Northwestern Agricultural Research Center Field Day

July 16, 2014

2:30 pm Registration and Introductions

3:00 pm Field Tours

5:30 pm Dinner Sponsored by CHS Kalispell

Guest Speaker: Dr. Glenn Duff, Interim Dean and Director, Montana Agricultural Experiment Stations

Northwestern Agricultural Research Center Staff

Bob Stougaard – Superintendent – PhD Professor of Weed Science

Jessica Torrion - PhD Assistant Professor of Crop Physiology

Brooke Bohannon – Research Associate

John Garner – Research Assistant

Jordan Penney – Farm Manager

Mike Davis – Assistant Farm Manager

Dove Carlin – Administrative Associate

Seasonal Employees

Austin Jones, Brittney Brewer, Taryn Butts, Ashley Hubbard, Dustin Toavs,
Brad Carlin, and Bethany Updike

Advisory Committee

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Markus Braaten, Toby Goodroad, Tryg Koch, Pat McGlynn, Miles Passmore, Dale Sonstelie,
David Tutvedt

Lake County

Dan Barz, Scott Buxbaum, Dan Lake, Steve Siegelin, Jack Stivers, Steve Tobol

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Ed Braaten, Al Cameron

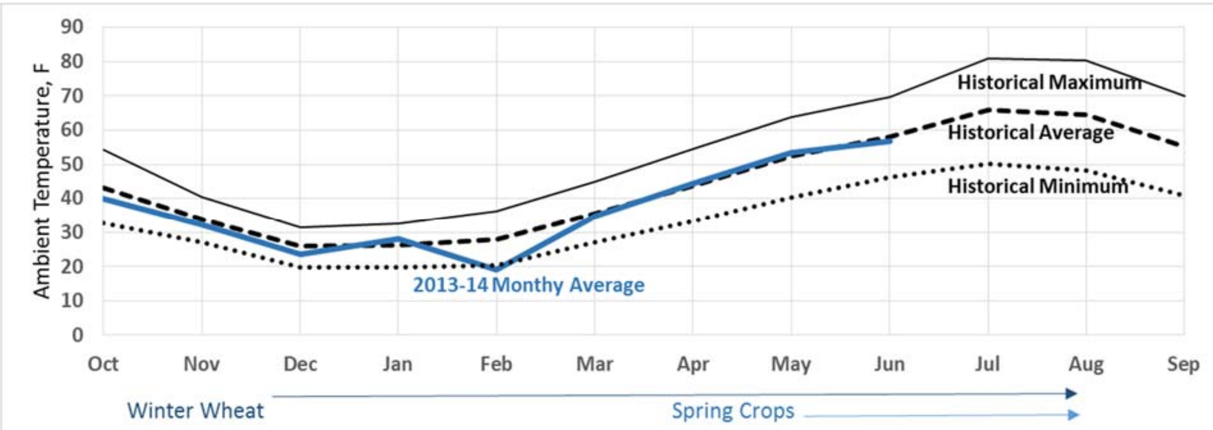
Sanders County

John Halpop, Dale Neiman, Craig Weirather

2013-2014 Weather Trend in Relation with the 24-year (1989-2013) Climate Data

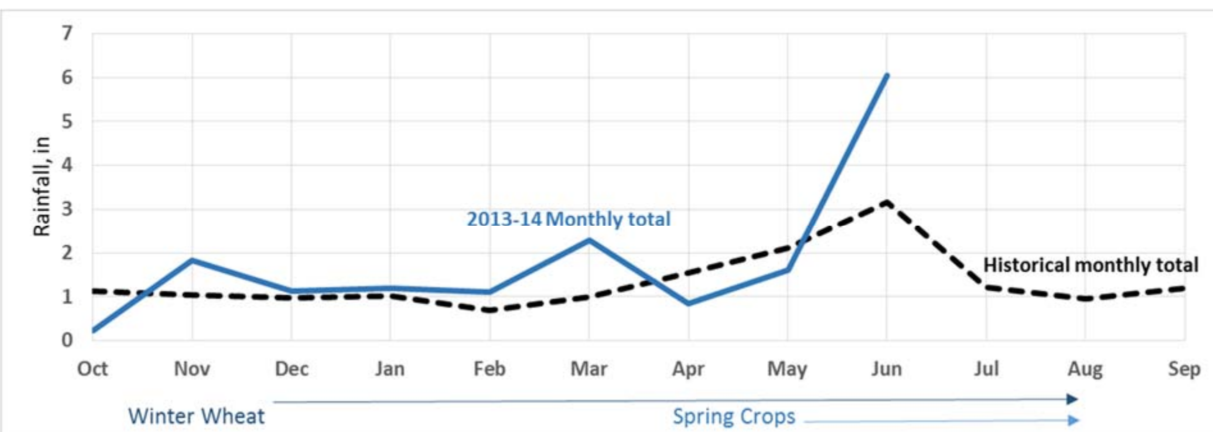
This year's crop season was slightly colder in the fall and beginning of winter (Figure 1). For the most part, 2014 average temperature is in close agreement with the historically expected average temperature except in February – which dropped to about 10 degree F below historical.

Figure 1. 2013-14 monthly mean temperature relative to the maximum, minimum and mean historical ambient temperature.



Overall, the monthly total rainfall received this year is above the historically expected rain except October, April and May. A full soil profile was observed at planting in spring. April and May were consistently lower than average by 0.70 and 0.50 inches, respectively. This prolonged low rainfall in two months caused coarse soil texture sites (i.e., fine sandy loam) to experience slight water stress. However, the amount of rain at mid-June recharged soil profiles to saturation. Total rain in June was twice the amount than expected (Figure 2).

Figure 2. 2013-14 monthly total rainfall received relative to the historically expected rain.



Crop Water Use Efficiency on Spring Wheat

