Joint Meeting, Western Wheat Workers and WCC-97 (Research on Cereal Diseases)
UC Davis
May 4-5, 2001

The year 2001 meeting of the WCC-97 occurred on the campus of University of California at Davis. The group, which was hosted by Lee Jackson, was welcomed by Jim MacDonald the Associate Dean of the College of Agricultural and Environmental Sciences. The meeting was highlighted by a series of presentations by personnel from the Western Regional Resource Center at Albany and centered on the role of biotechnology as a tool to influence wheat genomics, cereal quality and disease resistance to Fusarium Scab. Saturday was spent visiting University small grains research plots where barley stripe rust was very evident. Cal Qualset presented an overview of the wheat breeding program, which was followed by a stop at the Center for Engineering Plants for Resistance Against Pathogens (CEPRAP) on the UC Davis campus (Dave Gilchrist). The field trip concluded with a stop at AgraQuest (Jerry Hensley), Resource Seed Inc (Bob Matchett), and the CA Wheat Commission (Sammy Haung).

Barley Stripe Rust

Cal Qualset

State Reports

California - by Lee Jackson

General. Small grains in California are sown in the fall throughout most of the state and are comprised primarily of hard red spring and durum wheat and 6-row spring feed barley. A substantial acreage of spring-sown spring barley and spring wheat also is normally grown in the intermountain area of NE California (Tulelake/Klamath basin), but a drought and restriction on irrigation in that area will result in little, if any, small grain production there this season. The U.S. Bureau of Reclamation made a zero allocation of surface water deliveries from the Klamath Project for the Tulelake Irrigation District. The available water was allocated for maintenance of lake levels and in-stream flows for protection of endangered fish species in the Klamath Lake and Klamath River. Because of the lack of irrigation, we will not grow the Western Regional Spring Wheat nurseries at Tulelake this season. Estimated acreage for the fall-sown small grain crop for the 2001 season in California includes nearly 580,000 acres of wheat (including 80,000 acres of durum wheat), 130,000 acres of barley, and 220,000 acres of oat. Leading wheat cultivars (non-durum) by acreage were Bonus (122,000 acres), Yecora Rojo (113,000 acres), Express (75,000 acres), and Brooks (60,000 acres). Those four cultivars accounted for 74% of non-durum acreage. Bonus, Yecora Rojo, and Brooks predominated in the San Joaquin Valley while Express and Bonus predominated in the Sacramento Valley. RSI 5, grown on 84,000 acres last year, was planted on only 2,500 acres this season. It was not marketed this season because of its extreme susceptibility to stripe rust. Kronos was the leading durum wheat cultivar and was grown on 54,800 acres, accounting for 68% of the durum wheat acreage. Wheat and barley stripe rusts are the main diseases this season, to date.

Wheat stripe rust. Wheat stripe rust occurred widely in the U.S. during the 2000 season. It was very severe in California, as I reported last year, particularly on the variety RSI 5. Xianming Chen, USDA/ARS, Pullman, analyzed collections from 20 states and identified 21 new races and 21 previously identified races. Sixteen races were identified from collections that I submitted from California. The new races included 8 pathotypes with combinations of virulence factors previously known to exist in the U.S., while 13 pathotypes were virulent on *Yr8, Yr9*, Clement and/or Compair. According to Chen, the detection of *Yr8* and *Yr9* virulence factors was the first in the U.S. Most of the new races also were virulent on the variety Express (races with virulence to Express have been present in California since 1998). Races virulent on *Yr8*, *Yr9*, and Express were widely distributed in California as well as in states east of the Rocky Mountains in 2000. This season, plots of susceptible varieties and lines have 100% severities at several nursery sites in the Sacramento Valley. Little acreage of highly susceptible varieties is being grown commercially in the region most affected. The variety Express, however, for which many of the newly identified races have virulence, was planted on about 75,000 acres this season. It is showing infection with a lot of necrosis, but with limited spore production. Wheat growth stage is early grain fill, so the opportunity for further spread exists. During the field tour on Saturday, the group will have the opportunity to view the high level of disease pressure from stripe rust this season and see the reaction of entries in the Western Regional Spring Cereal Disease Nursery and the Western Regional Winter Cereal Disease Nursery that are coordinated by Xianming Chen.

Barley stripe rust. Barley stripe rust is severe on susceptible lines and varieties in both the Sacramento and the San Joaquin Valley. As with wheat stripe rust, the group will have the opportunity to view the high level of disease pressure from barley stripe rust this season during the field tour on Saturday. We again are conducting a screening program for BSR resistance at UC Davis with funding from the American Malting Barley Association. About 3000 lines, consisting of advanced materials from many U.S. breeding programs and a portion of winter barleys from the National Small Grains Collection that come from all over the world, are being evaluated.

Colorado – No report yet
Idaho – No report yet

KANSAS – By William W. Bockus and Robert L. Bowden

The final estimates of wheat disease losses during 1999-2000 were as follows: barley yellow dwarf, 5.0%; leaf rust, 2.9%; wheat streak mosaic, 0.9%; strawbreaker, 0.3%; tan spot, 0.2%; stripe rust, 0.05%; powdery mildew, 0.05%; Septoria complex, 0.4%; and bunt and loose smut, 0.01%. Additionally, there were trace losses estimated for take-all, common root rot, scab, and stem rust. It was estimated that wheat soilborne mosaic and Cephalosporium stripe caused no losses in the state. This follows a significant downward trend for these two diseases because of the widespread adoption of resistant cultivars. The two virus diseases that caused appreciable losses (BYD & WSMV) were important because of the unusually warm, open fall and winter that allowed the insect vectors to remain active for most of the season. Additionally, of particular note is the re-appearance of strawbreaker foot rot in a significant number of fields in south central Kansas. Strawbreaker had not caused substantial losses in Kansas since 1985.

