Request for Release of 'Windham' Winter Feed Pea

Date: January 2006

Development Team: K.E. McPhee, C. Chen, D. Wichman and F.J. Muehlbauer

Team Members/Agencies Cooperating in Development Work:

USDA-Agricultural Research Service
Washington State University
Montana State University

Identification:

1. Market Class: Winter feed pea
2. Selection Number: PS9830S358 (Cross number: X93P060)
3. Proposed Name: 'Windham'
4. Pedigree: CAH-61/D258-1-3//CAH-61/B686-320-0/3/D258-1-2

General Situation:

1. Unique cultivar characteristics

   The unique characteristic of PS9830S358 is its winter growth habit. It has sufficient winter hardiness to survive moderately severe winter temperatures commonly experienced in the Palouse region of eastern Washington, northeastern Oregon and northern Idaho. Evaluations in Montana and Wyoming show that PS9830S358 has sufficient winter hardiness to survive most winters in colder and more harsh environments compared to the Palouse.

2. Need for cultivar

   Dry pea production has expanded to over 308,000 hectares across the northern tier states of the US with production in 2005 reaching 626,550 Mt. Current production is predominantly based on spring sown cultivars. Pea has been maintained in crop rotations for its invaluable role in allowing growers the opportunity to control cereal disease, control grassy weeds and improve soil nutritional status. Despite their vital role, yield of traditional spring sown peas are marginally profitable and are highly variable due to environmental fluctuations. Fall sown peas have shown potential to increase yield from 50% to as much as 100% over spring types, depending on annual weather cycles.

   Traditional tillage practices for spring pea crops leave soils vulnerable to erosion. Fall sowing winter legumes will require some form of reduced tillage or ideally direct seeding to be practiced since the young seedlings are small and unable to hold soil in place during winter rain events and spring snow melt. Availability of

a winter hardy pea that can be fall-sown directly into standing stubble will provide a more sustainable crop management option for producers. Direct seeding will have the added benefits of snow retention and conservation of precipitation as well as protection of the small seedlings from harsh winter conditions such as cold, desiccating winds.

The high yield potential of PS9830S358 and its potential for multiple end use products such as dry seed, forage, green manure, etc., coupled with the agronomic benefits of fall planting and direct harvest provide significant merit to the release of this breeding line.

3. Variety to supplant

PS9830S358 has performed with greater yield and adaptation than Specter in the intermountain regions of Montana and has been specifically requested for release in this area. In addition, PS9830S358 is intended to complement the recent release of 'Specter', a long vine cultivar, with a cultivar having a semi-dwarf plant habit.

Performance Evaluations:

PS9830S358 has been evaluated in the USDA-ARS Advanced and/or Preliminary Winter Pea Yield Trials (1999-2002 and 2004-2005) and has demonstrated excellent winter hardiness and high yield potential (Tables 1-5). PS9830S358 received a winter hardiness score of 9 on a 0-10 scale (0 = no survival; 10 = 100% survival) at Pullman in 2004 where differential killing was observed and had 98% winter survival at Torrington, WY, in 2004 (Table 6). In addition, PS9830S358 has been evaluated in regional yield trials in Montana, Wyoming, South Dakota and Oregon where it showed excellent agronomic performance and high yield potential. PS9830S358 was evaluated in direct seeding trials in Montana, Idaho and Washington and performed very well under these conditions. Advanced winter pea yield trials were grown at Pullman, WA in 2000 and 2001. Two additional locations near Rosalia, WA and Genesee, ID were added in 2002-2005. Due to dry conditions and poor stand establishment all three sites in 2003 were abandoned. Data from the Pacific Northwest trials showed that PS9830S358 exceeded the mean of the trials by 17% and in Montana PS9830S358 exceeded the mean of the trials by 43%. Across all head-to-head comparisons PS9830S358 exceeded the yield of Specter by 12%.

