

## Spring Wheat Breeding

### Principal Investigator:

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During the 2000 growing season, over 50 percent of the acres within our three state (SD, ND, MN) spring wheat production region were sown to varieties derived from the South Dakota State University breeding program. “Briggs” became available to growers prior to the 2002 production season. In 2005, Briggs was sown on approximately 1.8 million acres throughout the region. “Granger” was made available to registered seed producers in 2004. Granger has not been as widely accepted as Briggs, perhaps due to lodging and seed shattering concerns, but also perhaps because Briggs has been so phenomenally well accepted. Granger was, however, the highest yielding released variety of those tested in Minnesota on-farm yield trials in 2005, and in 2006 was one of the most widely grown varieties in southern Minnesota. Our newest variety, “Traverse,” was released to registered seed producers in spring 2006 and seems to have gained a good amount of grower attention through its high yield potential. Traverse typically produces more grain than both Briggs and Granger, is more resistant to Fusarium Head Blight (FHB) infection, and tends to have fewer issues with leaf disease than several other recently released varieties. Plans remain intact to release SD3851 to Registered seed producers prior to the 2009 production season.

Agronomic performance data collected from several regionally prominent varieties and experimental lines are presented in tabular form and visually with Table 1 and Figure 1, respectively.

### Traditional Variety Development

Two advanced experimental lines (SD3851 and SD3948) are currently being increased and considered for release as varieties. Each is described below. During 2007, a third advanced experimental line (SD3868) was grown in a large-scale increase plot with the intent to release it as a variety in 2009. In 2007, however, it became very susceptible to leaf rust and has therefore been discarded from the program.

#### SD3851

SD3851 is an F4 derived line from the cross ND2897/SD3219//SD3414. In 2003, SD3851 produced more grain than all other Preliminary Yield Trial (PYT) entries tested. Its test weight and protein levels were also above average. It was first entered into the Advanced Yield Trial (AYT) in 2004. In the growing years 2006-2007, SD3851 produced less grain than Briggs, Granger, and Traverse, however, its test weight was, respectively, 1.3, 1.2, and 3.9 pounds per bushel heavier than these three varieties (Table 1).

SD3851 is approximately 3.3 and 2.1 inches shorter than Granger and Traverse, respectively. It is nearly equal in height to Briggs. Its heading date is approximately 2 to 3 days earlier than Briggs, Granger, and Traverse. Several tests designed to measure levels of FHB resistance have revealed that, when released as a variety, SD3851 will be

our most resistant. Loaf volume of SD3851 over the years 2006-2007 was 181.3 cm<sup>3</sup> which was statistically similar to Alsen, (184.7 cm<sup>3</sup>) our high end-use quality comparison variety. Information supporting SD3851 has been presented to the variety review and release committee.

Permission was granted to increase seed with the intent to release SD3851 as a variety in 2007. Unfortunately, difficulties arose at the winter increase site in CA, and only a small amount of breeder seed (approx 100 lbs) was available to begin the increase process again in SD during 2007. Two to three hundred acres of SD3851 Foundation seed will be grown in SD during 2008. Additionally, a portion of seed produced from 2007 increase plots will be provided for Wheat Quality Council evaluation in 2008. SD3851 should be made available to Registered seed producers prior to the 2009 production season.

### **SD3948**

SD3948 is an F4 line derivation from the cross SD3367/FN1500-118. It was first placed in the AYT during 2006. Over the years 2006-2007, SD3948 averaged 45.67 bushels per acre, which was nearly identical to Briggs (45.78 bu/ac). Over the same period, its test weight and protein concentration (59.65 lb/bu and 14.97 percent) were statistically similar to those of Briggs (58.54 lb/bu and 15.37 percent). It is less than one inch taller than Briggs, and has a heading date that is approximately one day earlier. Loaf volume of SD3948 over the years 2006-2007 was 187.0 cm<sup>3</sup> which was statistically similar to Alsen, (184.7 cm<sup>3</sup>) our high end-use quality comparison variety. Information supporting SD3948 has been presented to the variety review and release committee. Permission was granted to increase seed with the intent to release as a variety as early as 2010.

### **High Yield-Low Quality (HYLQ) Variety Development**

In recent years, interest in the creation of highly productive wheat varieties, with little regard for quality, has increased. This is viewed as a means of potentially providing wheat growers the opportunity to participate in nationwide expansion of biofuel production without necessarily decreasing wheat production. Whether this plan comes to fruition remains to be seen, though in 2006, the Minnesota Wheat Research and Promotion Council sponsored what is called the “High Yield Trial” that was sown at two locations in MN, ND, and SD.