Supplemental irrigation, when scheduled at the right time, boosts yield. It is known that crop yield increases with an increased transpired water supplied from stored soil water at planting, rain and irrigation. The goal of this research is to determine the yield performance and grain quality of 8 spring wheat cultivars when subjected to full irrigation, deficit (2/3 full irrigation), and various early irrigation terminations.

Plant available water is monitored by soil-water-balance approach using daily weather data from the Creston Weather Station such as: rainfall & air temperature, humidity, radiation, and wind speed used to calculate reference evapotranspiration (ETr). E is water evaporated from soil surfaces; T is water transpired (escaped) through plant stomata; & r is a standard ET reference cover of either alfalfa or grass. Daily crop ET (ETr X crop coefficient) is interchangeably used as actual daily crop water use. The soil water for fully irrigated treatment is maintained above 50% plant available water (PAW) to avoid stress. Soil water sensors were installed to complement monitoring of PAW.

We expect that the various irrigation strategies not only influence spring wheat yield but also grain quality, particularly falling numbers. We will also evaluate cultivar-specific responses to irrigation treatments in relation to yield and grain quality.

Planting date	April 23	Spring wheat varieties	Brennan Buck Pronto Cabernet Expresso McNeal WB Rockland Solano Volt
Emergence date	May 7		
Average Soil Temp 2" (April 23-May 7)	54 F		
Target seeding rate	20 seeds/ft^2		
Treatments (6)	Full Irrig (100ET); 2/3 Full Irrig(2/3 100ET); Full Irrig minus 1(100ET-1); minus 2 (100ET-2); and minus 3 (100ET-3) early termination of irrigation events; and a dryland check		
Fertilizer applied	196 N, 10 P_20_5, 100 K_2O lbs/A	Seed Treatment	Cruiser Maxx Vibrance
Herbicide applied	At 4-leaf stage		
Midge control applied Fungicide applied	At heading		

Photographed on June 24, 2014

Nitrogen Use Efficiency of Irrigated Spring Wheat

This research aims at determining the response of various spring wheat varieties (yield and quality) to levels of Nitrogen (N) when water is not a limiting factor. It is expected that the nitrogen use efficiency (NUE) decreases as soil N increases. Whereas, water use efficiency (WUE) increases with increasing soil N. The spring wheat cultivar-specific NUE versus WUE will be evaluated.

