Dry Pea, Lentil, Chickpea and Winter Legume Breeding

2010 Progress Report

Prepared by

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and

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PROGRESS REPORT: PEA BREEDING

The 2010 Pacific Northwest growing year started with a very wet, cool spring and advanced into a warm very dry summer. There was no significant snow fall during the 2009-2010 winter, consequently soil moisture levels were generally quite low. Overall, yields of the check varieties in the advanced yield trials were the lowest of the past five years. This reflects the lower average yields of growers throughout the Pacific Northwest in 2010. Seed size was typically larger in 2010 than in the previous five years.

SPRING PEA YIELD TRIALS

In 2010, 18 advanced breeding lines and six check varieties of green peas were tested in the advanced yield trials. Identical trials were planted in Pullman, Fairfield and Dayton, Washington and in Kendrick and Genesee, Idaho. The Kendrick trial was lost due to extreme disease pressure (*Aphanomyces* root rot). The Genesee trial suffered severe deer depredation. The mean yields at the four harvested locations were: Pullman: 1706 kg/ha; Fairfield: 1778 kg/ha; Dayton: 1684 kg/ha; and Genesee: 1139 kg/ha. 2010 was the third year of advanced testing for many of the advanced lines and the first year for three of the top ten (i.e. PS07100470, PS07100471 and PS07100474). All the advanced breeding lines and four of the checks had significantly higher yields than did Columbian. Five of the advanced lines significantly out-yielded Banner and 15 out-yielded Aragorn. Yields of the advanced lines ranged from 1349-1876 kg/ha, the average yields of the check cultivars ranged from 1222 kg/ha (Lifter) to 1592 kg/ha (Banner). Seed size of the check cultivars ranged from 15.6 g/100sd (Ariel) to 18.8 g/100sd (Aragorn). Seed size of the advanced breeding lines ranged from 15.3-20.8 g/100sd. The earliest check (Columbian) flowered in 59 days and the earliest breeding line (PS05100632) flowered at 43 days. Aragorn was the earliest check to reach harvest maturity (98 days), PS05100632 was the earliest maturing breeding line (97 days). PS05100632 was also the highest yielding line in the advanced yield trials.

Ten breeding lines and four check varieties were evaluated in the yellow pea advanced yield trials. Identical trials were planted in Pullman, Fairfield and Dayton, Washington and in Kendrick and Genesee, Idaho. As with the green pea trials, the Kendrick trial was lost due to extreme disease pressure (*Aphanomyces* root rot) and the Genesee trial suffered severe deer depredation. The mean yields at the four harvested locations were: Pullman: 1715 kg/ha; Fairfield: 2230 kg/ha; Dayton: 1728 kg/ha; and Genesee: 1203 kg/ha. 2010 was the first year of advanced testing for six of the breeding lines and the fourth and fifth years for the two highest yielding entries (PS04100710 and PS03101822, respectively). Yields of the advanced lines ranged from 1545 kg/ha to 2086 kg/ha, the average yields of the check cultivars ranged from 1568 kg/ha (Delta) to 1942 kg/ha (DS Admiral). Seed size of the check cultivars ranged from 17.6 g/100sd (Carousel) to 19.1 g/100sd (Universal). Seed size of the advanced breeding lines ranged from 17.3-21.9 g/100sd. The earliest check (Universal) and the earliest, retained breeding line (PS03101822) both flowered in 68 days. PS04100710 and PS03101522 as well as the three checks reached harvest maturity in 99 days.

The 2010 preliminary yield trials were planted in Pullman. The green trial consisted of 18 breeding lines and three checks. Four green pea breeding lines had yields significantly greater than the commercial check, Aragorn. Seed weight among the green breeding lines ranged from 13.6 to 20.3 g/100sd. The seed weight of the checks ranged from 17.2 g/100sd (Stirling) to 19.1 g/100sd

(Aragorn). Stirling, the earliest check variety, flowered in 67 days; four breeding lines flowered as early as Stirling. The yellow preliminary yield trial consisted of 23 breeding lines and two checks. Three lines had yields significantly greater than the higher yielding check (Universal). Seed weight among the yellow breeding lines ranged from 17.0 to 23.1 g/100sd. The seed weight of the check varieties was 19.2 g/100sd (Delta) and 19.1g/100sd (Universal). Universal was the first check to flower (68 days), five breeding lines flowered at or before Universal.