The primary need for this release is to provide a semi-dwarf, white-flowered winter feed pea cultivar adapted to Montana production regions. This release will also provide an additional semi-dwarf cultivar for the PNW to complement the release of Specter, a long-vine cultivar, and allow producers to select a cultivar with appropriate agronomic traits specific for their farm. The ability of this breeding line to survive harsh winter conditions provides producers with a viable alternative to spring sown legumes with increased yield potential compared to spring varieties. The long vine length and early spring plant growth make this cultivar an excellent choice for forage

production as well. The semi-leafless morphology will reduce the incidence of foliar diseases such as Sclerotinia white mold and the Ascochyta complex of foliar diseases.

Other Agronomic Traits:

1. Flowering Date: PS9830S358 flowers at the 18th node and approximately 21 days earlier than traditional spring varieties.
2. Plant Height: PS9830S358 has a semi-dwarf plant stature and an average vine length of 78 cm, but an average plant height index (canopy height at maturity/total vine length) of 0.45. A value of 1.00 indicates perfectly erect plant habit.
3. Seed Size: 100-seed weight averages 15.0 gm.
4. End-use Quality: Seed of PS9830S358 is expected to be limited to animal feed and green manure or forage production. Presence of "ghost mottling" in the seed coat coupled with relatively small seed size and dull hue of the yellow cotyledon make it unsuitable for human food markets, although it could be used to make split yellow peas. Seed integrity and agronomic quality overall is acceptable and hard seed content is typically less than 1.0%.
5. Disease Resistance: PS9830S358 is resistant to Fusarium wilt race 1.
6. Weaknesses: The primary weakness of PS9830S358 is the lack of resistance to pea enation mosaic virus and powdery mildew; however, the early maturity of PS9830S358 due to the winter growth habit should enable the variety to escape infection by these pathogens in most years. In addition, seed quality is unsatisfactory for traditional human food markets, but is suitable for animal feed.

Seed source, Status and Availability:

Two hundred single plants were selected from a strip increase of PS9830S358 grown in the 2004 crop year at the WSU Spillman Research Farm, Pullman, WA. Seed harvested from these plants was sown as microplots in the field for the 2005 crop year as the initial increase of breeder seed. Seed from the microplots which is true to type and uniform was bulked and sown 0.25ac in September 2005 for the 2006 crop year. It is expected that 500 pounds of seed from this increase will be available as breeder seed for further increase to foundation seed during the 2007 crop year.

Probable date for release:

Spring 2006

Provisions for PVP:

Plant Variety Protection will only be pursued for PS9830S358 at the request of the industry.

Table 1. Seed yield summary for Specter from 1999 through 2005 in the winter hardy feed pea advanced and preliminary yield trials grown in Washington, Idaho, Wyoming, South Dakota and Montana. * Data for Specter at Pullman in 2000 is from an adjacent nursery grown at the same location.

Location	Year	PS9830S358 kg/ha	'Specter' kg/ha	'Whistler' kg/ha	Trial Mean kg/ha
Pullman, WA	1999	343	640		369
Pullman, WA	2000	4331	4505*		3859
Pullman, WA	2001	2280	2332		2215
Pullman, WA	2002	2438	1918		1921
Genesee, ID	2002	3844	3460		3353
Wall, SD	2003	1550	1320		1348
Torrington, WY	2003	4188	4511		3497
Pullman, WA	2004	3564	3467		3419
Genesee, ID	2004	3443	2725		2914
Rosalia, WA	2004	2156	1901		1881
Kalispell, MT	2004	3058	1818		2051
Moccasin, MT	2004	2658	1854		1956
Pendleton, OR	2004	3213	3525		1329
Dakota Lakes, SD	2004	2842	2091		2100
Torrington, WY	2004	1019	2821		1752
Pullman, WA	2005	1551	1675	1380	1367
Rosalia, WA	2005	2820	2798	2989	2716
Wall, SD	2005	2023	1476		1707
Moccasin, MT	2005	2681	2079		2201
Amsterdam, MT	2005	2267	1693		1690
Waterville, WA	2005	3480	2610	3318	3007
Wilbur, WA	2005	3806	3780	3998	3589
Pendleton, OR	2005	2479	2274		2079
Moro, OR	2005	356	384		524
Mean	all	2491	2219	2921	2054
Mean (direct)	358 vs. Whistler	2914	2716	2921	2670
PNW		2610	2309		2223
WA		2677	2347		2434
ID		3644	3093		3134
OR		2016	2061		1311
Midwest States		2476	2185		2034
MT		2666	1861		1974

