

A motion to release 'CAP400' for District 1 where the orange wheat blossom midge is a problem as a public variety with PVP Title V protection..

A motion to name CAP400 'Creston'.

CAP400 was developed in response to identification of the orange wheat blossom midge (OWBM) as a serious yield and quality-reducing pest of spring wheat in the Flathead Valley. The source of resistance is a single gene, referred to as *Sm1*, which causes mortality of the young larvae feeding on developing seed.

CAP400 has the pedigree (McNeal*5/Glupro)*2//CAP19/Choteau. Glupro was developed by North Dakota State University, and contains a chromosome segment from the wheat relative *Triticum dicoccoides*. The segment contains a gene for high protein Gpc-B1 and a gene for stripe rust resistance Yr36. CAP19 (Reeder/BW-277) was developed by North Dakota University and contains the *Sm1* gene for OWBM resistance. CAP400 has Gpc-B1, Yr36, and *Sm1*.

The release of CAP400 is supported by two years of data from the Advanced Yield Trial (AYT) grown across the state, additional trials grown at the Northwestern Agricultural Experiment Station near Kalispell, and by data from the Cereal Quality Lab. Yield performance over locations for the 2012 AYT (Table 1) shows CAP400 to be at or below the mean nursery performance for most environments. However, CAP400 was the highest yielding line grown at Northwestern Agricultural Research Center near Kalispell. The 2012 nursery was not treated with insecticide to control OWBM. The agronomic summary for 2012 (Table 2) shows that CAP400 has moderate test weight and acceptable height and heading date. Grain protein for CAP400 was among the highest in the nursery. Grain yield over all sites in 2013 (Table 3) was typically average or below for CAP400, except at Kalispell where it was one of the highest-yielding lines. Other lines performed similarly to CAP400 in 2013, likely because the 2013 nursery was treated with Lorsban to control the OWBM. Agronomic data summarized across all sites in 2013 (Table 4) shows that CAP400 had acceptable test weight, heading date and height, and was higher than other lines for grain protein.

Data from additional nurseries grown at the Northwestern Agricultural Experiment Station are found in Tables 5 and 6. These experiments were split plots with both treated and untreated plots. Treated plots were sprayed with recommended rates of the insecticide Lorsban. All of the lines designated 'CAP' contain the *Sm1* gene for OWBM resistance. CAP400 had several positive characteristics for the Flathead Valley in 2012 (Table 5). Most importantly, the number of surviving OWBM was zero in both treated and untreated plots. Stripe rust resistance was superior to the other lines. CAP400 also had the highest grain yield of all varieties in both the treated and untreated plots. Results were similar in 2013, as CAP400 had zero surviving OWBM, the lowest incidence of stripe rust, the highest grain yield, and the highest grain protein. In 2013,

CAP400 and the leading variety for the area, Solano, had similar yield potential even after insecticide treatment.

Data from the Montana Cereal Quality Lab for four sites in 2012 is shown in Table 7. CAP400 has significantly higher grain protein than the check varieties. This translates into very strong gluten and excellent end-use quality for all measured traits.

As a footnote, there is serious concern that the OWBM may overcome the resistance imparted by the *Sm1* gene. To slow down resistance development, this variety should only be planted in a blend, with 10% of the seed being from a non-resistant variety. This strategy is currently used in other regions of the world with varieties containing *Sm1*. The variety Duclair may serve as a potential susceptible blend component for CAP400 as its white chaff would contrast with the dark chaff of CAP400 to enable monitoring the blends.