Cultivar blends occupied about 7.5% of the acreage in Kansas during 1999-2000. This was up from 6.1% during the 1998-1999 season and would have made them the third most popular cultivar behind Jagger (34.0%) and 2137 (23.1%). A recent publication by the KAES and Cooperative Extension

Service reports on the results of comparing blends with pure line cultivars in the Kansas Wheat Variety Performance tests during 1994-1997. Blends had a small but statistically significant 0.85 bu/A increase in yield over the mean of their counterparts. The main advantage of the blends was their more "stable" yields. It was noted that blends tended to do better when there was "differential injury" early enough in the season for compensation to occur by one of the components of a blend.

As a result of beginning screening nurseries for reaction to Fusarium head blight three years ago, enough data were collected to allow the inclusion of a new column in the Extension publication *Wheat Variety Disease and Insect Ratings 2000*. In that publication, 23 cultivars are rated for their reaction to scab. The cultivar with the lowest reaction was Hondo with a rating of 3 on the 1- (resistant) to-9 (susceptible) scale. For comparison, the two most popular cultivars in Kansas, Jagger and 2137, were rated 8 and 9, respectively. Other notable cultivars with improved scab resistance were Heyne and Lakin (both recently-released hard white winter wheats) that were rated a 4.

Minnesota – Ruth Dill-Macky

2001 season. At the time of writing this report (May 4, 2001) planting of wheat and barley in Minnesota for the 2001 cropping season was just beginning. Spring flooding, particularly in the Minnesota River, was severe but as this area is south the grain production area and thus the planting of small grains in Minnesota has not been delayed although only a small portion of the crop is planted.

2000 season: In 2000 Minnesota spring wheat production was similar to 1999 with production estimated at 2 million acres. Durum wheat was estimated at 2,000 acres, down 3,000 acres from 1999. Winter wheat acres were estimated at 20,000 acres. Minnesota's barley acreage increased to an estimated 240,000 acres, up 70,000 from a record low in 1999. The 2000, season was generally good for small grains production with state yields of barley averaging 64 bu/A and spring, durum and winter wheat averaging 49, 51, and 46 bu/A respectively. A dry winter and early spring resulted in much of the Minnesota cereal crop being planted well ahead of the 5-year average. The early part of the growing season was generally cool and dry and afforded crops an excellent start with little disease development. Continued dry conditions posed concern to crops in southwest and southern Minnesota toward the end of May. Rainfall, shortly before anthesis, relieved dry soil conditions but raised concerns over the development of foliar diseases, particularly leaf rust and Fusarium head blight. While Fusarium level were generally low and yield losses minor, however levels of deoxynivalenol in harvested barley prevented much of the Minnesota crop from being sold as malt quality. Septoria, powdery mildew, tan spot, and Fusarium head blight were observed on wheat but infections were generally low and yield losses were light. Leaf rust of wheat was also observed, but disease development was later and slower than last year and the resulting disease was not as widespread or severe as in 1999. Common root rot and crown rot were widespread and likely contributed to significant yield losses in some crops, root rots were especially prevalent in those fields that became waterlogged following heavy rainfall. Aphid populations were much lower than last year and aphid damage was minimal. Armyworms became a problem in some fields late in the season and insecticide applications were required in some locations to check large populations in wheat and barley fields.

Personnel changes in Minnesota:

Retirements:

Robert H. Busch, USDA-ARS Wheat Geneticist and Breeder - retired July 2000.
Donald C. Rasmusson, University of Minnesota Barley Breeder - retired July 2000.
Kurt Leonard, USDA-ARS Cereal Disease Laboratory, Research Leader - retired April 2001.

New Personnel:
James A. Kolmer – USDA-ARS Cereal Disease Laboratory, research plant pathologist –leaf rust and Fusarium head blight of wheat, started July 2000.
Hala Toubia-Rahme, University of Minnesota, Northwest Research and Outreach Center, Crookston – Small grains and canola extension, started October 2000.
Brian J. Steffenson, University of Minnesota, Plant Pathology, Liebermann-Okinow Endowed Chair - utilizing disease resistance in wild cereal for improving small grains, started November 2000.

Montana - by Bob Johnston

Fusarium Crown Rot continues to be an important disease affecting small grain production in Montana. Durum producers in particular appear to be hard hit with both the crown rot and scab phases of Fusarium.

The crown rot phase tends to follow the typical disease cycle which favors increased disease in those plants which are over-fertilized and stressed for moisture. With the drought last year and the potential for a continuation this summer, we are expecting that Fusarium will be a factor limiting durum production in the state. We are currently accessing 8 durum lines for disease susceptibility in inoculated trials and the potential of three seed treatments to control this disease.

Durum Cultivars			
Medora	Mountrail	Plaza	Lebsock
Kyle	Renville	Ben	Utopia
Seed Treatments			
Charter max	Raxil MD	Dividend XL	

Scab has been found in seed harvested from durum fields in the north-east corner of Montana. This area in contrast to the rest of the state received above normal moisture during the 2000 growing season. There have been a number of telephone calls requesting seed treatment information concerning the best materials to apply to infected seed lots being used for 2001 plantings. Based on a number of experiments that we did in the mid 90's our recommendation is to treat scab infected seed with either Vitavax extra or Maxim in combination with a broad spectrum fungicide such as Dividend.

