

Research Summary 2010

Title: Ag Appreciation Weekend

Principal Investigator: Jeff Jacobsen

Objectives: Showcase agriculture and outstanding agriculturists in Montana during Ag Appreciation Weekend. Provide an opportunity for the agricultural community of Montana to gather together and celebrate agriculture.

Amount Funded: \$3,000

Summary: Ag Appreciation Weekend serves as a key recognition event for the College of Agriculture. Sponsors are continually recognized throughout the Weekend and at other events throughout the year. Without a doubt, we have raised the awareness of agriculture's importance on campus and throughout the state. With donor support and through the activities of the Weekend, we highlight agriculture's impact in Montana and promote the College of Agriculture to agricultural industries, ag and consumer groups, parents, alumni and potential students (recruitment).

Title: Critical Infrastructure at Wheat and Barley Research Facilities

Principal Investigator: Jeff Jacobsen

Objectives: To improve and create quality research facilities

Amount Funded: \$227,000

Summary: The State of Montana provided a total of \$5M toward MAES LRBP projects and an additional authority (\$1.25M) amount for the minimum match. We received a total of \$227,000 from the MWBC toward the building and renovation of key facilities (EARC, NARC) in the MAES system. Every non-state dollar donated has created at least five dollars for improving research facilities across the State. The new and improved facilities will allow faculty and staff to spend more time and energy on research and outreach programs and projects for decades to come.

TITLE: Early Generation Durum Selection and Germplasm Improvement – 2009

PRINCIPAL INVESTIGATOR: Dr. Joyce Eckhoff, MSU Eastern Agricultural Research Center

OBJECTIVE: To develop improved durum germplasm and varieties for Montana production

AMOUNT FUNDED: \$10,000

SUMMARY: Durum production continues to increase in Montana and the Mondak region. This project is developing germplasm appropriate to Montana conditions using both conventional breeding methods and double-haploid technology. The germplasm is tested in each generation for agronomic and quality characters. A solid stem program was initiated in 2005 with 86 solid-stemmed lines identified and crossed onto male sterile lines to establish a solid-stemmed population. Selections from this population were made. Genetic material with low Cd accumulation has been used in crosses onto populations to develop composite cross populations with low accumulation of Cd.

Title: Orange Wheat Blossom Midge (OWBM) Management

Principal Investigators: Bob Stougaard, Luther Talbert and David Weaver

Objective 1: Screen experimental lines for VOC's and non-preference

Objective 2: Screen experimental lines for the *Sm1* gene and antibiosis

Objective 3: Screen near-isogenic lines that vary in phenolic properties

Objective 4: Monitor potential midge populations in the Flathead and Triangle counties.

Amount Funded: \$21,913

Summary:

Initial observations regarding the variation in larvae densities among wheat varieties have proven to be beneficial. This differential oviposition preference has its basis in the genetic background of specific wheat varieties. This trait has been shown to be heritable and QTLs have now been identified. Furthermore, VOCs have been isolated which may be responsible for the behavior. This new form of host plant resistance could be used in combination with the antibiotic *Sm1* gene, providing for a more durable and integrated approach to managing this pest. Towards that end, efforts to incorporate the *Sm1* gene into Montana adapted varieties have progressed well. Seventy experimental lines with this form of phenolic-induced antibiotic resistance have been selected and will be evaluated in preliminary yield trials at Kalispell and Bozeman in 2010. Other forms of plant phenolics were identified this year that might prove beneficial in managing this pest. Specifically, red-seeded wheats were found to be more resistant than white-seeded varieties. This observation could potential lead to new forms of plant resistance. Midge biology is more complicated than previously believed. The transition from cocoon to larval stage appears to be a function of soil moisture as well as temperature. Overall, larval and pupa developmental rates had higher temperature thresholds than predicted by the model, while adult emergence had lower thresholds. The distribution of the midge is currently confined to the northeastern and northwestern parts of Montana.

Title: Genetic mapping of the new rust resistance genes. FY09.