The breeding lines were evaluated for resistance to Pea Enation Mosaic Virus in Corvallis, Oregon, for resistance to Fusarium wilt, Race 1 in Pullman, Washington and for tolerance to Aphanomyces root rot intentionally in Athena, Oregon and in LeSueur, Minnesota and unintentionally in Kendrick, Idaho. Breeding lines and segregating families were also screened in pure culture in the greenhouse for tolerance to *Aphanomyces* root rot. Within the segregating families (F_4 to F_6 families), tolerant individuals were selected and transplanted for crossing and generation advance.

Potential product quality of the green pea breeding lines was assessed visually. All entries in the green pea advanced and preliminary yield trials were subjected to a simulated high temperature, high humidity bleach test.

Potential Spring Pea Variety Releases

PS0310445 was identified in 2008 as a potential variety release. It is a semi-leafless spring green breeding line that has been tested in 15 location/years of yield trials. The data in Table 1 provide comparisons of the performance of PS0310445 with Columbian, Aragorn and Banner.

Table 1. Comparison of the performance of PS0310445 with three commercial varieties in 15 location/years.

Entry	FW R1	PM	PEMV	Leaf	Days to Flr	Days to Mat	Vine Lgth (cm)	Plnt Ht (cm)	Sd Wt (g/100sd)	Yield (kg/ha)
PS0310445	R	S	S	af	59	75	66	51	18.7	2050
Columbian	R	S	S	Af	48	76	101	36	18.7	1655
Aragorn	R	S	S	af	57	74	70	58	19.2	1979
Banner	S?	S	S	af	56	74	75	53	17.7	1945

PS05100840 was identified in 2009 as a potential new spring pea variety release. It is semi-leafless and has green cotyledons. It has been evaluated in 12 location/years. Pre-breeder seed was made in 2010. The data in Table 2 provide comparisons of the performance of PS05100840 with Columbian, Aragorn and Banner.

Table 2. Comparison of the performance of PS005100840 with three commercial varieties in 12 location/years.

Entry	FW R1	PM	PEMV	Leaf	Days to Flr	Days to Mat	Vine Lgth (cm)	Plnt Ht (cm)	Sd Wt (g/100sd)	Yield (kg/ha)
PS05100840	R	S	S	af	63	71	69	58	19.0	1950
Columbian	R	S	S	Af	49	74	96	38	18.7	1592
Aragorn	R	S	S	af	58	71	68	58	19.2	1949
Banner	S?	S	S	af	57	71	73	53	17.6	1850

PS03101822 was identified in 2008 as a potential variety release. It is a semi-leafless spring yellow pea breeding line. It has been evaluated in 19 location/years of yield trials. The data in Table 3 provide comparisons of the performance of PS03101822 with Carousel, Universal, DS Admiral and Delta.

Table 3. Comparison of the performance of PS03101822 with four commercial varieties in 19 location/years.

Entry	FW R1	PM	PEMV	Leaf	Days to Flr	Days to Mat	Vine Lgth (cm)	Plnt Ht (cm)	SdWt (g/100sd)	Yield (kg/ha)
PS03101822	R	S	S	af	55	87	58	47	22.3	2282
Carousel	S		S	af	56	90	69	61	21.5	1959
Universal		R	S	af	55	87	67	60	20.5	2125
DS Admiral	S	S	S	af	59	88	71	65	21.0	1856
Delta	R	R	S	af	57	87	59	54	20.2	1861

PS04100710 was identified in 2010 as a potential variety release it is a semi-leafless, yellow cotyledon spring pea. It has been evaluated in 16 location/years of yield trials. We anticipate making pre-breeder seed of it in 2011.

Pre-breeder seed of PS03101445 and PS05100840 was made in summer 2010. It was sent to New Zealand for increase in 2010-2011. Seed will return in March 2011, in time for spring planting and seed increase. We anticipate releasing these two varieties in 2011. Pre-breeder seed of several other varieties in both the green and yellow trials displayed exceptional performance and potential; however, they have been in trials for only 1-2 years and must be evaluated across more location/years.