Source, Treatment, Percent Active, and Rate (oz/cwt)*	% Germination (Petri dish)	% Emergence (glasshouse)	Field Stand-Plants/0.9m^2	Field Yield-g/1.5m^2
Nontreated	29.3 a	50.7 a	75.8 a	809.0 a
Gustafson Vitavax 200 34F 4.0	27.3 ab	78.3 b	106.5 cde	865.3 ab
Gustafson FloPro 31F 0.5	49.0 d	72.7 b	107.0 cde	897.0 b
Agsco RR 10F 0.4	43.3 cd	75.3 b	108.3 de	866.5 ab
Wilbur Ellis Nuzone 10F 1.5	61.3 e	74.7 b	107.0 cde	848.0 ab
Ciba Dividend 32.8F 0.5	36.7 bc	71.7 b	106.0 cde	843.5 ab
Gustafson Baytan 30F 1.5	41.3 cd	76.3 b	100.3 cd	868.5 ab
Agsco DB Green 34.2 5.0	27.3 ab	77.0 b	111.3 de	883.5 ab
Gustafson RTU PCNB 24F 3.0	33.7 bc	74.3 b	101.8 cde	850.5 ab
Gustafson Captan 37.4F 4.0	18.7 a	72.7 b	108.3 de	886.3 ab
Gustafson Raxil 3.02 1.0	44.7 cd	73.3 b	95.3 cd	877.8 ab
Nontreated	24.3 x	52.3 x		
Ciba Maxim 40.3F 0.2	54.0 y	76.7 y	106.3 cde	912.0 b
Gustafson Kodiak** (0.6 dry) 16.0	28.0 x	52.0 x	90.0 bc	854.0 ab
Agsco 4452 5F 10.0	34.0 x	71.0 y	102.8 cde	859.8 ab
Agsco 4452 5F 20.0	24.3 x	71.7 y	103.3 cde	874.0 ab
Gustafson Vitavax Extra 33.3F 3.0	62.0 y	80.0 y	118.0 e	884.4 ab
Agsco DB Green 34.2F 5.0+RR 10F 0.4	--	--	96.3 cd	867.0 ab

- F = Flowable, and cwt = 100 pounds; ** Kodiak is a biological control agent formulated from spores of *Bacillus subtillis*. Column means with a letter in common are not significantly different at P = 0.05.

We also evaluated the susceptibility of 10 barley cultivars and their interaction with a number of commonly used seed treatments for reaction to Fusarium Crown Rot and obtained the following results:

Grams of seed per 16 feet of row.

Treatment	Harrington	B1202	Morex	Chinook	Baronesse	Bowman	Hector	Gallatin	Valier	Xena	Mean
Inoculated	731.0	660.5	754.0	848.8	834.5	794.0	820.0	810.0	864.3	852.8	797.0 c
Non—Inoc	763.5	760.5	826.5	903.0	851.8	798.0	839.5	850.3	904.5	911.0	840.9 a
Charter Max	723.3	742.8	786.3	915.0	836.8	781.0	840.3	841.5	946.5	855.3	826.9 ab
Charter PB	770.8	747.0	786.3	929.8	872.8	819.5	891.0	835.8	896.3	891.5	844.1 a
Dividend XL	736.0	729.3	785.3	889.5	869.8	786.3	806.8	806.0	885.0	898.0	819.2 abc
Dividend+Maxim	789.0	720.5	759.5	912.0	847.3	786.3	833.0	839.8	878.3	886.8	825.2 ab
Raxil MD	804.8	717.0	779.5	902.5	851.8	809.3	850.8	850.3	899.5	877.8	834.3 ab
Raxil-Thiram	768.8	720.0	808.5	910.0	833.5	788.3	853.5	849.8	931.0	904.8	836.8 ab
Vitavax+Flo	692.8	728.5	773.8	859.3	930.8	753.8	813.5	790.4	893.8	831.0	806.7 bc
DBGreen+RR	777.5	701.0	731.8	867.5	815.3	769.5	830.0	845.8	893.5	842.8	807.5 bc
Mean	755.7	722.7	779.1	893.7	854.4	788.6	837.8	831.9	899.3	875.2	
	cd	d	bcd	a	ab	bcd	ab	abc	a	a	

Application rates for barley cultivar test:

Treatment	% ai	oz/cwt
Charter PB	14.1	5.5
Charter MAX	1.8	5.8
Dividend XL	17.9	0.5
DividendXL+Maxim	17.9+40.3	0.5+0.04
Raxil MD	1.12	5.0
Raxil-thiram	21.6	3.5
RTUVitavax+FloPro	20.0+31.0	6.0+0.25
DB Green L + RR	34.2+10.0	3+0.4/bu

Montana has a unique climate in that we have very cool moist soils in the spring during seeding. Although these soil warm quickly, we can have a slight problem with *Pythium* causing a reduction in emergence and plant vigor. Our current recommendation based on seed treatment data is to use a treatment which contains apron as one of the active ingredients. This recommendation is for spring seeding only. Fall seeding temperature and moisture levels are not conducive to *Pythium* infection.

In a test conducted at Bozeman in 2000, three cultivars of durum wheat which varied in lab germination tests from 54-84% were treated with commonly available seed treatments. When this seed was planted on April 17, 2000, only 23% of the non-treated seed emerged and produced a viable plant. However, the addition of apron to the non-treated seed resulted in a 55% increase in the number of emerged/viable plants and a 4.4 bushel increase in yield. In previous tests, similar results were seen with hard red spring wheat. This decrease in emergence is due to cool weather fungi which live in the soil and attack the germinating seed. Many times, even if the non-treated seedling does emerge from the soil it is more susceptible to root rot organisms which attack the seedling latter in the growing season.

Fortunately, apron is readily available in a number of seed treatments, including Dividend XL and Raxil MD. Charter Max, an experimental seed treatment from Aventis which is expected to be registered in the near future, also contains apron in the formulation. **Apron should always be applied in combination with other fungicides to obtain maximum disease control.**

Treatment and Rate		Emergence – plants per 10 ft	Bu/a
Nontreated		34.7 c	61.4 bc
Charter PB	(5.5 oz/cwt)	41.3 bc	66.3 ab
Charter MAX	(5.8 oz/cwt)	51.5 ab	67.1 a
Dividend XL	(1.0 oz/cwt)	54.4 a	66.4 ab
DB Green L + RR	(3 oz/bu+0.4 oz/bu)	35.0 c	60.5 c
RTU Vitavax +FloPro	(6 oz/cwt+0.25 oz/cwt)	48.7 ab	65.1 abc
Raxil MD	(5.0 oz/cwt)	55.2 a	65.5 abc
Dividend XL	(0.5 0z/cwt)	51.0 ab	64.1 abc

Means followed by a letter in common are not significantly different

Personnel – **Don Mathre** will retire at the end of 2001. A job description has been written and hopefully will be advertised by mid-Aug 2001.