Principal Investigator: Li Huang

Objectives: In order to prevent catastrophic yield loss in case the stem rust pathogen Ug99 migrates to the United States, or when the wind changes its direction and the pathogen overcomes the resistance genes used in the Puccinia pathway, we need to increase the diversity of rust resistance—especially resistance to Ug99—in Montana's wheat cultivars. The project is a continuous effort of introduce new rust resistance genes into Montana's cultivars. From previous project, we developed all the populations that are essential for charactering and mapping the new rust resistance genes. This project is the second step—genetic mapping the genes.

Amount funded: \$7,500

Summary: We have mapped 140 molecular markers from 21 wheat chromosomes on a population of 98 individuals. A stem rust resistance gene from a CTYIM line kingbird is mapped on chromosome 5D long arm.

Title: Improved Quality of Montana Hard Red and Hard White Wheats

Principal Investigator: Deanna Nash

Objectives:

1. Evaluate end-use quality of hard red and hard white wheat lines developed by MSU spring and winter wheat breeding programs.
2. Showcase Montana's newest varietal releases for visiting Trade Teams while they tour the Cereal Quality Lab (CQL) testing facilities.
3. Participate in the milling and baking contests for the Central Montana Fair and the Chouteau County Fair.
4. Promote Montana wheat quality by conducting tours and hands-on demonstrations.
5. Participate in research projects designed to determine ways to improve end-use quality parameters of new wheat varieties by cooperating with Montana Agricultural Experiment Station (MAES) researchers, the general public and industry.

Amount funded: \$33,000

Summary:

Beyond our work with the MSU breeding programs, the CQL continues to cooperate with MAES researchers and the general public for addressing end-use quality attributes of experimental material.

We actively participate in collaborations across the Pacific Northwest (PNW) in order to promote Montana wheat and to be contributing members in the society of wheat researchers.

Title: Mining for Markers to be used in Marker-Assisted Breeding

Principal Investigator: Jamie D. Sherman, Assistant Research Professor
Department of Plant Sciences

Objectives:

- 1) Utilization of existing markers to improve spring wheat for insect resistance, heat tolerance, herbicide tolerance, and end-use quality.
- 2) Development of new markers for economically important traits.

Amount funded: \$40,000

Summary:

I have been primarily responsible for marker development for the MSU wheat genetics lab. Marker-assisted selection has become an integral part of wheat breeding programs across the nation and the world. My research has contributed to the overall science of wheat molecular biology, and most importantly, has allowed the Montana breeding program to take advantage of new technologies for variety development. My work will continue to involve using exiting markers for variety improvement, and expanding the list of available markers important to Montana wheat growers.

Title: Distribution and Severity of Root Diseases in Montana's Wheat

Principle Investigator: Alan Dyer

Objectives:

1. Determine the distribution and severity of Fusarium crown rot and common root rot within Central Montana.
2. Determine the impacts cold weather fungal pathogens have on winter wheat production

Amount funded: \$18,524

Summary:

For 2010, the survey for Fusarium crown rot and common root rot is progressing according to schedule and processing of the samples should be completed by early March. This year's survey includes 51 fields throughout the central portion of the state, with five fields sampled intensively to establish relationships between diseases levels and yield losses. In addition to the survey work, seed treatment trials (both inoculated and non-inoculated) have been set up in North Central Montana and in Bozeman to assess biological causes of winter injury. Due to late harvests and poor fall moisture, these trials were planted in later than planned. All winter injury trials in Bozeman have been inoculated. The (un-inoculated) four trials in North Central Montana have been planted but due to late planting, emergence counts were made for only two of the four trials. Plant samples (960 total seedlings) were also taken from these two trials. The plant samples were processed for pathogen isolation using traditional techniques and are being additionally processed by molecular techniques to identify species. While the survey work is near completion, the winter injury trials will be carried out through 2010. The latter work has garnered additional funds (gifts) and will seek federal funds in the 2010-11.

Title: Susceptibility of Montana cereal crops to *Wheat streak mosaic virus* and stem rust fungicide trials.

Project Leader: Dr. Mary Burrows

Objectives

1. Evaluate widely planted winter wheat, spring wheat and barley varieties in Montana for susceptibility to *Wheat streak mosaic virus*.
2. Evaluate fungicides for control of stem rust, in preparation for Ug99 arrival in the United States.
3. Disseminate the results of these studies to growers in Montana and throughout the Great Plains region.