Table 2. Agronomic Data from the Advanced Clear Seed Coat Winter Pea Yield Trial, 2001 (0122F)

Cultivar	Origin	Leaf Type	Plant Type	Seed Type	Disease Fw	Disease Aph	Nodes to Fst Flwr	Pods/ Peduncle	Pod Ht (green) ..cm..	Plant Ht (green) ..cm..	Weight 100 Seed ..g..	Mean Seed Yield ..kg/ha..
YellowCots:												
Melrose	-------	+	+	AWP	+/-	2	21	2	62	106	12.6	2636
PS9830S431	X95P679	+	+	CSC	+/-	3	15	2	53	94	12.8	2525
PS9830F010	X92P056	-	+	CSC	-	3	17	2	65	109	12.9	2396
PS9530726*	X91P241	-	-	CSC	+	3	17	2	24	51	15.5	2340
PS9830F009	X92P056	-	+	CSC	+	3	15	2	66	98	12.6	2332
PS9630448	X92P056	-	+	CSC	+	3	19	2	65	102	13.3	2314
PS9830S358	**X93P060**	**-**	**-**	**CSC**	**+**	**3**	**19**	**2**	**33**	**48**	**15.3**	**2280**
PS9830F035	X91P234	+	-	CSC	+	2	21	2	86	125	16.2	2244
PS9830F011	X92P056	-		CSC	+	3	16	2	26	43	14.8	2243
PS9830S316	X92P028	-	+	CSC	+	3	15	2	49	90	13.0	2153
Granger	-------	-	+	AWP	+	3	19	2	71	105	13.9	2128
PS9430706	X91P091	-	+	CSC	+/-	3	18	2	90	126	13.7	2126
PS9830S329	X92P056	-	+	CSC	+	3	17	2	58	94	12.5	2053
PS9830S523	X92P056	-	+	CSC	+	3	18	2	64	93	12.8	2025
PS9530645	X91P241	-	-	CSC	+	3	20	2	42	54	15.3	1941
PS9830S307	X92P028	-	+	CSC	+	3	19	2	80	121	14.8	1709
Grand Mean							18	2	58	91	13.9	2215
C.V. (%)							13		13	9		15
LSD (α=0.05)							3		10	12		462
Planting Date												9/26/00
Harvest Date												7/25/01

Yield data are means of three replications at the Pullman, WA location.

* Green Cotyledon

Leaf type; + = normal leaf, - = *afila* or semileafless type.
Plant type; + = tall plant type, - = short plant type.

AWP = Austrian Winter Pea Seed Type (purple flowered).
CSC = Clear Seed Coat Winter Pea (white flowered).

Fw = Fusarium wilt race 1; + = resistant, - = susceptible.
Aph = Aphanomyces; 1 = no symptoms, 2 = some symptoms, 3 = moderate symptoms, 4 = severe symptoms, 5 = dead.

Pod height was measured at the green pod stage.
Plant height was measured at the green pod stage.

Table 3. Agronomic and Yield Data from the Advanced Clear Seed Coat Winter Pea Yield Trial, 2002 (0222F)