Production figures for Montana 1999-200

Winter Wheat

Year	Total						
	Acres		Production		Value		
	Planted (000)	Harvested (000)	Yield Per Acre Bu.	Total Bushels (000)	Price Per Bu. Dols.	Value of Production (000) Dols	Value Per Acre Dols.
2001	1,200						
2000	1,500	1,350	33	44,550	3.05	135,878	101
1999	1,050	970	38	36,860	2.67	98,416	101
1998	1,400	1,250	39	48,750	2.80	136,500	109
1997	1,600	1,450	38	55,100	3.40	187,340	129
1996	2,150	1,980	31	61,380	4.24	260,251	131

Durum wheat

Year	Total						
	Acres		Production		Value		
	Planted (000)	Harvested (000)	Yield Per Acre Bu.	Total Bushels (000)	Price Per Bu. Dols.	Value of Production (000) Dols	Value Per Acre Dols.
2001	470						
2000	480	470	28	13,160	3.85	50,666	108
1999	360	350	27	9,450	3.45	32,603	93
1998	450	430	28	12,040	3.23	38,889	90
1997	300	290	26	7,540	5.18	39,057	135
1996	290	280	25	7,000	4.65	32,550	116

Spring Wheat

Year	Total						
	Acres		Production		Value		
	Planted (000)	Harvested (000)	Yield Per Acre Bu.	Total Bushels (000)	Price Per Bu. Dols.	Value of Production (000) Dols	Value Per Acre Dols.
2001	3,250						
2000	3,350	3,100	25	77,500	3.25	251,875	81
1999	4,150	4,000	27	108,000	2.97	320,760	80
1998	3,800	3,600	30	108,000	3.13	338,040	94
1997	4,250	4,100	29	118,900	3.58	425,662	104
1996	4,200	4,100	26	106,600	4.22	449,852	110

Barley

Year	TOTAL						
	Acres		Production		Value		
	Planted (000)	Harvested (000)	Yield Per Acre Bu.	Total Bushels (000)	Price Per Bu. Dols.	Value of Production (000) Dols.	Value Per Acre Dols.
2001	1,200						
2000	1,250	950	40	38,000	2.35	89,300	94
1999	1,300	1,150	50	57,500	2.32	133,400	116
1998	1,350	1,200	48	57,600	2.27	130,752	109
1997	1,250	1,150	53	60,950	2.83	172,489	150
1996	1,250	1,150	43	49,450	3.07	151,812	132

NORTH DAKOTA by Len Francl

Planting of the 2001 crop is just getting underway during the first week in May. Producers are optimistic for a good year.

The 2000 season was a mixed bag for wheat and barley in the state. Small grain yields per acre were up 10 to 20% statewide from 1999 according to the National Ag Statistics Service (Table 1). Prices were up for wheat and durum but down for barley, probably because of the large crop volume that didn't make malting quality standards (Fig. 1).

Table 1. Selected production statistics from the 2000 ND small grain crop.

Grain	Acres planted (1,000)	Yield (bu/a)	Production (1,000 bu)	Price ($/bu)	Dollar Value (1,000)
Spring wheat	6,800	36	230,400	2.95	679,680
Durum	3,250	27	78,300	2.75	215,325
Barley	1,900	55	97,350	1.50	146,025

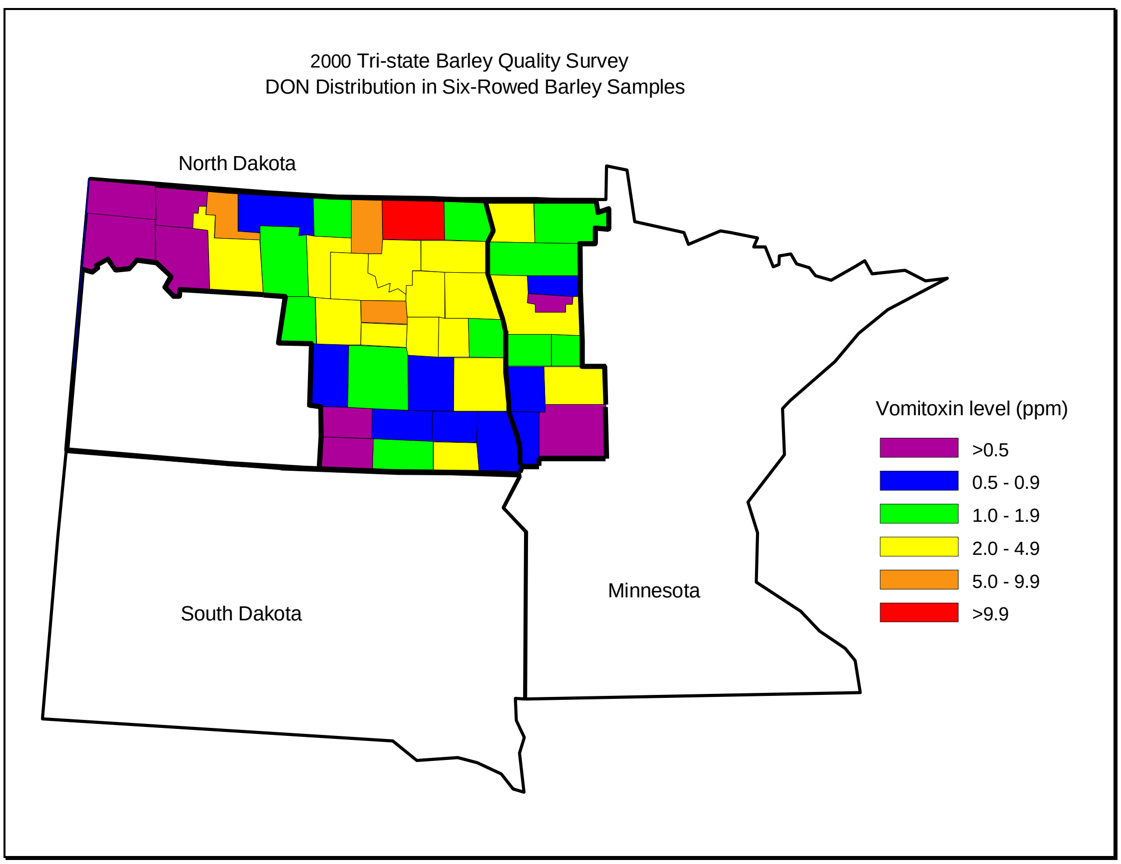
The North Dakota Small Grains Disease Survey, managed by Dr. Marcia McMullen, tracked disease progress through the season. Extension IPM scouts from all districts reported that the most common flag leaf diseases on wheat were leaf rust, Septoria (Stagonospora) blotch, and tan spot, with combined severities ranging from 3% to almost 100%. Stripe rust was observed on wheat this year. The T race complex of leaf rust continued to put pressure on growers to switch to newer, more resistant cultivars. Although early season rust pressure was light due to unfavorable disease conditions elsewhere in the Great Plains, the northern tier of counties suffered some yield loss. On barley, leaf rust, Septoria, and spot blotch were most evident. Net blotch and stem rust were also observed on barley in low amounts. Other small grain diseases observed to lesser extent included black chaff, glume blotch, barley yellow dwarf, ergot, and loose smut. Small grains, especially durum, in the north central part of the state were hit with rain at harvest, which resulted in serious sprouting, mold damage, and steep price discounts.