Amount funded: \$20,000

Summary: WSMV inoculation significantly reduced yields in winter wheat, spring wheat, and barley regardless of the time of infection (fall, spring) or level of infection (low to high). Symptom severity and relative yield loss was highest in the spring wheat varieties.

Project Title: Wheat pest calendar

Project Leader: Mary Burrows, Assistant Professor, PSPP

Objectives: To develop a wheat pest calendar to assist growers, county agents, and crop consultants to identify and manage common wheat disease, insect, and weed pests.

Amount funded: \$4,000

Summary: The feedback I have received from this calendar has been very positive. Stakeholders think it is a useful tool for pest identification and management.

Title: Impact of Polyphenol Oxidase Genes on Asian Noodle Quality and Agronomic Traits in Winter Wheat

Principal Investigator: Jack Martin and Phil Bruckner

Objectives:

Determine the impact of two major genes controlling polyphenol oxidase (PPO) on: a) kernel PPO activity, b) agronomic traits, and c) Asian noodle quality.

Amount funded: \$7,000

Summary:

We measured PPO activity and agronomic traits in a winter wheat population segregating for two major genes affecting kernel PPO activity. The Ppo-A1 gene had greater effect than Ppo-D1 on kernel PPO activity. In fact the difference between the two forms of Ppo-D1 was observed mainly when Ppo-A1 was present in "Low" form. The PPO genes did affect other agronomic traits. In this population, selecting for the low form of each PPO gene would have the undesirable effect of lower grain yield, kernel weight, and test weight. The observed effects of the PPO genes on agronomic traits were not expected. These results should be interpreted with caution since they were obtained from a single segregating population grown in atypical winter wheat environments. The effect of these two PPO genes on agronomic traits will be investigated further in other genetic backgrounds in the future.

PROJECT TITLE: Enhanced field selection for wheat stem sawfly resistance in wheat

PROJECT LEADER: Phil Bruckner, PSPP Dept., Bozeman

OBJECTIVES:

1. Subject early-generation segregating winter wheat bulk populations and derived lines to heavy selection pressure for wheat stem sawfly (WSS) resistance and select plant phenotypes resistant to WSS infestation and cutting damage.
2. Evaluate spring and winter wheat cultivars and advanced lines for resistance to infestation and cutting damage by WSS and for yield performance under heavy infestation by WSS.
3. Provide a field site, representative of sawfly infested production regions, for demonstration to producers of effective sawfly management strategies including use of resistant cultivars.

Amount funded: \$20,000

SUMMARY:

Progress has been made in winter wheat cultivar development. Genou has been the leading planted winter wheat cultivar in Montana the last three years. Although wheat stem sawfly cutting was severe in Genou (and all other cultivars) this past year, our data indicates the cultivar still provides a significant amount of protection to wheat stem sawfly cutting relative to hollow-stem cultivars. Additional promising solid stem experimental lines have been identified and are being extensively tested in comparison to Genou, Rampart, and each other. Seed of these lines is being increased as rapidly as possible in case we wish to release one of the lines as a new cultivar. The wheat stem sawfly nursery was of limited value this year due to the lack of sawfly cutting, but we were able to identify valuable winter-hardy, solid stem lines from the site. At Havre we had high levels of sawfly infestation and cutting which made phenotypic selection for tolerance to sawfly quite effective in that tolerant genotypes were visually distinguishable from susceptible genotypes. The ability to select for our primary breeding objective in environments where reasonable selection pressure for sawfly normally occurs has strengthened the Montana winter

wheat cultivar development programs. The priority breeding objective will remain WSS resistance until adequate cultivars are developed. This field selection site for screening of WSS resistance at the Peterson farm north of Havre has been (except for this past year) characterized by a heavy level of sawfly pressure which is useful to identify sawfly tolerant germplasm and document performance under pest pressure. Evaluation of early-generation segregating populations and selected lines under heavy WSS selection pressure will continue at north Havre and supplemental sites. Research to identify solid stem lines with enhanced winter-hardiness is being expanded with federal stimulus funding in the short term. Spring and winter wheat cultivars and advanced lines will be evaluated at multiple sites to quantify levels of WSS resistance and to determine relative yield performance under WSS pressure.

PROJECT TITLE: Winter Wheat Breeding/Genetics.