Our program contributed three experimental lines to the test (SD3623, SD3868, and SD3870). Results are presented visually with Figure 2. We have contributed 8 experimental lines to the 2007 and 2008 versions of the High Yield Trial. Additionally, this trial was sown at three locations in SD during 2007 and 2008. What remains unknown, and will be interesting from the standpoint of quantitative genetics, is whether grain yield will be easily increased further through the creation of segregating populations by using only HYLQ parents. This endeavor is in its infancy.

Table 1. –Performance data for 24 spring wheat entries tested at 8 locations over a 2 year period (16 environments in 2006 – 2007) in Advanced Yield Trials.

LSD Grouping*			Entry	Grain Yield (Bu/Ac)	Test Weight (Lb/Bu)	Protein Conc. (%)	Head Date (D>6/1)	Plant Height (in)	FHB Dis (%)	FDK (%)	Loaf Volume (ccm <sup>3</sup> )								
A			SD3943	49.95	59.26	14.01	18.64	35.66	20.66	2.33	173.83								
A			SD3944	49.45	58.95	14.44	18.72	37.10	19.66	2.33	170.67								
A	B		SD3942	48.76	58.77	14.01	18.36	34.40	16.15	2.33	172.00								
	B	C	TRAVERSE	47.25	55.92	14.08	19.92	38.73	30.52	51.67	162.67								
	B	C	D	SD3868	47.17	56.95	14.18	18.89	37.77	25.99	177.83								
	B	C	D	STEELE-ND	46.95	58.58	15.25	21.00	37.69	35.83	11.67	198.00							
		C	D	E	GRANGER	46.17	58.61	14.80	20.67	39.90	32.17	182.17							
		C	D	E	SD3983	46.06	58.51	14.31	20.00	37.18	36.59	3.67	188.50						
		C	D	E	BRIGGS	45.78	58.54	15.37	18.89	36.27	27.46	4.33	180.50						
		C	D	E	SD3948	45.67	59.65	14.97	17.81	36.79	24.98	3.67	187.00						
		C	D	E	SD3927	45.53	58.78	14.29	23.11	36.28	37.78	8.33	183.83						
			D	E	F	SD3965	45.07	57.82	14.19	19.26	38.30	27.77	4.33	174.17					
				E	F	SD3997	44.68	58.99	15.15	19.56	40.20	27.54	8.67	195.33					
				E	F	SD3870	44.41	58.58	15.20	19.47	39.55	30.17	4.33	185.00					
				E	F	G	KNUDSON	44.13	58.10	15.38	18.83	36.07	27.23	3.67	187.00				
					F	G	H	SD3851	43.31	59.85	14.93	17.14	36.61	5.54	2.33	181.83			
					F	G	H	I	SD3976	43.20	60.02	15.74	18.92	36.84	19.71	6.00	177.50		
						G	H	I	J	SD3956	42.21	59.35	14.76	18.06	36.64	25.33	4.33	178.83	
							H	I	J	K	RUSS	41.61	56.67	14.47	20.58	38.29	34.83	7.33	182.33
								I	J	K	WALWORTH	41.11	57.11	14.86	19.71	36.32	30.70	3.00	189.00
									J	K	KELBY	40.35	58.18	15.68	20.42	30.42	41.96	12.33	195.13
										K	OXEN	39.98	56.01	14.59	20.11	34.05	42.73	16.67	180.00
			L	ALSEN	36.28	57.28	15.64	21.92	35.16	28.61	15.00	184.67							
			L	REEDER	35.95	55.78	14.67	22.69	35.34	38.83	16.67	179.67							
Average				44.21	58.18	14.79	19.69	36.73	28.70	8.81	181.98								
CV				8.27	2.12	3.70	7.44	5.69	29.86	115.90	4.52								
LSD (0.05)				2.12	0.55	0.62	0.73	1.72	10.41	13.56	11.25								

\* = Entries demarcated with the same letter are statistically similar (in terms of yield).