Scab was found in wheat and barley in almost all areas of the state, with average head severities ranging from 3% to 80%, again depending on variety, use of fungicide, and location (Table 2). Figure 1, while only showing DON on barley, gives a good overall representation both wheat and barley areas most affected by scab. Marketing discounts were common in areas most affected. Alsen, a new NDSU spring wheat cultivar with type II resistance to scab, was released in 2000 and performed well. A significant acreage increase is expected in 2001 because there will be an adequate seed supply.

Table 2. Final survey assessments of scab in select crop reporting districts, data from Dr. Marcia McMullen.

District	Severity (head sev x incid)	Incidence (% of fields)
Northeast	1-8%	100%
Central	1-18%	50%
North Central	1-30%	60%

Fig. 1. Distribution of average DON levels in six-rowed barley from quality samples, data kindly supplied by Dr. Paul Schwartz, Cereal Science Department, NDSU.



Nebraska – By John E. Watkins

Virulence Pattern of *Puccinia triticina* in Nebraska in 2000

Leaf rust incidence in 2000 was limited due to dry conditions that persisted through the growing season. Statewide leaf rust severity ranged from moderate in eastern and central Nebraska to very light in the west.

Urediniospore isolates of *Puccinia triticina* were obtained from wheat leaf field collections made in four wheat-growing regions in Nebraska. Sixteen Thatcher lines that are near-isogenic for leaf rust resistance were used to determine 43 virulence phenotypes among 212 field isolates collected in 2000. The most prevalent phenotype was TDBM, virulent on host genes *Lr1, 2a, 2c, 3, 10, 23* and *24* (Table 1). Phenotypes TDRM (virulence on *Lr1, 2a, 2c, 3, 3ka, 10, 11, 23, 24* and *30*) and MDRM (virulent on *Lr1, 3, 3ka, 10, 11, 23, 24* and *30*) were the second and third most common virulent phenotypes in 2000. Collectively, these three phenotypes comprised 56% of the total number of isolates screened.

Virulence frequency to the 16 host genes has been monitored since 1995. Consistently, virulence has been high to *Lr1, 3ka, 10, 11* and *30* from 1995 to 1999 (Table 2). However, in 2000 virulence to *Lr3ka, 11*, and *30* was 30 to 48% less than that found in 1999. No virulence was found to *Lr16* and *21* in 2000.

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Wheat Streak Mosaic Virus as a Gene Vector

Infectious cDNA clones of wheat streak mosaic virus (WSMV) were used to develop a virus gene expression vector for cereals. Inserts bearing the coding sequences of NPT II and ß-glucuronidase (GUS) were placed between the nuclear inclusion b (Nib) and coat protein (CP) domains of the WSMV polyprotein. The WSMV Nib-CP junction containing the nuclear inclusion a (NIA) protease cleavage site was duplicated permitting excision of foreign protein domains from the viral polyprotein. Wheat, barley, oat, and maize seedlings supported systemic infection of WSMV bearing NPT II. Histochemical assays indicated the presence of functional GUS protein in systemically infected wheat and barley plants inoculated with WSMV bearing GUS. The GUS constructs had greatly reduced virulence on both oat and maize. Both reported genes were expressed in wheat roots at levels comparable to that observed in leaves. These results clearly demonstrate the utility of WSMV as a transient gene expression vector for grass species, including two important grain crops, wheat and maize.

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Impact of High Plains Disease and Wheat Streak Mosaic on Wheat Varieties and Lines

Warm and extended fall in 1999 provided environmental conditions favorable for the development of wheat curl mite populations and of wheat streak mosaic (WSM) and high plains disease (HPD). Sampling in November 1999 indicated that all of the varieties and lines in the virus screen plots at Sidney and Scottsbluff were infested. ELISA analysis for the presence of WSMV and HPV in the fall of 1999 indicated an infection rate at Sidney of 85% of the plants positive for WSMV and 20% positive for HPV; at Scottsbluff these figures were 41% for WSMV and 0% for HPV.

Yield data indicated that the Kansas resistant lines held up very well against both the moderate wheat streak pressure at Scottsbluff (Table 3) and the more severe pressure observed at Sidney (Table 4). Those commercial lines with wheat streak mosaic resistance or tolerance in their background did separate out as to the impact of the virus. Disease ratings, which include a yellowing and a stunting rating , and SPAD meter chlorophyll readings are also given in the tables. These disease ratings give an indication as to the virus severity at each location.