PROJECT LEADER: Phil Bruckner, Plant Sciences & Plant Pathology Dept., Bozeman

OBJECTIVES:

1. Develop improved cultivars of winter wheat adapted to Montana climatic conditions and cropping systems, which possess superior on-farm production characteristics (grain yield, winter hardiness, adequate and durable pest resistance, stress tolerance, agronomic characteristics) and superior end-use qualities.
2. Isolate, as much as possible, our foreign wheat customers from variations in wheat performance by development and release of suitable cultivars and production research to develop strategies to maximize quality consistency for wheat produced in Montana.
3. Investigate environmental, genetic, and management factors that influence wheat productivity and end-use in Montana including 2009 projects: effect of two gene marker selection for low polyphenol oxidase (PPO) on agronomic and quality traits of winter wheat; and effect of selection for SGP-SSII starch mutants (high amylose) on winter wheat end use quality
4. Coordinate Montana statewide winter wheat variety testing program and provide long-term performance data necessary for cultivar release decisions, variety recommendations, and producer management decisions.

Amount funded: \$80,000

SUMMARY:

Progress has been made in winter wheat cultivar development. Yields have been improved an average of 0.63 bu/acre/cycle over 16 breeding cycles (1993-2009) resulting in improved yield potential of 10.14 bu/acre since 1993 (Figure 1). Genou and Yellowstone have been rapidly accepted by producers and represent significant yield advances and increased grain production for Montana producers (Table 5). Yellowstone represents the highest yielding winter wheat line ever developed at MSU. Decade (MT0552), a high-yielding, winter-hardy hollow-stem selection was approved for release in 2010. Several promising experimental lines are emerging from the testing program and are being increased and considered for variety release.

Table 5. Economic impact of two improved winter wheat cultivars in 2007, 2008, & 2009.

	2007	2008	2009	Total	Yield gain	Additional production	Assumption regarding cultivar(s) replaced
	acres	acres	acres	acres	bu/acre	bushels	by improved cultivar
Genou	353,600	507,600	598,000	1,459,200	+4.3	6,274,560	Rampart
Yellowstone	83,100	212,800	311,800	607,700	+7.4	4,496,980	Neeley, Rocky, Tiber
Total						10,771,540	
Yield estimates based on statewide, 6 year means (2003 to 2008, n=125).							
Genou 56.9, Rampart 52.6, Yellowstone 65.4, mean of Neeley, Rocky, Tiber=58.0 bu/a							

Our program has explored marker-assisted selection (MAS) technology to enhance efficiency of solid stem, disease resistance, and Clearfield cultivar development efforts. We have identified 2-gene Clearfield lines for further testing. MAS is a useful and essential tool for variety development. Unfortunately our breeding program does not have the financial resources to maintain our laboratory effort in marker-assisted selection. Due to budget changes over the last year, the winter wheat breeding program has terminated the laboratory research professional involved in DNA extraction and PCR marker selection efforts. Priority breeding objectives will remain resistance to higher grain yield, wheat stem sawfly, imidazolinone herbicide tolerance, winter hardiness, and end-use quality. Development of yield-competitive, winter hardy, sawfly-resistant HRWW and HWWW cultivars is priority. The sawfly selection nursery north of Havre will be used as a selection site for phenotypic screening of sawfly resistance. Selection for winter hardiness and sawfly resistance will also be conducted at Research Center sites including Williston, Havre, Conrad, and Moccasin. End-use quality protocols have expanded to evaluate noodle-making characteristics. Proprietary research such as development of herbicide-resistant varieties will be conducted for benefit of Montana wheat producers.

TITLE: Spring Wheat Breeding and Genetics

PRINCIPAL INVESTIGATOR: Luther Talbert

OBJECTIVES:

- 1) Develop spring wheat varieties for Montana producers.
- 2) Coordinate the variety testing program.
- 3) Conduct genetic studies to enhance our ability to develop better varieties.

Amount funded: \$80,000

SUMMARY

The spring wheat breeding program has a full pipeline of genetic materials designed to provide superior varieties for Montana growers. This includes crosses made between complementary parents developed at MSU and by other breeding programs, early generation materials for selection in Bozeman, and advanced lines being tested throughout the state. Three solid-stemmed lines are currently under consideration for variety release.