Spring soil available N was determined by soil testing. Just prior to planting, fertilizers were broadcast (Photo A) and incorporated into the soil. Irrigation is determined by soil water balance approach (similar to the crop water use efficiency study). Plant available water (PAW) is maintained above 50% in avoidance of water stress. Soil water sensors were installed to complement monitoring of soil PAW. The first irrigation was on June 10 (Photo B).

Planting date	April 23	Spring wheat varieties	Brennan Buck Pronto Cabernet Expresso McNeal WB Rockland Solano Volt
Emergence date	May 7		
Average Soil Temp 2" (April 23-May 7)	54 F		
Target seeding rate	20 seeds/ft^2		
Treatments (4)	150, 300, 450 lbs N/A and a "No additional N" as a check.		
Fertilizer applied	___N, 10 P_2O_5, 100 K_2O lbs/A	Seed Treatment	Cruiser Maxx Vibrance
Herbicide applied	At 4-leaf stage		
Midge control applied Fungicide applied	At heading		

A. Pre-plant fertilizer application

B. First irrigation applied on June 10 to avoid water stress [near 50% of Plant Available Water was depleted on a fine sandy loam soil on this date]

Alfalfa Disease Management

Alfalfa is an import forage crop in Northwestern Montana. However, alfalfa is subject to stand and yield loss from disease, insect injury, nutrient deficiencies, and other environmental stresses. This study was established to evaluate the impact that diseases have on alfalfa forage yield and quality.

Priaxor, Headline, Endura, and Quadris were applied on May 21 when the crop height was 12 inches. Spring black stem was confirmed to be present by The MSU Schutter Diagnostic lab.

	Rate	June 9		June 23		6/23/2014
Treatment	(oz/A)	Leaf Loss	Infection	Leaf loss	Infection	YLD
		IN	%	IN	%	T/A
CHECK		11	30	17	30	3.2
PRIAXOR	4.0	10	26	14	12	3.5
PRIAXOR	5.5	10	29	16	26	3.1
HEADLINE	6.0	10	23	16	29	3.0
ENDURA	6.5	11	23	18	21	2.9
QUADRIS	6.0	9	24	11	9	3.0
LSD (P=.05)		2	19	5	13	1
CV		16.26	48.86	23.18	39.66	13.37
Treatment Prob(F)		0.4786	0.933	0.113	0.012	0.3467

Orange Wheat Blossom Midge Preference

In past years, the OWBM have been found in much lower numbers in Reeder than in most other spring wheat varieties. While this occurs in small research plots, it's uncertain if the same outcome would happen on a field scale. This demonstration was established to find out if the midge preferred Solano over Reeder in a large scale trial. The trial was put out in 4 locations across Flathead Valley. The seeding date was to be after May 1st to ensure adequate midge pressure. The target plant population was to be at 35 plants/sq. ft, which meant that Solano was seeded at 135 lbs/acre and that Reeder was seeded at 100 lbs/acre. Reeder was to be sprayed with Palisade at the two node stage. Both varieties were to be sprayed at 50% heading with Warrior II if economic thresholds were present.