The severity of virus impact was greater at Sidney with the yield losses (assuming a 40 bu yield potential) for commercial lines ranging from about 25% (2137) to about 75% (Vista and Tomahawk). The milder infection at Scottsbluff showed a range in yield loss from 0% (2137) to about 25% (Vista) or 40% (Tomahawk). As in 1999, the performance of Pronghorn and Millennium was surprising. At Scottsbluff, both varieties performed as well as some of the commercial varieties classified as having some degree of tolerance. At Sidney, Millennium performed as well as the best commercial lines, but Pronghorn yields fell into the range of the susceptibles. The mechanism responsible for these lines to perform better in the presence of the virus is not known, but under the heavy virus pressure at Sidney Pronghorn did not perform as well. The resistance present in 2137 holds up better than any other commercial line and should be classified higher than >moderately susceptible= to the virus. The very good performance of the Kansas resistant lines is encouraging as this source of resistance has held up well in all of our trials and in several backgrounds out of Kansas.

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Table 1. Virulence phenotypes of *Puccinia triticina* isolates collected in Nebraska in 2000[x]

		East		Central		West Central		Panhandle		Total	
Prt Code[y]	Virulence formula[z]	No.	%	No.	%	No.	%	No.	%	No.	%
MBRM	1,3,3ka,10,11,23,30	1	1.2	0	0.0	1	5.6	0	0.0	2	0.9
MBRQ	1,3,3ka,10,11,18,30	1	1.2	0	0.0	0	0.0	0	0.0	1	0.5
MDBL	1,3,10,24	1	1.2	0	0.0	0	0.0	1	3.0	2	0.0
MDBM	1,3,10,23,24	2	2.4	0	0.0	1	5.6	0	0.0	3	1.4
MDG	1,3,10,11,23,24	1	1.2	0	0.0	0	0.0	0	0.0	1	0.5
M	1,3,3ka,10,23,24	1	1.2	0	0.0	0	0.0	0	0.0	1	0.5
MDLM	1,3,3ka,10,24,30	0	0.0	1	1.3	0	0.0	0	0.0	1	0.5
MDML	1,3,3ka,10,23,24,30	1	1.2	0	0.0	0	0.0	0	0.0	1	0.5
MDM	1,3,3ka,10,11,23,24	1	1.2	0	0.0	0	0.0	0	0.0	1	0.5
M	1,3,3ka,10,11,24,30	0	0.0	0	0.0	2	11.	0	0.0	2	0.9
MDQ	1,3,3ka,10,11,23,24,30	7	8.2	13	17.	4	1	5	15.	29	13.
M	1,3,3ka,10,11,18,24,30	0	0.0	1	2	0	22.	0	2	1	7
MDRL	1,3,3ka,10,11,18,23,24,30	5	5.9	1	1.3	1	2	1	0.0	8	0.5
MDRM	1,3,3ka,10,11,17,18,23,24,3	0	0.0	1	1.3	0	0.0	0	3.0	1	3.8
MDRQ	0	0	0.0	1	1.3	0	5.6	0	0.0	1	0.5

MDRR	1,2c,3,10,24	1	1.2	1	1.3	0	0.0	0	0.0	2	0.5
MDTR	1,2c,3,3ka,10,11,23,24,30	1	1.2	0	1.3	0	0.0	0	0.0	1	0.9
PDBL	1,2c,3,3ka,10,11,23,24	0	0.0	1	0.0	0	0.0	0	0.0	1	0.5
PDRM	1,2a,2c,3,10,18	0	0.0	1	1.3	0	0.0	0	0.0	1	0.5
PDQM	1,2a,2c,3,3ka,10,18	1	1.2	1	1.3	0	0.0	0	0.0	2	0.5
TBBQ	1,2a,2c,3,3ka,10,11,23,30	1	1.2	0	1.3	0	0.0	0	0.0	1	0.9
TBLQ	1,2a,2c,3,10,24	15	17.	24	0.0	3	0.0	14	0.0	56	0.5
TBRM	1,2a,2c,3,10,23,24	0	6	0	31.	0	0.0	1	42.	1	26.
TDBL	1,2a,2c,3,10,18,24	1	0.0	0	7	0	16.	0	4	1	3
TDBM	1,2a,2c,3,10,18,23,24	2	1.2	0	0.0	0	6	0	3.0	2	0.5
TDBQ	1,2a,2c,3,10,23,24,30	0	2.4	1	0.0	0	0.0	2	0.0	3	0.5
TDBR	1,2a,2c,3,10,11,23,24	0	0.0	0	0.0	0	0.0	1	0.0	1	0.9
TDCM	1,2a,2c,3,10,11,18,23,24	0	0.0	1	1.3	0	0.0	0	6.1	1	1.4
TDGM	1,2a,2c,3,10,11,23,24,30	4	0.0	2	0.0	1	0.0	1	3.0	8	0.5
TDGR	1,2a,2c,3,3ka,10,23,24	1	4.7	1	1.3	0	0.0	0	0.0	2	0.5
TDHM	1,2a,2c,3,3ka,10,24,30	4	1.2	1	2.6	0	0.0	0	3.0	5	3.8
TDLM	1,2a,2c,3,3ka,10,23,24,30	1	4.7	1	1.3	0	5.6	0	0.0	2	0.9
TDML	1,2a,2c,3,3ka,10,18,23,24,3	7	1.2	4	1.3	0	0.0	2	0.0	13	2.3
TDMM	0	1	8.2	2	1.3	0	0.0	0	0.0	3	0.9
TDMR	1,2a,2c,3,3ka,10,11,23,24	19	1.2	9	5.4	4	0.0	3	6.1	35	6.1
TDQM	1,2a,2c,3,3ka,10,11,24,30	0	22.	1	2.6	0	0.0	0	0.0	1	1.4
TDRL	1,2a,2c,3,3ka,10,11,23,24,3	2	3	2	11.	1	0.0	0	9.1	5	16.
TDRM	0	1	0.0	0	9	0	22.	0	0.0	1	4
TDRQ	1,2a,2c,3,3ka,10,11,18,24,3	0	2.4	1	1.3	0	1	0	0.0	1	0.5
TDRR	0	1	1.2	1	2.6	0	0.0	2	0.0	4	2.3
TDSM	1,2a,2c,3,3ka,10,11,18,23,2	0	0.0	1	0.0	0	5.6	0	0.0	1	0.5
TFRM	4,30	1	1.2	1	1.3	0	0.0	0	6.1	2	0.5
TNRM	1,2a,2c,3,3ka,10,11,17,23,2	0	0.0	1	1.3	0	0.0	0	0.0	1	1.9
TNGM	4	85	1.2	76	1.3	18	0.0	33	0.0	21	0.5
TNRM	1,2a,2c,3,3ka,10,11,23,24,2		0.0		1.3		0.0		0.0	2	0.9
TNTM	6,30				1.3		0.0				0.5
	1,2a,2c,3,9,10,23,24						0.0				
	1,2a,2c,3,9,10,11,23,24										
	1,2a,2c,3,3ka,9,10,11,23,24,										
	30										
	1,2a,2c,3,3ka,9,10,11,17,23,										
	24,30										