Table 1. 2012 GRAIN YIELD (BU/AC) SUMMARY FOR THE ADVANCED SPRING WHEAT NURSERY GROWN ACROSS MONTANA

PEDIGREE	HAVRE RAINFED	SIDNEY RAINFED	SIDNEY IRR	MOCCASIN RAINFED	HUNTLEY RAINFED	CONRAD RAINFED	BOZEMAN RAINFED	BOZEMAN IRR
CAP400	31.5	34.9	48.2	25.4*	53.3	71.5	51.9	92.5*
THATCHER	27.1	26.7	53.3	16.6	42.5	57.9	46.6	71.6
FORTUNA	32.7	36.5	50.3	21.6	52.4	62.6	46.1	60.1
MT1172	35.3*	43.0*	71.6*	26.1*	62.6*	76.9	60.1	86.4
REEDER	31.4	41.3*	71.2*	24.4	61.5*	74.2	55.4	82.8
MCNEAL	33.2	35.8	67.8	23.9	55.2	74.5	54.4	89.8*
CHOTEAU	30.5	37.3	56.3	18.9	54.1	75.0	54.2	97.2*
VIDA	35.4*	40.0*	66.8	24.2	60.0*	79.9*	64.7*	91.9*
DUCLAIR	33.9	39.8*	60.7	21.8	61.7*	74.3	55.4	91.5*
SITE MEAN *****	32.6	36.6	60.9	22.6	57.2	75.4	55.7	91.1
C.V.	6.2	8.5	16.3	14.1	7.3	5.9	6.1	9.4
F-VALUE (ENTRY)	4.54**	4.03**	2.79**	2.45**	2.62**	3.06**	4.37**	2.38**
LSD (.05)	4.21	5.29	16.35	5.37	7.03	7.56	5.81	14.55
PEDIGREE	AVG ¹	KALISPELL RAINFED						
CAP400	51.2	84.3*						
THATCHER	42.8	27.6						
FORTUNA	45.3	59.1						
MT1172	57.7*	77.2						
REEDER	55.3	63.7						
MCNEAL	54.3	56.4						
CHOTEAU	52.9	43.1						
VIDA	57.9*	53.4						
DUCLAIR	54.9	57.0						
SITE MEAN *****	54.0	51.1						
C.V.	9.2	9.8						
F-VALUE (ENTRY)	3.59**	22.36**						
LSD (.05)	4.86	8.43						

Table 2. Agronomic Summary Over All Locations 2012 Advanced Yield Trial

PEDIGREE	Yield (bu/ac)	Test wt (lb/bu)	Headdate	Pl. Ht. (In)	Protein (%)
CAP400	51.2	57.7	177.0	29.6	15.5
THATCHER	42.8	55.2	178.3	<u>37.5</u>	14.8
FORTUNA	45.3	59.2	175.9	34.9	14.7
MT1172	57.7*	57.7	177.0	29.2	14.4
REEDER	55.3	59.0	176.0	30.4	14.9
MCNEAL	54.3	57.6	176.5	30.6	14.8
CHOTEAU	52.9	58.2	175.8	28.7	14.8
VIDA	57.9*	58.2	176.3	29.9	14.3
DUCLAIR	54.9	57.4	174.4*	29.8	14.5
SITE MEAN *****	54.0	58.5	175.7	29.2	14.7
C.V.	9.2	1.6	0.5	4.4	3.99
F-VALUE (ENTRY)	3.59**	11.22**	16.16**	17.84**	5.96**
LSD (.05)	4.86	0.91	0.85	1.26	0.58

Table 3. 2013 GRAIN YIELD (BU/AC) SUMMARY FOR THE ADVANCED SPRING WHEAT NURSERY GROWN ACROSS MONTANA

ENTRY	ID	HAVRE	MOCCASIN	HUNTLY	CONRAD	BOZEMAN	KALISPELL	AVG	RANK
1	THATCHER	44.9	33.9	34.2	66.5	35.8	68.5	47.3	64
2	FORTUNA	49.3	39.2	43	74.5	48.6	88.3	57.1	61
3	MCNEAL	53	43.2	49.9	83.3	46.3	107.6	63.9	31
4	REEDER	62.7	41.1	45	77.1	49.5	102.6	63	39
5	CHOTEAU	53.9	43.4	48.7	74.4	45.8	106.7	62.2	46
6	VIDA	67.2	52.4	51.4	79.6	46.8	109.6	67.8	6
7	DUCLAIR	61.7	48.9	49.9	74.4	51.2	112.8	66.5	14
25	MT 1172	62.6	53	49.5	83.7	50.7	105.5	67.5	10
31	CAP400-1	55.6	38.6	42.3	72.3	52.3	111.6	62.1	47
	MEAN	59.3	44.8	47.2	74.3	49.4	106.2	63.6	
	C.V.	7.7	12	6.9	13.6	14.6	5.2	9.2	
	F-								
	VALUE(ENTRY)	4.95***	1.62*	5.85***	1.35NS	1.56*	11.32***	2.51***	
	LSD(0.05)	7.4	8.7	5.2	16.4	11.6	8.9	6.7	

Table 4. Agronomic Summary Over All Locations 2013 Advanced Yield Trial

ID	YIELD (BU/AC)	TEST WEIGHT (LB/BU)	HEADING DATE (DAYS FROM JAN.1)	PLANT HEIGHT (IN.)	PROTEIN (%)
THATCHER	47.3	58.6	180.8	<u>40.7</u>	14.7
FORTUNA	57.1	60.9	178.6	38.3	14.4
MCNEAL	63.9	59.8	179.5	32.6	14.2
REEDER	63.0	60.7	178.6	32.5	14.4
CHOTEAU	62.2	59.8	179.1	31.0	14.2
VIDA	67.8	59.6	179.6	32.4	13.4
DUCLAIR	66.5	59.1	177.2	31.4	13.9
MT 1172	67.5	59.4	179.3	31.0	13.7
CAP400-1	62.1	59.6	179.9	31.4	15.3
MEAN	63.6	60.1	178.7	31.3	14.1
C.V.	9.2	1.5	0.6	3.3	3.3
F- VALUE(ENTRY)	2.51***	8.30***	7.66***	17.76***	7.36***
LSD(0.05)	6.7	1.0	1.1	1.4	0.5

Table 5. Effect of genetic resistance and insecticide application on OWBM, 2012.