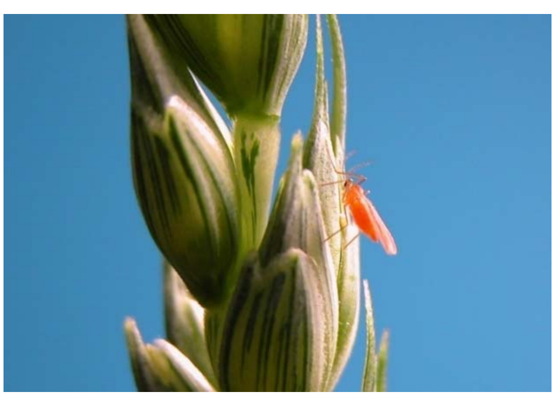
OWBM (Number per spike)				Yield (Bu/ac)			
Year	Variety			Year	Variety		
	Reeder	Hank	Conan		Reeder	Hank	Conan
2008	28	69	113	2008	64	46	23
2009	7	13	26	2009	101	93	62
2010-1	2	25	18	2010-1	103	90	74
2010-2	5	50	47*	2010-2	82	70	53*
2011-1	10	58	46	2011-1	44	19	13
2011-2	81	321	341*	2011-2	37	9	13*
2012	46	102	-	2012	34	15	-
2013	39	33.6	31.6*	2013	79.2	59.1	83.0*

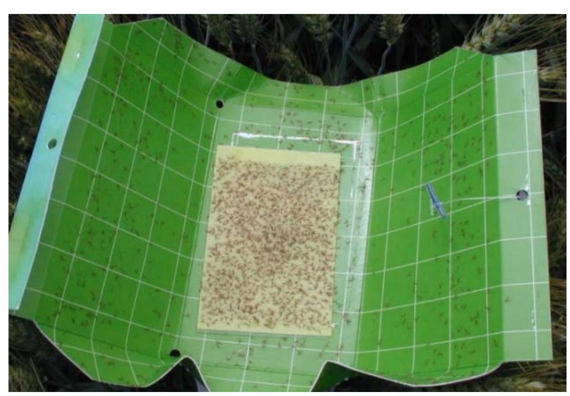
*Indicates Solano was used in place of Conan

Location	HCF		NWARC		Chris Fritz		Karl Schrade	
Variety	Reeder	Solano	Reeder	Solano	Reeder	Solano	Reeder	Solano
Plants/ft2	29	25	37	26	24	17	24	23
Plant Dry wt (g)	54	40	24	21	29	27	41	38

Variety	TKW	Rate
Solano	38.8	135 lb/ac
Reeder	28.8	100 lb/ac

*Target plant population = 35 /sqft





Development of Orange Wheat Blossom Midge Resistant Spring Wheats

The Sm1 gene is the only known form of antibiotic resistance against the orange wheat blossom midge (OWBM). A backcross and selection program has been on-going to incorporate the Sm1 gene into locally adapted spring wheats. Things have progressed well and MSU has recently released “EGAN” (CAP 400), its first midge resistant variety.

Agronomic performance of spring wheat when treated with an insecticide, 2013.

	Yield		OWBM		Stripe Rust		Falling No		Protein	
	N	T	N	T	N	T	N	T	T	N
EGAN	91	99	0	0	4	5	408	421	17.0	16.9
REEDER	79	87	7	0	12	7	348	369	15.0	15.7
HANK	59	76	27	6	83	48	272	273	13.4	14.7
SOLANO	83	97	18	4	5	7	311	312	15.9	16.5

The resistance gene is highly effective, resulting in almost complete mortality of the wheat midge. The selection pressure is so intense that entomologists are concerned that the midge population might develop resistance to the gene. In order to delay the development of resistance, entomologists are recommending that producers use variety blends, or refuge systems.

The purpose of the interspersed refuge system is to delay the selection of virulent, Sm1 resistant midge populations. The refuge, or susceptible variety, is blended with the midge resistant variety at a ratio of 1:9. The combination is then planted together in an effort to maintain the genetic diversity of the midge population. In this study, CAP 34-1 and CAP 400-1 contain the Sm1 gene for OWBM resistance, while Solano and Choteau are midge susceptible varieties. These four cultivars were planted alone and as blends, where the CAP lines comprise 90% of the blended mixtures.

Evaluation of the interspersed refuge system for OWBM management.