[X] Number and percent of isolates from indicated area.
[Y] *Prt* code or virulence phenotype is based on high/low infection type on 16 near-isogenic lines of Thatcher wheat each with a different gene for leaf rust resistance. The 12 differentials (*Lr1, 2a, 2c, 3, 3ka, 9, 11, 16, 17, 24, 26* and *30*) in the *Prt* nomenclature were used along with near-isogenic lines *Lr10, 18, 21* and *23.*
[Z] *Lr* genes on which the isolate is virulent.

Table 2. Virulence frequency[y] for the 1995, 1996, 1997, 1998, 1999 and 2000 *Puccinia triticina* populations in Nebraska to 16 near-isogenic Thatcher wheat differentials.

Lr gene	1995	1996	1997	1998	1999	2000	Mean	Slobe b[z]
1	100	100	100	100	100	100	100	--
2a	27	55	21	6	64	73	41	0.08*^
2c	40	55	36	22	71	75	50	0.07*^
3	100	100	99	100	100	100	100	--
3ka	93	85	100	91	94	63	88	--
9	0	9	0	0	0	4	2	--
10	100	100	100	100	100	100	100	--
11	96	97	91	91	90	56	87	-0.04*^
16	0	4	0	0	0	0	1	--
17	0	30	1	18	11	1	10	--
18	100	94	100	44	14	11	60	--
21	---	---	0	0	0	0	0	--
23	---	---	88	93	78	92	88	0.20*^
24	58	34	99	87	89	97	77	0.17*^
26	14	1	14	4	18	1	9	-0.01*^
30	100	96	100	100	100	52	91	--
Total no.	120	156	121	178	192	221	163	

[y] Represents the percentage of leaf rust isolates collected from that year.
[z] b = regression slope over years, ns = no significant. *significant (P<0.05) linear trend, ^ signficant (P<0.05) residual trend, and -- not statistically anlyzed since more than (P<0.05) 25% of cells had counts less than 5 (1).

Table 3. Wheat damage ratings and yields for wheat virus (wheat streak mosaic and high plains viurses) screen, Pnahandle Research and Extension Center, Scottsbluff, NE 1999-2000.

Variety	Yield (bu/A)	Chlorophyll Reading (SPAD)	Yellowing Rating (0-5)	Stunting Rating (0-100%)
KS96HW103	43.1	47.5	1.5	5.8
KS95H103	40.9	51.1	1.3	9.2
2137	40.5	42.8	2.0	19.2
KS97HW4	37.8	46.2	0.8	0
KS95H103 with	37.7	50.3	1.3	5.8
Furadan	35.5	39.5	2.8	25.0
Pronghorn	33.6	38.8	2.8	29.2
Millennium	33.6	40.9	2.7	41.7
Niobrara	32.3	39.2	2.7	29.2
Redland	31.1	40.2	2.8	34.2
Tam107	29.7	38.6	3.7	56.7
Vista	28.6	32.6	3.3	53.3
Alliance	27.5	37.3	3.3	43.3
Arapahoe	27.4	38.3	3.0	35.0
NE99585	25.0	29.9	3.7	50.0
Tomahawk with	21.6	30.4	4.3	53.3
Furadan	6.8	2.7	1.2	10.0
Tomahawk				
LSD				

Table 4. Wheat damage ratings and yields for wheat virus (wheat streak mosaic and high plains viruses) screen, High Plains Ag Lab, Sidney, NE 1999-2000.

Variety	Yield (bu/A)	Chlorophyll Reading (SPAD)	Yellowing Rating (0-5)	Stunting Rating (0-100%)
KS96HW103	49.9	50.5	0.8	1.7
KS95H103 with	49.5	49.3	0.3	0.8
Furadan	43.1	45.2	0.3	6.7
KS97HW4	39.4	47.2	0.8	8.0
KS95H103	29.3	42.5	2.5	38.3
2137	25.4	37.2	3.3	48.3
Redland	25.1	39.5	3.0	46.7
Millennium	22.2	39.5	3.2	53.3
NE99585	21.9	38.8	3.2	50.0
Niobrara	17.4	37.2	3.7	58.3
Arapahoe	16.3	38.2	3.8	68.3
Alliance	16.1	36.0	3.3	51.7
Pronghorn	14.7	39.8	3.7	53.3
Tam107	11.9	36.0	4.0	58.3
Tomahawk with	10.3	34.3	4.0	73.3
Furadan	7.3	35.2	4.0	73.3
Vista	6.6	3.4	0.6	10.2
Tomahawk				
LSD				

Oregon – By Chris Mundt

Condition of crop

There were an estimated 680,000 acres of common soft white wheat and 72,000 acres of winter club wheat planted in fall 2000. This is about average for recent history in Oregon. Spring acreage has increased recently, and between 130,000 to 160,000 acres have been planted in the most recent years, with about 70-75% of this being soft white wheat and the rest hard red. Indications are that much spring wheat has been sown this year, despite the drought.

We had decent sowing conditions in fall 2000 and a mild winter. The big news, of course, is the drought. Much of our drier areas are at about 50% of normal moisture for the crop season. Some localized areas have been just about normal.