TITLE: Identifying and Developing Improved Barley Varieties for Montana

Principal Investigator: Dr. Tom Blake

Objectives:

- A. Identify new barley varieties adapted to Montana's rainfed production system that provide increased farmgate economic yield.
- B. Identify the most reliable malt barley varieties for Montana's rainfed production system
- C. Through collaborative evaluation, identify the best available genotypes from the US, Europe and Australia for production in Montana's rainfed production system
- D. Identify potential germplasm resources that provide reduced cutting by the wheat stem sawfly

Amount funded: \$55,000

Summary

2009 was a banner year for the MSU barley improvement program. We successfully launched Hockett, our new rainfed malting barley variety. Our new lines, MT960101 and MT010158, are in their second year of plant scale malt evaluation and we look forward to the results of year two. We took a leadership role in characterizing the genes that contribute to adaptation in spring barley germplasm from the eight largest spring barley breeding programs in the US. We expanded collaboration with MaltEurop and are evaluating their germplasm for Montana adaptation. We extended collaboration to European barley breeders by testing 200 lines representing the historical European barley germplasm resources for agronomic productivity in Montana. Our sawfly experiment failed due to a near absence of sawfly cutting.

Title: Quantifying ammonia volatilization losses from surface applications of urea to no till wheat

Principal Investigator:

Richard Engel, Associate Professor of Soil Science
Dept. of Land Resources and Environmental Sciences

Objectives

1. To quantify field losses of ammonia from top-dressed urea applied to winter wheat in the fall, winter, and early spring.
2. To establish whether volatilization of urea-N represents a significant economic loss to Montana producers, and to test strategies to mitigate losses should they prove to be significant.

Amount funded: \$20,600

Summary

Surface applications (post-emergence and preplant) of urea fertilizer are a common practice for Montana's small grain producers. However, the efficacy of this practice may be negatively affected by N losses to the atmosphere as a result of ammonia volatilization. This study has provided to the Montana agricultural community (farmers, fertilizer dealers, NRCS, county agents) the first information on the magnitude of ammonia loss associated with surface applied urea. In addition, our study has evaluated the effectiveness of a commercial urease inhibitor (NBPTA or N-(n-butyl) thiophosphoric triamide) sold under the trade name Agrotain to mitigate these losses. Since this project's inception (Spring 2008) we have received considerable interest in our study, both within and outside Montana. This past year funds from the MWBC were used to purchase/acquire equipment necessary to establish a third field site in support of the research efforts under this project.

Project Title: 1) Dryland Cropping Systems: Diversified High and Low Input Strategies;
2) Residual Effects of Soil-Active Herbicides on Dicot Crops.

Principal Investigator: Dr. Perry Miller, Dept. Land Resources and Environmental Sciences

Objectives:

1. Compare diversified no-till and organic cropping systems for crop productivity and quality and resource use efficiency.
2. Compare low and high input strategies for crop productivity and quality and resource use efficiency.
3. Quantify dicot crop yield loss due to residual soil-active wheat herbicides in a favorable environment.

Amount funded: \$14,482

5. Summary

These crop rotation studies serve as a crucial foundation for other studies superimposed by MSU scientists related to diversified no-till and organic cropping systems. The requested funding from MWBC serves mainly to 'grow the crops', providing a key operational base for other more in-depth studies related to crop energy budgets, soil properties, and pest management.

1) Organic systems were agronomically competitive in 2009. Lentil grown organically outyielded lentil grown in three no-till systems, owing to much lower weed pressure. Despite 6 – 9 yr of prior history, organic sweet clover or pea green manures did not produce less biomass than in well fertilized no-till systems. However, a solution must be found to manage creeping (aka 'Canada') thistle effectively in organic systems since this weed has forced abandonment of 2 of 8 plots in one crop rotation study and 2 of 4 plots in the other.

2) Energy use and productivity metrics appear most favorable for rotations that contain N-fixing pea or lentil in the rotation. However it has become clear that the change in soil organic nitrogen must be understood to fully understand crop energy budgets. We will be seeking funding from alternative sources to permit measurement of this key aspect.

3) Reduction in N fertilizer to half recommended resulted in crop yield loss for canola, flax, safflower and spring wheat that ranged from 20 to 30%.