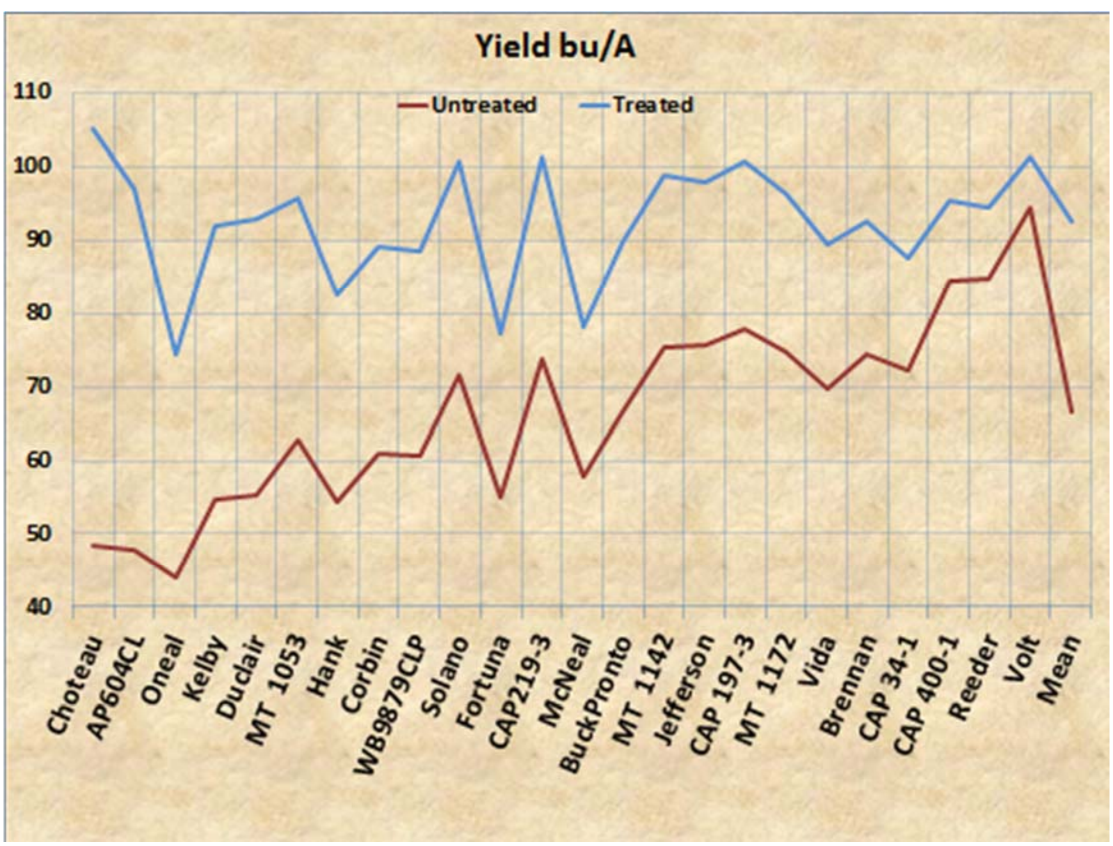
	Yield	Protein	OWBM	Height	Test Wt.
CAP 400	95.8	15.5	0.0	38.5	60.1
CAP 34	88.6	13.1	0.0	35.8	59.9
SOLANO	84.2	15.2	11.9	31.8	58.9
CHOTEAU	73.5	15.5	13.4	37.3	58.5
CAP 400 & SOLANO	91.5	15.6	0.0	38.1	60.0
CAP 400 & CHOTEAU	92.6	16.1	0.0	38.5	59.7
CAP 34 & SOLANO	90.0	13.4	0.0	35.7	59.9
CAP 34 & CHOTEAU	88.2	13.4	1.8	36.0	59.9

Spring Wheat Variety Response to Insecticide and Fungicide Applications

Stripe rust and the orange wheat blossom midge (OWBM) are two troublesome pests in spring wheat. This study was conducted to determine the level of plant resistance present in common spring wheat varieties, and to determine the agronomic response of these materials when treated for the control of these two pests. Twenty four spring wheat varieties were grown and were either treated or not treated with appropriate pesticides. Headline was applied for the control of stripe rust, while Lorsban was applied for the control of OWBM.