It is too early in the season to evaluate most diseases, but we can make the following guesses:

Cephalosporium stripe - Continues to be perhaps our most important disease of wheat in eastern Oregon. Severity will be down this year due to the mild winter. An increased emphasis is being placed on screening for resistance through a cooperation among Jim Peterson, Oscar Riera-Lizarazu, and Chris

Mundt. Recent results suggest that insensitivity to toxin may be an important mechanism of resistance to Cephalosporium stripe.

Eyespot - Incidence and severity likely to be reduced this year due to dry conditions. This is becoming a disease of the past due to availability of cultivars with the VPM resistance.

Dryland foot rot - Given this season's weather, dryland foot rot is likely to be of increased importance. Dick Smiley is doing some very nice work on evaluating resistance of cultivars using paired inoculated/non-inoculated plots. Based on first year of data, it appears that there may be substantial differences among cultivars.

Wheat stripe rust - This disease has become almost a non-issue on winter wheat due to incorporation of high temperature, adult-plant resistance. An exception would be at high elevations, where warmer temperatures sometimes do not occur early enough to trigger the resistance. Wheat is sometimes sprayed with fungicide under these conditions. Stripe rust can still a problem on spring wheat, where there has been less emphasis on breeding for resistance.

Wheat leaf rust - At this point, pretty much a problem only on spring wheat and durum wheat. In the Willamette Valley, leaf rust will likely again become more of a problem if we get the Septoria problem under control.

Septoria - Septoria is a problem only in the Willamette Valley of Oregon. Septoria will be less severe than average this year due to dry weather in winter and spring. However, we will probably still see more Septoria than most sites do in a conducive year. *Septoria tritici* still dominates, but *Septoria nodorum* is also present.

Christina Cowger (graduate student at OSU) has continued work on the genetics of *Septoria tritici* and effects of host selection. Using historical data sets, she has very convincing evidence that the quantitative resistance of the cultivar Madsen has eroded substantially over the last 10 years. This is perhaps the best evidence available demonstrating erosion of quantitative resistance. The new cultivar 'Foote' has demonstrated very favorable yields and a high level of quantitative resistance to Septoria.

Barley stripe rust - Was devastating on spring barley last year in the Klamath Basin, with yield loss estimates region-wide of 15-20%. Planting is still underway for this season; a significant amount of land will not be planted due to irrigation restrictions.

Information received during the week of 23-27 April 2001 suggests that there has been a major race change for barley stripe rust in Peru. These preliminary numbers also suggest that two QTLs for resistance that have been incorporated into Oregon cultivars may have been overcome by these new rust genotypes. Obviously, there's a lot more that needs to be done to resolve this recent development.

South Dakota – No report submitted yet

Washington – Timothy Murray and Xianming Chen

Acreage estimates.

Total - nearly 3.0 million acres

- Winter wheat – 1.85 million acres (+0 over 2000); 73 bu/ac in 2000 (+15 over 1999)
- Spring wheat - 680,000 acres (+55,000 ac over 2000); 54 bu/ac (+10 over 1999)
- Spring barley – 400,000 ac (-100,000 ac under 2000); 70 bu/ac (+11 over 1999)

Oats – 35,000 (+0 over 2000); 75 bu/ac +0 over 1999)

Growing Conditions.

Fall 2000. Early autumn seedbed moisture in the high rainfall producing area was good, but seeding dates were later than normal. Consequently, much of the winter wheat crop was small entering winter. Seeding conditions in the moderate to low-rainfall areas were better and seeding and emergence was timely.

Autumn and winter temperatures were lower than previous years, with below normal temperatures during early December. Snow cover was present over a wide area and persisted for over 100 days in many areas. Timely snow cover and moderate temperatures resulted in good winter survival throughout the state.

Spring '01. Spring weather has been cool and moist with only a few days of warm, dry weather. Rainfall is running behind long-term averages in most areas, although recent rains have added substantially to the seasonal accumulation. Overall the winter wheat crop is in good condition with respect to stand and growth stage, but yields are expected to be average at best based on current soil moisture. Seeding of spring crops is still in progress in many areas of the state.

Disease problems.

Overall it's too early to determine which diseases will present major problems in most of the winter wheat growing areas.

Soilborne pathogens. Cephalosporium stripe is beginning to appear in some areas, and is expected to be serious in some area due to significant soil freezing in early December. Eyespot is expected to be prevalent in the intermediate and low rainfall areas where resistant varieties are not grown and where fall sowing was early, resulting in lush stands. Pink snow mold was present in many fields, but not severe enough to cause significant damage. Speckled snow mold was moderate to severe in the northern wheat production areas. Eltan winter wheat, which is moderately resistant, and Bruehl, a new snow mold-resistant club wheat, are grown widely in the snow mold areas and thus, losses are expected to be minimal with these varieties.

Foliar pathogens. Stripe rust (wheat and barley) is beginning to appear in the higher rainfall region of the state. In northwestern Washington, 1% stripe rust was observed in commercial fields. In eastern Washington, stripe rust started to show up in commercial wheat fields. If weather in the Pacific Northwest continues to be favorable for stripe rust, susceptible wheat and barley cultivars will likely suffer significant losses. It is too early to know whether leaf rust and stem rust will be a problem this year. In plots at Mt. Vernon, susceptible wheat lines had 40 to 60% stripe rust in the late April. Susceptible barley entries had 20% stripe rust. Powdery mildew occurred on many entries but mainly on lower leaves. Scald was common in the barley nurseries. It's too early to know whether Physiological leaf spot will be a problem this year. Chloride applications to reduce this problem are used by many growers who have experienced this problem. Barley yellow dwarf has not been reported yet.

Personnel.

Dennis Gross left WSU to become Dept. Head at Texas A & M Univ. Tim Murray assumed duties as chair in November 2000.

Gerry Santo, WSU nematologist located at Prosser, retired in December 2000. A search for his replacement is underway.

Steve Wyatt, WSU virologist, will leave WSU for Kansas State Unviersity in June.

Pat Okubara will join the USDA-ARS Root Disease and Biological Control unit in May.