State of Montana
Annual Report for Calendar Year 2005
to the W-6 Technical Committee
Compiled by J. M. Martin

Eighteen individuals received 1325 accessions in Montana during 2005. The survey of recipients obtained responses from ten users representing 90% of the accessions.

Mike Giroux, Plant Sciences, MSU-Bozeman received one *Triticum aestivum*. The requested accession is being used in a study of the quality effects of adding additional copies of puroindolines into soft wheats. The accession has been used as a source of DNA so far.

Luther Talbert, Plant Sciences, MSU-Bozeman, received 2 *Triticum aestivum* accessions. These two lines are resistant to the Hessian fly biotypes that were found in Montana in 2005. These two lines have been crossed to hard red spring wheat lines grown in Montana. Backcrossing will be done with marker-assisted selection for the resistance genes.

Jamie Sherman, Plant Sciences, MSU-Bozeman received 3 *Triticum aestivum* accessions. Each of the three accessions was listed as being homozygous dominant for one of the red loci. Each was crossed into a white variety. A mapping population will be created for each red gene. Each individual will be phenotyped for red versus white and then will associate with molecular markers.

Phil Bruckner, Plant Sciences, MSU-Bozeman, received 19 *Triticum aestivum* accessions. The objective with most of this germplasm is to generate backcross populations for potential marker assisted selection to add specific traits to some cultivars. This is still a work in progress. Specific accessions will target tan spot resistance, root rot resistance (Fusarium), Russian wheat aphid resistance, photoperiod insensitivity, root lesion nematode resistance, stem rust resistance, and stripe rust resistance.

Ragan Callaway, Division of Biological Sciences University of Montana, received 2 *Festuca idahoensis* and 24 *Pseudoroegneria spicata*. They are using these in competition studies with spotted knapweed.

Elaine Nichols, Montana Seed Potato growers, Bozeman, received one *Solanum tuberosum*. The potato variety was requested by a Montana Seed Potato grower for production not for research. The grower's market for the variety fell though so the variety was not increased for the grower.

Andy Lensen, USDA-ARS, Sidney, MT received two *Triticum* accessions and nine accessions representing three different legume genera. The two *Triticum* accessions were used in a study of wheat stem sawfly (*Cephus cinctus*) oviposition preference. The legume accessions were planted last summer at the Roosevelt and Sheridan County Conservation District Farm near Froid, MT. The same lines were planted again this year.

C. Walt Newman, Bozeman, MT received 2 *Horeum vulgare* accessions. The two samples of Bere barley seeds were planted in research plots in Arizona in autumn of 2005. The barley did

not grow very well, producing only a minimum amount of seed. Apparently, this barley is not adapted to the Arizona climatic conditions.

Nan Rohan, Missoula, MT, received 11 *Triticum aestivum* accessions. These were grown to evaluate for suitability for wheat weaving.

Alice Pilgeram, Co-Director Biobased Institute, MSU-Bozeman received 1114 accession from the germplasm system. This represented 84% of the total number in the state. A report of their activities is as follows.

The primary objective of my research is to develop new crops and value-added products for Montana Agriculture. The primary emphasis of new crop development in Montana has been oilseed crops that can be produced for fuel, biolubricants, or other bioproducts. Duane Johnson (Northwestern Ag Research Center, Kalispell, MT) and collaborators evaluated 9 oilseed crops for dryland production in Montana in 2002-2006. Camelina sativa (French variety Celine) was included in this evaluation. Camelina sativa performed well in this evaluation. Seed yield ranged from 1200-200 lbs/acre. Most importantly, input costs were substantially lower than other oilseed crops. As a result, the Great Northern Grower Cooperative was formed to produce, process and distribute camelina oil for production of biodiesel. However, camelina oil contains 40% omega-3 fatty acid and is much more valuable in the nutraceutical/culinary market than the biofuel market. GNG producers planted 450 acres of camelina for harvest in 2005. 2006 production is estimated at 10,000 acres. MSU and MARC subsequently established breeding programs to select for Montana varieties of Camelina sativa. The germplasm for this program consisted of NPGS accessions of C. sativa, NPGS accessions of other camelina species and European varieties of C. sativa. We anticipate publishing our findings (yield, fatty acid profile, tocopherol, glucosinolate) in 2006.

The NPGS accessions plantings were duplicated at the MSU Hort farm (Bozeman, MT) and NWARC (Kalispell, MT). The third set of camelina accessions was used in an undergraduate research project to evaluate camelina for production of sprouts. The sprout evaluation is ongoing. All of the accessions established at each location. Camelina alyssum and C. laxa never developed beyond the rosette stage. Camelina microcarpa set mature seed, but yields were lower than C. sativa. Aster yellows was detected in all camelina accessions in Bozeman in 2005 with near uniform susceptibility. The camelina in Bozeman was not planted until June 10, which should have greatly contributed to its susceptibility. Other disease or insect pests were not observed.

Biolubricant and Bioproducts. We are also evaluating oilseeds as feedstock for biolubricant production. Erucic acid, hydroxy acids and epoxy acids have applications in lubricants. I spend a fair amount of time search the SOFA (seed oil fatty acid database) to find species that produce a desirable fatty acid. Once I find the species, I order any available accessions from NPGS. The Montana climate has changed in the past couple of decades. The water patterns are less predictable and the springs/summers are hotter. As a result, we are evaluating species that historically may not have thrived in Montana.

Cordia sebestena: Cordia oil is a rich source of oleic (c18:1)and gondoic acids (C20:1). The fatty acid profile is highly variable from species to species. The oil content is high. Yield is unknown**. Not a good choice for Montana.**

Winter 2005 – MSU Greenhouse**.**
Spring 2006- Ft. Ellis Research Station (Bozeman, MT) – Intolerant of frost.