Stripe rust infection averaged 31% in the check varieties, ranging from a low of 0% for Volt to a high of 95% for AP604CL. Treatment with Headline reduced stripe rust infection to an average of 3.6%. OWBM pressures were moderate, averaging 15 larvae per spike. The highest numbers were recorded for Hank at 31 larvae per spike, while several of the CAP lines had no larvae. Lorsban effectively control OWBM, reducing densities to an average of 3 larvae per spike.

The combined effect of both pests negatively affected yields. The check varieties averaged 66 bu/A while the treated varieties averaged 92 bu/A. The treatments improved the yield of every variety evaluated, but the magnitude of the yield response varied depending on the susceptibility of each variety to the pest complex present. In general, the more susceptible the variety, the greater the yield benefit. In summary, the relative ranking of some spring wheat varieties changed depending on whether or not they had been treated for stripe rust and the OWBM. However, several varieties consistently yielded well, irrespective of treatment.



Optimum seeding date and rate for spring canola in northwestern Montana

In 2012 the valley experienced a late frost which caused severe damage to canola stands. Many producers were faced with the decision of whether or not to reseed their fields. Based on this experience and with the input of our Advisory Committee, we developed a research project to investigate the effects of seeding date, rate and maturity on canola production.

This study consists of three seeding dates, 3 plant densities, and two maturity groups.

Seeding dates were chosen by the number of growing degree days it takes for canola to be fully emerged and the first true leaf visible (300 GDD32). The 2014 seeding dates were: April 22, May 14, and May 29. Target plant populations were 4, 8 and 16 plants/sqft, and were calculated using the following formula: lb/A = 9.6 x plants/sqft x tkw ÷ % survival. The table below shows the seeding rates used based on a 75% survival estimate.

Variety	TKW	Plant/sqft	Rate (lb/ac)
DKL 30-03	4.7	4	2.4
DKL 30-03	4.7	8	4.8
DKL 30-03	4.7	16	9.6
DKL 70-07	5.1	4	2.6
DKL 70-07	5.1	8	5.2
DKL 70-07	5.1	16	10.4

DKL30-03 and DKL 70-07 were selected as the early and late maturity groups.

Soil analysis revealed nutrient levels to be 246-24-178. A fertilizer blend of 50-30-40-20 was broadcast and incorporated prior to planting. All plots were treated with glyphosate (16 oz/A) at the 5-6 leaf stage.

Results from one year, 2013, do not favor the latest seeding date. The late May date demonstrated poor stand establishment and was severely grazed by deer from bolt to early flower. In contrast, the 2014 late May seeding is demonstrating the highest stand establishment.

Effect of plant density and seeding date on agronomic performance of canola - 2013

Density Plants/sqft	PLNT sqft	LOD %	HT in	YLD BU	OIL %	2014 PLNT sqft
			4/17/13			4/22/14
4	4.2	4.4	54.0	56.2	48.5	2.7
8	9.9	12.0	55.9	58.3	49.1	5.7
16	16.9	56.7	53.4	50.9	48.5	11
			5/9/13			5/14/14
4	6.0	1.1	58.3	50.5	47.9	3.3
8	12.3	6.7	57.3	53.3	47.7	6.3
16	23.8	46.1	54.0	46.5	47.2	12
			5/21/13			5/29/14
4	2.4	0.0	44.4	12.6	44.3	4.8
8	5.1	0.0	49.2	16.2	44.6	8.8
16	6.3	0.0	48.7	20.3	45.8	18.8
LSD	1.5	8.6	3.4	6.2	0.5	2.1
Pr>F	0.0001	0.0001	0.0383	0.0367	0.0007	0.0064