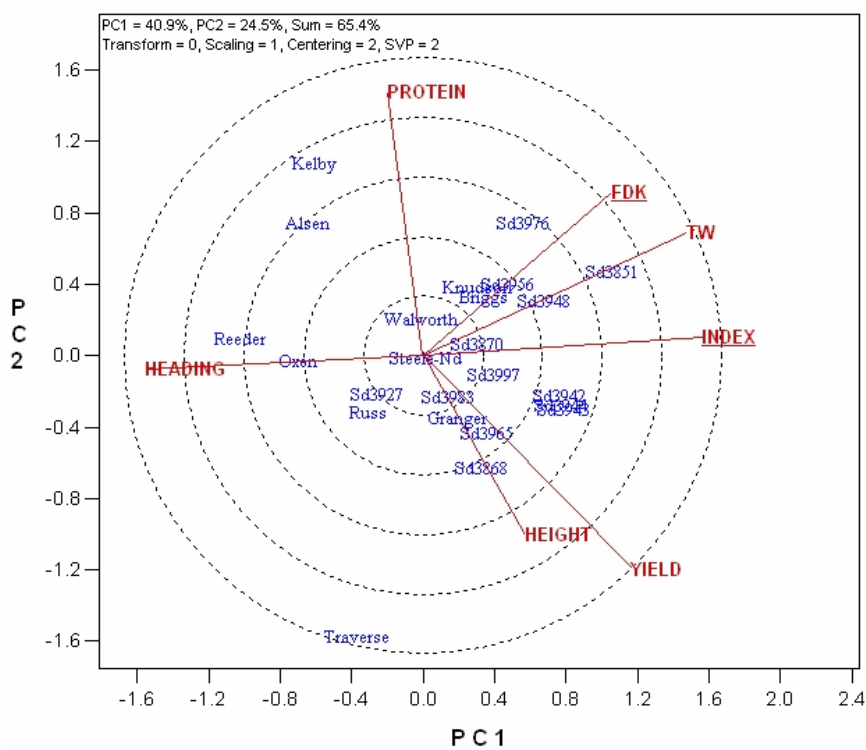


Figure 1. Genotype by trait biplot of agronomic performance data for 24 spring wheat entries tested at 8 locations over a 2-year period (16 environments in 2006 – 2007) in Advanced Yield Trials.

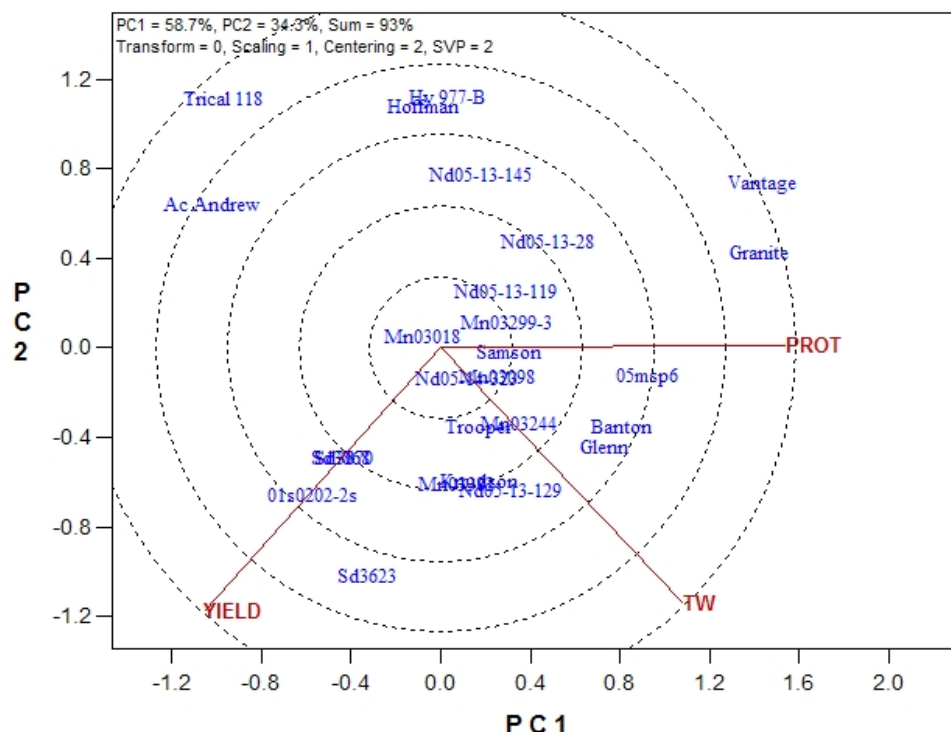


Figure 2. Genotype by trait biplot of performance data for entries tested at 6 locations in 2006 High Yield Trial. (NOTE – SD3868 and SD3870 cover each other slightly above 01S0202-2S)