Lunaria: Lunaria oil contains nervonic (24:1) and erucic (22:1) acid. These longer chain fatty acids are desirable in lubricants. Lunaria stands are very common in parts of Southwestern Montana.

Winter 2005 – MSU Greenhouse. Whiteflies are problematic.
Spring 2006 - Ft. Ellis Research Station (Bozeman, MT)

Vernonia: Vernonia contains approximately 60% Vernolic acid. Vernolic acid is an epoxylated fatty acid useful for production of lubricants, polymers and surfactants.

Spring 2006- Collection was planted at the NWARC (Kalispell, MT) for harvest in August 2006. Collection will be screened for yield and vernolic acid content.

Buglossoides, Echium & Neatostema: These plants contain gamma-linolenic acid (C20:3 c6,c9,c12) which is utilized in the health and nutraceutical industries.

Winter 2005 – MSU Greenhouse. .
Spring 2006 - Ft. Ellis Research Station (Bozeman, MT)

Perilla, Agastache, and Camelina: These seed oils contain relatively high levels of Omega-3 fatty acids. Perilla is currently produced for omega03 in Canada. The perilla was planted at the NWARC and decimated by a late frost (June 1). The success with camelina oil as a source of omega-3 diverted our efforts. We have yet analyzed the Agastache.

Biocontrol of Weeds: This group of accessions was utilized to evaluate the host range of a biocontrol insect being developed for control of Meadow hawkweed. They were utilized in the insect containment facility in the MSU Plant Growth Center.

1 Brassica nigra
1 Lappula barbata
1 Lepidium densiflorum
1 Lepidium heterophyllum
1 Lepidium lasiocarpum
1 Lepidium ruderale
1 Sinapis alba
1 Symphytum peregrinum

Fenugreek: We are evaluating fenugreek as a rotation crop for wheat. Horses show great preference for this legume over other legumes such as alfalfa. We evaluated the accessions for

yield in MT. The top ten accessions were planted in Arizona this winter. The Arizona plantings were not successful due to Fusarium/Pythium infestations and the impact of heat on maturity (?). The selected accessions will be planted in MT in 2006. The Montana plantings were duplicated at WARC, NWARC, Bozeman, and CARC.

Jim Miller, Belgrade, MT reported on *Corylus* accession he has received in previous years. His complete narrative of his activities is as follows. I received hazelnuts from 15 varieties of hazelnut plants from the germplasm bank last fall and stratified them by leaving them in the shipping box in my garage. Early this spring, I selected the largest, best formed nuts from each variety, cracked them, then selected 15 of the best kernels from each variety. I then planted five of each selection in three different soils. The soils were: Miraclegrow with ground oyster shells added (5 lbs to three, 20lb bags). I then used EKO clay buster for the second soil. I then mixed Miraclegrow with native Belgrade clay/silt (50/50). I planted a total of 225 nuts of which about 25 sprouted. Of those sprouted, about 10 survived to date. Most of the sprouts were lost to very high heat. They were in direct sun. Several were lost to grasshoppers and one I hit with the watering can. Of the ten, a short frost about a week ago caused them to drop the leaves and begin dormancy. Two have retained their leaves. The remainder of the seeds, along with the plants, continue to be watered.

The seeds were planted in 32 oz plastic Pepsi cups. Each cup had four, 1/4" holes in the sides at the bottom. I used coffee filters to keep the soil from draining out through the holes. The poor germination was perhaps influenced by the heating cables, although, they never got above 80 degrees F. The Pepsi cups were in two cold frames. I covered the frames each night with 12 mils of black plastic. When the first seeds germinated, I opened the top during the day to let the sun in. Once a good set of leaves had started, I removed the black plastic and left the chicken wire to prevent birds from digging out the nuts.

Most of the varieties did not include hybrids of C. americana. I ordered a new batch to be delivered after the fall harvest, which contains a greater number of C. americana crosses. My current quest is to determine why I did not get 70% or so germination. I will also be constructing a greenhouse with temperature control. I plan to use growth promoters on the next batch.

If you were to review my correspondence with the Germplasm bank, you would note that the purpose of these field trials is to determine which hazelnut cultivars do well in Montana and in what soil. My research with Dr. Callan, indicated that the C. americana as the maternal parent stands the best chance of being successful in Montana. The best choice for the paternal parent appears to be C. maximus, C. cornuta and C. californica. Field trials will last at least seven years and probably longer.

My prior studies include the selection of hazelnut cultivars under the guidance of Dr. Nancy Callan, MSU Western Agricultural Experimental Station, Corvallis, MT, and the soil foodweb under Dr. Bruce Maxwell, MSU. I am a member of the Northern Nut Growers Association. I am current taking a soils course and a course in vegetable production. My main interest continues to be agroforestry crops, especially high value nitch crops. Next summer, I will also be growing vegetable crops, some in the greenhouse and some outdoors, in addition to the hazelnuts. My goal is to become a successful biodynamic farmer of nitch crops.

Publications:

Bergman**,** J.W. N.R. Riveland, C.R. Flynn, G.R. Carlson, D.M. Wichman, and K.D**.** Kephart**.** 2005. Registration of 'Montola 2003' Safflower.
Crop Sci 2005 45: 801-802**.**

Bai, F. J. Watson, J. Walling, N. Weeden, A.A. Santner and D.A. DeMason. 2005. Molecular characteristic and expression of PsPK2, and PINOID-like gene from pea (Pisum sativum). Plant Sci. 168:1281-1291.

Moffet M. and N.F. Weeden. 2005. Pheophorbide a monooxygenase (Pao) is located on LG VII near Amy in pea and lentil. Pisum Genetics 37:24-29.