Cultivar	SR %	Height inch	Lodging %	Yield bu/A	Protein %	TWT lb/bu	TKW g	FN sec	OWBM no./spk
Treated									
CAP34-1	89	32	11	58	12.4	62	30	353	0
CAP84-1	62	32	0	59	14.0	61	32	335	0
CAP84-2	60	33	4	58	14.1	61	32	363	0
CAP108-3	53	32	14	67	14.0	61	33	362	0
CAP197-3	65	35	31	61	12.3	60	31	345	0
CAP201-2	64	33	2	61	13.4	62	33	330	0
CAP219-3	68	34	5	56	13.0	61	31	323	0
CAP400-1	11	35	0	75	16.3	59	33	380	0
MQTL 1075	40	35	57	51	16.1	58	37	183	34
MQTL 1076	33	36	61	47	16.6	59	34	219	41
MQTL 3042	59	36	5	54	14.8	60	38	253	17
MQTL 3043	72	36	2	50	15.2	60	35	226	26
REEDER	33	37	16	56	15.5	61	36	251	18
HANK	97	31	0	44	13.3	57	39	323	10
Nontreated									
CAP34-1	81	31	0	49	14.0	60	29	333	0
CAP84-1	68	32	0	41	15.5	59	29	320	1
CAP84-2	66	32	0	42	15.5	60	30	328	0
CAP108-3	49	31	0	51	15.1	59	31	338	0
CAP197-3	69	32	0	51	13.1	60	28	350	0
CAP201-2	72	32	0	46	14.1	60	29	303	0
CAP219-3	81	31	0	42	13.7	60	29	301	0
CAP400-1	18	33	0	52	17.8	56	27	326	0
MQTL 1075	38	34	0	20	17.6	55	33	86	54
MQTL 1076	37	35	22	25	17.8	56	30	174	51
MQTL 3042	77	35	0	27	16.4	58	37	176	34
MQTL 3043	81	34	0	20	17.4	57	33	119	65
REEDER	34	34	0	34	16.7	59	34	180	46
HANK	99	29	0	15	16.1	52	35	193	102
Mean	60	33	8	47	15.1	59	32	278	18
CV	15.31	3.83	208.39	14.69	2.30	1.26	4.04	11.70	91.88
LSD (P=.05)	15.0	2.1	28.0	11.2	0.57	1.2	2.1	53	27
Pr>F	0.0001	0.0001	0.0010	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

SR: stripe rust, TWT: test weight, TKW: thousand kernel weight,

FN: falling number, OWBM: orange wheat blossom midge.

Table 6. Effect of genetic resistance and insecticide application on OWBM control – 2013

