quality, disease resistance, and agronomically important traits using molecular and cytogenetic approaches; 2) identifying novel or useful genes and incorporating these genes into parental lines and populations; 3) identifying and developing molecular markers for genes of interest and

using these markers to introgress useful genes into germplasm; and 4) determining genetic control, inheritance, and linkage relationships of quantitative and qualitative traits.

Dr. Xu collaborates with several scientists in the Cereal Crops Research Unit, including Tim Friesen (foliar disease resistance), Justin Faris (molecular mapping), Jim Miller (scab and stem rust resistance), and Gary Hareland (quality traits). Dr. Xu's research is expected to provide basic knowledge and improved germplasm that will contribute to wheat improvement.



RRVARC History



Bioscience Research Laboratory (formerly the MRRL) in 1964.

Many individuals identify our two laboratory buildings by the color of their roofs. Having a red and a blue roof building does make it easy for visitors to identify us. The red roof or Biosciences Research Lab (BRL) is our older facility and currently houses three research units. This facility was authorized to be built in 1962 by President John F. Kennedy. It opened in February 1964 as the Metabolism and Radiation Research Laboratory. At the time of its opening the lab could house up to 41 scientists and conducted pioneering research targeted at investigations of animal, plant, and insect life aimed primarily at acquiring a better understanding of metabolism - the process by which living cells assimilate materials and dispose of wastes. Scientists also studied insect genetics and the effects of radiation and chemicals on insect reproduction. On July 16, 1965 the Lab was dedicated. Mr. Arlon Hazen, Dean of the College of Agric. at NDSU served as Master of Ceremonies for the occasion. Dr. H. R. Albrecht, (NDSU President), Senator Milton Young, and Dr. Nyle Brady (Director of USDA Science and Education) were invited speakers. A few of our current employees were in attendance (we won't mention any names). Over the years the laboratory increased in physical size and changed portions of its research thrust. Today the Animal Metabolism-Agricultural Chemicals Unit, Plant Science Unit, and Insect Genetics and Biochemistry Unit continue to conduct pioneering research. Time has passed, staff have changed, facilities have improved, but the quality of research continues to be a cornerstone of the BRL research efforts.



RED RIVER VALLEY AGRICULTURAL RESEARCH CENTER

USDA-ARS-RRV ARC
Fargo, ND

1307 North 18th Street
P.O. Box 5677, State University Station
Fargo, ND 58105-5677

Phone: 701-239-1370
Fax: 701-239-1395
Email: meyersa@fargo.ars.usda.gov

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Upcoming Events

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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 Meyers by phone (701-239-1370), fax (701-239-1395), or e-mail (meyersa@fargo.ars.usda.gov).

EVENTS AT THE CENTER

OCTOBER 2002

22: RRVARC Research Partners Mtg. USDA-ARS-RRV ARC, Fargo, ND

EVENTS ELSEWHERE

OCTOBER 2002

5-9: ESA; Winnipeg, Canada
7-9: Technical FAO Mtg on Sunflower; Montpelier, France
12-17: American Assn of Cereal Chemists, Montreal, Canada
24-26: Assn of Natural Biocontrol Producers, Oxnard, CA

NOVEMBER 2002

6-8: 2nd Congress of the European Federation for the Science & Technology of Lipids; Strasbourg, France
10-14: ASA/CSSA/SSSA, Indianapolis, IN
15-22: Brighton Crop Protection Conf, British Soc of Plt. Pathology; Brighton, England
17-20: Entomology Society of America Ft. Lauderdale, FL
25: Sugarbeet R&E Brd, Fargo, ND

DECEMBER 2002

7-9: U.S. Wheat & Barley Scab Initiative, Erlanger, KY
7-9: Scab Forum Conf, Cincinnati, OH
15-18: Annual Pierce's Disease Res Symp, San Diego, CA

JANUARY 2003

N. Plains Potato Growers Assn. Res. Board Mtg. E. Grand Forks, MN
6-10: Beltwide Cotton Conf, Nashville, TN
7: RRVSBGA: Sugarbeet R&E Brd Reporting Session, Fargo, ND
7-9: ND Weed Control Assn, Mandan, ND
7-9: Barley Improvement Conf, San Francisco, CA
11-15: Plant & Animal Genome XI, San Diego, CA
16-17: Natl Sunflower Assn Forum, Fargo, ND
21-22: USDA-ARS/NDSU Sclerotinia Initiative, Bloomington, MN
26-31: Wheat Industry Conf, Albuquerque, NM

FEBRUARY 2003

3: American Soc. Sugarbeet Technologists, San Antonio, TX

10-13: Weed Science Soc. of America, Jacksonville, FL
13-18: American Assn. for the Advancement of Science, Denver, CO
18-20: Wheat Quality Council, Kansas City, MO
20-25: Functional Genomics, Keystone Symp., Santa Fe, NM

MARCH 2003

3: N. American Cereal Rust Wkshp, St. Paul, MN
17-19: Pacific Rim American Assn of Cereal Chemists; Honolulu, HI
18-23: 22nd Fungal Genetics Conf; Asilomar, CA
22-26: Entomology Society of America North Central Branch Mtg; Madison, WI
31-Apr. 2: Stadler Genetics Symp; Columbia, MO

APRIL 2003

8-10: 4th Natl IPM Symp Wkshp; Indianapolis, IN
27-May 1: Society of Environmental Toxicology & Chemistry; Hamburg, Germany
27-May 2: XI Symp. Biological Control of Weeds; Canberra, Australia