PLNT: plants, LOD: lodging, HT: height, YLD: yield

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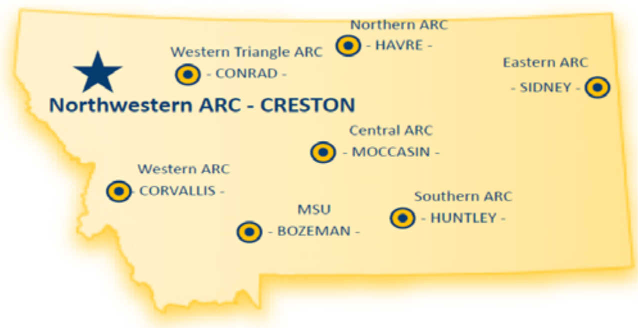

FY14 MONTANA WHEAT & BARLEY GRANTS

GRANT TITLE	PRINCIPAL INVESTIGATOR	MSU	CARC	EARC	NARC	NWARC	SARC	WARC	WTARC
Identifying and developing improved barley varieties for Montana	Tom Blake	X	X	X	X	X	X		X
Winter wheat breeding and genetics- early line selection	Phil Bruckner			X	X	X			
Winter wheat breeding and genetics - advanced line selection	Phil Bruckner	X	X	X	X	X	X	X	X
Plant disease management and education in Montana	Mary Burrows		X		X				
Early generation durum selection and germplasm improvement	Joyce Eckhoff			X					
A field survey for occurrence of herbicide-resistant kochia in Northern Montana	Prashant Jha						X		
Light-activated sensor controlled sprayer technology	Prashant Jha						X		
Strategic investment in SARC for small grains research in South Central Montana	Ken Kephart						X		
Soil sampling equipment for field scale-smal plot on & off-station research at NARC	Peggy Lamb				X				
Weather data collection for producers in North Central Montana	Peggy Lamb				X				
Adding ESN to urea as nitrogen source for irrigated spring wheat production	Kent McVay						X		
Assessing agronomic practices to advance cereal production in Montana	Kent McVay	X	X	X	X	X	X		X
Trapping click beetles with pheromone traps (Coleoptera: Elateridae)	Gadi V.P. Reddy								X
Purchase of diesel pick-up	Gadi V.P. Reddy								X
Orange wheat blossom midge management	Bob Stougaard					X			
Evaluation of materials/practices contributing to economic production in Montana	Bob Stougaard					X			
Spring wheat breeding and genetics - early line selection	Luther Talbert	X			X	X			
Spring wheat breeding and genetics - advanced line selection	Luther Talbert	X	X	X	X	X	X	X	X
Sensor-based nitrogen fertilization Algorithm for winter wheat varieties	Olga Walsh		X		X		X	X	X
Expanded implementation of wheat stem sawfly IPM	David Weaver				X				X

FY14 FERTILIZER TAX AWARDS

GRANT TITLE	PRINCIPAL INVESTIGATOR	MSU	CARC	EARC	NARC	NWARC	SARC	WARC	WTARC
Tillage and crop rotation effect on nitrogen use efficiency and crop yield	Chengci Chen		X						
Nitrogen management of Roundup Ready sugar beets	Joyce Eckhoff			X					
Effect of fertilizer nitrogen weed control and crop-weed competition in Montana cereal production	Prashant Jha						X		
Comparison of Urea to ESN as nitrogen source for irrigated corn production in Montana	Ken Kephart						X		
Effects of alternative nitrogen sources applied in variable blends and timings on yield and quality of short seasoned dryland corn grown for grain production in a low rainfall	Peggy Lamb				X				
Comparison of foliar applied nitrogen fertilizers in spring wheat	Olga Walsh							X	X
Evaluation of sensor-based technologies & nitrogen sources for improved recommendations for dryland & irrigated spring wheat production in Montana	Olga Walsh							X	X
Effect of nitrogen sources, rates & application time on spring wheat yield & grain protein	Olga Walsh								X
A comparison of nitrogen sources for spring wheat production	Olga Walsh							X	X
Winter wheat, in a continuous system, yield and protein response to time of winter application of urea and ESN nitrogen fertilizer	Dave Wichman		X						

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