4) *Finesse* herbicide caused measurable yield loss (13 – 19% in dicot crops (flax and pea) planted 54 months after herbicide application in the favorable Bozeman environment, despite no apparent visual crop injury.

Title: Sawfly and Wireworm Demonstration Plots in Barley and Wheat

Principal Investigator: Dr. Kevin Wanner

Objectives:

1) Evaluate wheat stem sawfly preference for different barley varieties. Evaluate resistance of different barley varieties to sawfly.

2) Test new seed treatments for control of wireworm damage in wheat and barley. Utilize results for extension demonstrations and education.

Amount funded: \$5,495

Summary: As a new entomologist at MSU my goal is to combine traditional field entomology with molecular genetic approaches to manage insect pests of Montana's crops. After a first full field season my research program is gaining its footing and future direction. During my first year at MSU I received MWBC funding (2008-2009 fiscal year, "Molecular genetics of wheat stem sawfly odor receptors to enhance IPM based on chemical ecology") to identify the receptor genes in sawfly antennae that detect host plant odors. The technical approach utilized new high throughput DNA sequencing technology. The goal was to sequence genes expressed in sawfly antennae. Our first attempt that used the antennae dissected from 200 sawflies failed because of the small size of the antennae. Consequently, this project was not funded by the MWBC during the 2009-2010 fiscal year. During the 2009 field season my lab collected 4,000 sawflies with help from the Weaver lab, and dissected their antennae. RNA was isolated from these antennae and sent to the University of Illinois Genomics Center for sequencing during November of 2009. The sequencing results were just completed during the second week of January 2010. Our project produced an astounding 694,000 sequences each averaging about 362 nucleotides in length (for a total of 253,000,000 nucleotides of DNA sequence). A very preliminary analysis indicates the presence of many odor receptor genes in these sequences. Assembling and identifying these DNA sequences is the next task. My field research has begun to focus on two economically important insect pests of small grains: wireworms and cutworms. To facilitate these efforts I

recruited a new PhD student (Anuar Morales) with extensive field entomology experience. Mr. Morales arrived in Bozeman on August 1 2009. He immediately began investigating an emerging insect pest, the Dingy cutworm. The Dingy cutworm is not traditionally a significant pest, but it caused significant damage to pulse crops in eastern Montana during 2008. We placed several traps in a spring wheat field in Townsend that had a history of cutworm damage (with assistance from the Virginia Knerr, local county agent). To our surprise, we caught more Dingy cutworms than the traditional cutworm pests (army cutworm and pale western cutworm) (Figure 1).

Project: Montana Ag Live! Underwriting

Project Manager: Dr. Jack Riesselman, Emeritus Professor, Plant Pathology & Chris Seifert, Outreach Director for KUSM

Objective: The allocation is used to fund production costs and air time for the live television show Montana Ag Live! which airs 16 or 17 times per season on Sunday evening at 7 p.m. There are ten spring shows and, in the fall of 2009, we produced seven live shows. Additionally, at 11 a.m. on Sunday, there are 51 weeks of re-runs.

Amount funded: \$3,500

Summary: This program, along with Back Roads of Montana, are public television's most popular locally produced programs. Currently, there are 600,000 televisions in Montana and KUSM can be viewed by over 380,000 of these televisions. The program has highlighted the interaction between MSU and Montana's agricultural industries. Each program has a special guest who discusses a topic of interest for the viewing audience and then answers questions relative to their specialty. In addition to the guest, there are also three other panel members who field questions from the general public. On a typical Sunday evening, the phone bank fielding questions for the panel will receive between 60 and 100 calls. The list of guest topics are diverse and touch all areas of agriculture.

TITLE: Evaluation of various materials and practices contributing toward economic crop production under flexible, continuous and other cropping systems in Montana.

PERSONNEL:

Research faculty members at the following Research Centers:

1. Central Agricultural Research Center (CARC) – Moccasin
2. Eastern Agricultural Research Center (EARC) – Sidney
3. Northern Agricultural Research Center (NARC) – Havre
4. Northwestern Agricultural Research Center (NWARC) – Kalispell
5. Southern Agricultural Research Center (SARC) – Huntley
6. Western Triangle Ag Research Center (WTARC) – Conrad

OBJECTIVES:

1. To evaluate the effects of differing systems on crop and variety performance under diverse environments represented across the Montana Agricultural Experiment Station – Research Center network.
2. To evaluate the potential fit of other materials, concepts and techniques with various cropping systems employed.