Cultivar	Origin	Leaf Type	Plant Type	Disease Fw	Nodes to First Flwr	Pods/ Peduncle	Pod Ht (green)	Pod Ht (mature)	Pod Ht Index	Plant Ht (green)	Plant Ht (mature)	Plant Ht Index	Weight 100 Seed	Mean Yield Pullman	Mean Yield Genesee	Seed Yield Mean
							..cm..	..cm..		..cm..	..cm..		..g..	..kg/ha..	..kg/ha..	..kg/ha..
PS9830S358	**X93P060**	**-**	**-**	**+**	**17**	**2**	**35**	**23**	**0.81**	**63**	**48**	**1.00**	**14.6**	**2438**	**3844**	**3141**
PS9830S431	X95P679	+	+	+	16	2	44	10	0.28	106	44	0.51	13.2	2465	3553	3009
PS9830F011	X92P056	-	-	+	17	2	29	27	0.85	60	52	1.00	13.5	2247	3628	2938
PS9630448	X92P056	-	+	+	19	2	64	10	0.18	103	48	0.51	14.8	1920	3926	2923
PS9830F010	X92P056	-	+	+	21	2	62	15	0.23	110	48	0.46	14.2	1660	3757	2709
PS9830F009	X92P056	-	+	+	17	2	55	10	0.15	104	45	0.46	13.5	1918	3460	2689
PS9830S329	X92P056	-	+	+	19	2	58	12	0.18	107	45	0.41	13.3	1886	3465	2676
PS9530645	X91P241	-	-	+	22	3	47	32	0.65	53	53	0.91	13.3	1994	3303	2649
PS9830S316	X92P028	-	+	+	18	2	65	12	0.65	107	46	0.49	13.1	1630	3477	2554
PS9830S307	X92P028	-	+	+	21	2	65	10	0.15	106	44	0.42	15.5	1562	3282	2422
PS9530726*	X91P241	-	-	+	16	2	33	18	0.56	48	38	0.62	14.6	1878	2955	2417
PS9830S523	X92P056	-	+	+	18	2	61	9	0.14	105	42	0.39	13.7	1750	3059	2405
PS9430706	X91P091	-	+	+	23	2	64	11	0.16	130	52	0.31	13.7	1740	2902	2321
PS9830F035	X91P234	+	-	+	21	2	81	10	0.13	109	39	0.26	17.1	1802	2331	2067
Grand Mean					19	2	55	15	0.34	94	46	0.55	14.2	1921	3353	2637
C.V. (%)														8.7	12.1	12.5
LSD (α=0.05)														234	563	317
Planting Date														10/04/01	10/05/01	
Harvest Date														10/29/02	08/19/02	

Leaf type; + = normal leaf, - = *afila* or semileafless type.
Plant type; + = tall plant type, - = short plant type.
* = green cotyledon; remainder are yellow cotyledon.
Fw = Fusarium wilt race 1; + = resistant, - = susceptible.
Pod and plant height were measured at the green pod stage and at harvest maturity.
Pod and plant height indices were determined by dividing the value at harvest maturity by the green pod stage value.
Agronomic data are means of three replications at Pullman, WA.
Yield data are means of three replications at Pullman, WA and Genesee, ID.

Table 4. Location Yield Summary (kg/ha) for the Advanced Winter Dry Pea Yield Trial, 2004 (0422)

Cultivar	Origin	Leaf Type	Plant Type	Genesee	Pullman	Rosalia	Mean Seed Yield
PS9830F011	X92P056	-	-	2843	3767	1965	2866
PS9830S358	**X93P060**	**-**	**-**	**3443**	**3564**	**2156**	**2860**
PS9630448	X92P056	-	+	2874	3803	1712	2757
PS9530726	X91P241	-	-	3656	3603	1846	2724
PS9830F009	X92P056	-	+	2725	3467	1901	2684
PS9830F010	X92P056	-	+	2555	3385	1975	2680
PS9830S431	X95P679	+	+	3560	3115	1769	2442
PS9430706	X91P091	-	+	1655	2651	1725	2188
Grand Mean – Winter Types				2914	3419	1881	2650
SHAWNEE	X84F259	+	+	2085	0	807	404
DELTA		-	-	1774	0	630	315
Grand Mean – Spring Types				1929	0	718	359
Planting Date				9/24/03	9/22/03	9/24/03	
Harvest Date				8/5/04	7/29/04	8/2/04	

Leaf type; + = normal leaf, - = *afila* or semileafless type. Plant type; + = tall plant type, - = short plant type. Yield data are means of three replications at each of the three locations.