Treatment	SR %	HD Julian	HT in	LOD %	OWBM no/spk	YLD bu/A	PRO %	TWT lb/bu	TKW g	FN sec
Treated										
CAP 34-1	36.7	182	33.7	0.0	0.0	88.4	13.4	61.4	32.9	324.8
CAP 84-1	35.0	181	37.0	0.0	0.0	80.4	14.6	60.9	33.2	353.0
CAP 84-2	31.7	180	34.5	0.0	0.0	82.3	14.3	61.0	34.4	347.3
CAP 108-3	20.0	182	34.1	0.0	0.0	94.8	14.4	61.4	35.9	349.3
CAP 151-3	18.3	180	31.6	0.0	0.0	87.3	15.0	62.2	32.5	380.0
CAP 197-3	25.0	183	38.3	3.3	0.0	88.7	13.6	60.1	31.6	333.7
CAP 201-2	26.7	181	36.6	0.0	0.0	84.6	14.6	61.2	33.1	317.1
CAP 219-3	40.0	181	35.3	0.0	0.3	82.9	13.8	61.3	33.1	337.3
CAP 400-1	5.0	182	37.5	0.0	0.0	99.2	17.0	61.4	34.6	420.5
MQTL 1075	21.7	182	36.5	15.0	4.0	86.4	16.0	60.1	39.4	332.0
MQTL 1076	16.7	183	37.7	55.0	4.3	88.2	16.1	59.8	36.4	365.5
MQTL 3042	28.3	181	38.1	0.3	3.0	94.2	14.3	61.6	38.5	353.9
MQTL 3043	30.0	181	37.3	0.0	4.7	89.9	15.2	61.7	37.9	355.0
REEDER	7.3	182	39.3	0.0	0.3	87.0	15.0	61.6	36.7	368.9
HANK	48.3	180	33.6	0.0	5.7	75.7	13.4	58.9	39.4	272.8
SOLANO	7.3	184	31.0	0.0	4.0	97.1	15.9	61.3	39.7	311.7
Nontreated										
CAP 34-1	40.0	182	33.0	0.0	0.0	81.7	13.5	60.5	32.4	335.9
CAP 84-1	40.0	181	36.2	0.0	0.0	73.3	14.8	60.1	32.2	347.9
CAP 84-2	30.0	181	36.1	0.0	0.3	71.4	14.8	60.5	32.5	347.6
CAP 108-3	25.0	182	35.0	0.0	0.0	86.4	14.9	60.6	34.0	357.2
CAP 151-3	23.3	180	32.3	0.0	0.0	77.4	15.4	61.5	31.2	362.2
CAP 197-3	20.0	184	38.1	4.3	0.0	87.8	13.7	60.0	30.6	328.7
CAP 201-2	26.7	182	36.9	0.0	0.0	83.3	14.9	60.4	31.9	321.5
CAP 219-3	35.0	181	35.6	0.0	0.0	76.7	14.0	60.3	31.7	318.8
CAP 400-1	4.3	184	37.3	0.0	0.0	90.8	16.9	60.8	33.8	408.0
MQTL 1075	21.0	183	35.3	1.7	13.0	66.7	16.6	58.9	39.1	294.5
MQTL 1076	16.0	184	38.9	50.0	7.7	78.5	16.3	59.2	34.9	365.5
MQTL 3042	33.3	181	37.5	0.0	11.0	74.3	15.3	60.5	38.9	347.7
MQTL 3043	26.7	181	37.4	0.0	9.7	69.9	16.3	60.5	38.4	317.8
REEDER	11.7	182	39.0	0.0	7.0	79.2	15.7	61.1	37.4	347.8
HANK	83.3	180	33.6	0.0	27.0	59.1	14.7	57.7	39.1	272.4
SOLANO	5.0	184	31.6	0.0	18.3	83.0	16.5	60.1	38.8	310.8
Mean	26.2	181.8	35.8	4.1	3.8	82.7	15.0	60.6	35.2	340.9
CV	33.2	0.4	3.9	140.1	74.4	5.7	1.4	0.6	1.9	3.6
LSD	14.2	1.1	2.3	9.3	4.6	7.7	0.3	0.6	1.1	20.0
Pr>F	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

SR: stripe rust, HD: heading HT: height, LOD: lodging, OWBM: orange wheat blossom midge, YLD: Yield, PRO: protein, TWT: test weight, TKW: thousand kernel weight, FN: falling number

Table 7. Cereal Quality data for 2012 for Four Advanced Yield Trial Locations

	Wheat Protein, % (12% m.b.)	Single Kernel Hardness	Flour Yield, %	Flour Protein, %	Flour Ash, %	Wheat Ash, %	Mixing Tolerance	Mixing Time, min
THATCHER	16.125	81.75	61.825	14.15	0.4025	1.7475	4.75	4.375
FORTUNA	15.825	75.25	59.25	14.25	0.435	1.6625	3.75	4.1
MCNEAL	16.225	95.5	56.1	14.725	0.44	1.7	6	7.425
REEDER	15.85	79.25	63.05	14.125	0.3775	1.595	3.5	3.975
CHOTEAU	16.125	77.5	63.25	14.45	0.39	1.66	4.75	4.425
VIDA	15.625	84.75	66.1	13.85	0.3875	1.54	3.25	4.15
DUCLAIR	15.875	73.25	62.025	14	0.3975	1.635	4.75	5.8
CAP400	17.1	86.75	62.225	14.925	0.395	1.79	6.5	9.6
MT1172	15.2	77.75	64.6	13.425	0.385	1.595	3.25	3.35
LSD (0.05)	0.76	5.1	3.2	0.65	0.02	0.11	1.1	1.4

	Mixing Water Absorption, %	Bake Mixing Time, min	Bake Water Absorption, %	Loaf Volume	Crumb Grain Score
THATCHER	65.35	7.575	75.3	1217.5	8
FORTUNA	65.5	6.8	75.7333	1195	7.66667
MCNEAL	68.075	11.7	78.5667	1310	8
REEDER	65.325	5.775	74.65	1217.5	7.25
CHOTEAU	65.975	6.225	75.675	1216.25	6.5
VIDA	65.25	5.725	74.825	1170	6.75
DUCLAIR	65.275	8.425	75.1	1258.75	7.25
CAP400	68.575	15.9	79.775	1258.75	7.5
MT1172	64.4	3.675	71.975	1101.25	6.75
LSD (0.05)	1.92	2.5	1.97	56	1.1