Amount funded: \$108,000

Summary:

Results substantiated via consistency with adequate repetition are available for dissemination to the Montana crop producer as well as to the scientific community. All results from these investigations will be available in CD format and will be posted to the web at <http://www.sarc.montana.edu/mwbc/> and via link at the Montana Wheat and Barley Committee website at <http://wbc.agr.mt.gov/>.

Title: Host Plant Resistance, Tritrophic Pest Interactions, and Cropping Systems for IPM of Wheat Stem Sawfly

Principal Investigator: David Weaver

Objective 1: Support a cropping systems project aimed at best management practices using solid and hollow stem wheat

Amount funded: \$134,640

Summary:

The growing of solid stem wheat under heavy sawfly pressure results in a significant increase in mortality of developing larvae, but this does not translate uniformly into a yield advantage. In our study heavily infested Genou yielded less than hollow stem Yellowstone, even under heavy sawfly pressure, but Choteau performed better than Outlook under similar pressure. Further scrutiny of yield loss shows variation in varietal photosynthetic losses due to larval feeding, which does translate into some variation in relative yield loss, but a surprising compensatory response was only evident in Ernest when the developing larva died. The exploration of trap crops continues to show promise for further development. For second year an attractive solid stem variety successfully protected an unattractive spring wheat variety. A key issue limiting the adoption of trap crops is the lack of higher yielding unattractive varieties. Our data suggest that some newer varieties may be replacements for Conan in this approach, but not all. Surprisingly Corbin was quite attractive under field conditions when it appeared that it should not be in the laboratory. More detailed analysis suggests that a newly identified compound, bergamotene, may play a role in limiting infestation, but this will require further exploration this spring. An attractive oat variety performed very well as a potential trap when planted against Vida. This is a particularly promising scenario, given the 100% mortality in oat, plus the tremendous yield potential of Vida. Research supporting a large best management practices study was completed. It appears that the interactions between varieties and multiple pest organisms are complex. The study will be replicated for two more years and the data will be provided to collaborator Menalled for modeling.

Title: Wheat Stem Sawfly Parasitoid Redistribution by County Extension Personnel Supported by Long-Term Monitoring

Principal Investigator: David Weaver

Objective 1: Continue a pilot program for parasitoid population monitoring
Provide parasitoids for County Extension personnel to redistribute
Incorporate long-term monitoring information into our laboratory website

Amount funded: \$40,900

Summary: Ongoing monitoring indicates that the dynamic process of cereal crop rotations causes considerable variation in parasitoid and sawfly populations. Undoubtedly, there is nearly enough evidence to support that the growing of a spring planted wheat, barley, or durum crop will enhance parasitism. If a solid stem variety can be spring planted that will improve the benefits, which will be maximized if cool, wet weather results in a late harvest. Although planting spring crops poses risks in terms of water availability impacting yield, it is important to mention that the years when this practice will work the best are those where the harvest is delayed by more abundant rainfall.

Grassroots interest in parasitoid conservation and redistribution is developing. This is a result of repeatedly stating the same message at venues throughout the State. This, plus a keystone effort by County Extension personnel has sparked grower awareness to the point that implementation, and perhaps enthusiasm have developed. This is entirely accomplished by the project that this committee suggested.

A final personal comment - after I made a presentation at the 2009 MGGGA Convention a grower asked me where he could buy a couple of sweep nets. He said the reason was he knew that he had parasitoids in pretty good numbers in his fields and he wanted to “sweep a couple of netfulls” and drive the parasitoids to another field where he thought they would be beneficial. I agreed that this would work well, as long as he kept them cool during transport, but pointed out that he would also move some sawfly adults as well. He made me laugh pretty hard when he said that they were his sawflies anyway, so he could do whatever he wanted with them. He didn’t care about moving a few sawflies – he wanted to move a lot of parasitoids. Note: he did approach me after my talk. Nobody thus far has asked where they can buy sweep nets during the open question-and-answer session at the end of the talks, but someone will someday. Many growers are still a little shy about acknowledging that they might put a sweep net in a pickup truck rifle rack – but I have seen it a few times.