Table 5. Agronomic data for the Advanced Witner Dry Pea Yield Trial, 2005 (0522)

Name	Leaf Type	Vine Type	Fw	PM	Nodes to First Flower	Mean Pods per Peduncle	Mean Pod Ht (green)	Mean Pod Ht (Mature)	Mean Pod Ht Index	Mean Plant Ht (green)	Mean Plant Ht (mature)	Mean Plant Ht Index	Mean Repr Nodes	Mean Weight 100 Seed	Mean Seed Yield	Percent of Check
							cm	cm		cm	cm			gm	kg/ha	
PS03100660	+	+	-	+	15	2	57	5	0.09	118	48	0.41	8	12.1	2435	145
PS03100635	-	+	+	+	15	2	51	5	0.10	104	44	0.43	8	12.2	2180	130
PS03101133	+	+	+	+	20	2	75	7	0.09	113	49	0.44	5	14.1	2064	123
PS0230F210	+	+	+	+	14	2	49	7	0.15	100	44	0.44	7	18.3	1755	104
PS0230F063	-	-	+	+	21	3	38	10	0.25	62	58	0.93	6	13.1	1716	102
SPECTER	-	+	+	+	19	2	74	4	0.05	119	64	0.54	8	13.3	1676	100
PS9830S358	**-**	**-**	**+**	**+**	**19**	**2**	**35**	**12**	**0.39**	**63**	**58**	**0.92**	**6**	**14.6**	**1551**	**92**
PS03101146	-	-	+	+	17	2	35	15	0.42	66	57	0.87	7	16	1494	89
WPX91208-3	-	-	+/-	+	22	2	47	14	0.30	71	59	0.84	5	18.2	1490	88
WPX90105-9	-	-	+	+	18	2	41	17	0.43	69	54	0.79	6	17	1380	82
PS0230F092	-	-	+	+	18	3	35	13	0.39	53	45	0.85	4	14	1300	77
PS0230F061	-	-	+	+	20	3	47	15	0.33	80	66	0.84	6	16.7	1269	75
PS03101150	-	-	+	+	17	2	36	17	0.48	71	54	0.77	7	16.8	1234	73
PS03101160	-	-	+	+	18	3	41	11	0.28	66	56	0.86	6	14.6	1070	63
WPX91002-2	-	-	+	+	11	2	21	3	0.12	44	23	0.52	5	17.9	850.4	50
PS0230F075	-	-	+	+	20	3	41	20	0.50	64	53	0.84	7	14.2	751.5	44
PS0230F077	-	-	+	+	17	3	33	16	0.47	65	51	0.79	7	11.2	655.2	39
PS0230F100	-	-	+	+	17	3	44	17	0.40	71	63	0.89	6	14.4	564.5	33
PS9530726	-	-	+	+	19	3	37	11	0.30	53	45	0.85	5	14.2	529.8	31
GRAND MEAN					18	2	44	11	0.29	76	52	0.73	6	15	1367	
CV					10	16	13	34	39	8	8	10	25	7	21	
LSD					3	1	10	7	0.19	11	7	0.12	3	2	474	

Leaf type; + = normal leaf, - = *afila* or semileafless type.
Plant type; + = tall plant type, - = short plant type.
* = green cotyledon; remainder are yellow cotyledon.
Fw = Fusarium wilt race 1; + = resistant, - = susceptible.
Pod and plant height were measured at the green pod stage and at harvest maturity.
Pod and plant height indices were determined by dividing the value at harvest maturity by the green pod stage value.
Agronomic data are means of three replications at Pullman, WA.
Yield data are means of three replications at Pullman, WA and Rosalia, WA.

Table 6. Irrigated Winter Dry Grain Pea Variety Evaluation - U-W Research and Extension Center, Torrington, WY 2003-2004
Data from James Krall and Jerry Nachtman, University of Wyoming

Entry	Yield (lb/A)	Bushel wt (lb/bu)	Winter Survival (%)
PS9830F011	3119	59	88
PS9830F009	2511	60.3	100
PS9830F010	2203	60.6	99
PS9830S431	2190	59.9	95
PS9430706	2067	59.2	100
PS9630448	1740	60.4	100
Delta	966	58.1	20
PS9830S358	**907**	**60.2**	**98**
PS953072	886		86
Shawnee	0		6
Average	1559	59.8	79
DRS 0.05	1052	2.3	15