WINTER PEA YIELD TRIALS

Winter pea advanced yield trials were planted at Garfield, Rosalia and Pullman, Washington. All trials were identical and consisted of 14 advanced breeding lines and three checks. Rosalia was lost to cultivator-driver error, Garfield was lost to winter-kill. Only Pullman was harvested. There were large differences in the dates of maturity of the lines. In previous years, the planting scheme did not allow 'just-in-time' harvesting – all plots were harvested on the same day. Therefore, many of the

early maturing lines shattered and the yields recorded are not reflective of what would have been realized if harvest was timely. In 2009-2010, the early maturing lines were planted in a block with their check, Whistler, and the 'full-season' lines were planted in an adjacent block with their checks, Windham and Specter. None of the early maturing entries survived the winter with appreciable stand counts and were not harvested. Yields of the retained full-season breeding lines ranged from 1079 – 2706 kg/ha. Yields of the checks were Windham: 2730 kg/ha and Specter: 2004 kg/ha. Windham was the highest yielding entry in the trial; however, three experimental lines had statistically equivalent yields.

Potential Winter Pea Variety Releases

PS03101269 has consistently performed well in the Palouse yield trials. Although it is a strong performer in the Palouse, it has not performed particularly well on the Waterville Plateau. It will not be recommended for that area. PS03101239 has long internodes, is semi-leafless and has green, food quality seeds. Data collected over five years are presented in Table 4. Issues with winter kill and cultivator operator error have resulted in limited location/year data. Breeder's seed was be made in 2010 and is being increased in New Zealand 2010-2011. We anticipate transferring breeder seed to the Washington Crop Improvement Association in March 2011.

Table 4. Performance of winter pea PS03101269 (2007-2010).

Entry	FW R1	PM	PEMV	Leaf	Coty Color	SdWt (g/100sd)	Yield (kg/ha)
PS03101269	R		S	af	Green	15.2	2237
Windham	R	R	S	af	Yellow	14.9	2068
Specter	R	R	S	af	Yellow	13.7	1394
Whistler	R	R	S	af	Yellow	16.5	1574

PS03101146, PS05300234 and PS05300180 continue to perform very well in Wilbur and on the Waterville Plateau (in trials conducted by the Central Washington Grain Growers) but with limited enthusiasm on the Palouse. We made pre-breeder's seed of these three lines in anticipation of releasing them as varieties with adaptation to a specific area. Characteristics of these three lines are presented in Table 5 (yield data kindly provided by Howard Nelson, (CWGG, Wilbur, Washington).

Table 5. Characteristics of winter pea varieties adapted to Wilbur, Washington.

Entry	FW R1	PM	PEMV	Leaf	Coty Color	SdWt (g/100sd)	Yield (kg/ha)
PS03101146	R		R	af	Green	14.7	2691
PS05300234	R		S	af	Green	22.3	2605
PS09300180	R		S	af	Green	16.8	2512
Windham	R	R	S	af	Yellow	16.4	2813
Specter	R	R	S	af	Yellow	16.2	2436
Whistler	R	R	S	af	Yellow	16.2	2423

OTHER PROGRESS TO REPORT

Mineral Nutrition

A preliminary survey of the diversity of the mineral nutrients in peas was conducted from the 2009 harvest. Seed samples harvested from each entry in the 2009 green and yellow advanced yield trials were analyzed for mineral concentration using inductively-coupled plasma atomic-emission spectroscopy. Concentrations of the macro-nutrients Ca, K, P, Mg and S and the micro-nutrients Co, Cu, Fe, Mn, Se and Zn were determined. Some summary statistics are presented below.

There are location differences in the levels of all macro minerals tested. Seeds from Kendrick consistently had lower levels of minerals than did seeds harvested from either Fairfield or Genesse (Table 6.).

Table 6. Means of macro-mineral concentrations in seeds of pea genotypes grown at three locations 2009. Means followed by different letters are significantly different (p<.01)

	Ca (mg/g DW) Mean(se)	**K (mg/g DW) Mean (se)**	**Mg (mg/g DW) Mean (se)**	**P (mg/g DW) Mean (se)**	**S (mg/g DW) Mean (se)**
Fairfield	1.00 (0.04) a	9.24 (0.08) a	1.28 (0.01) a	3.57 (0.05) a	1.77 (0.03) a
Genesee	0.92 (0.04) ab	9.36 (0.08) a	1.25 (0.02) a	3.11 (0.04) b	1.70 (0.03) ab
Kendrick	0.86 (0.03) b	8.92 (0.09) b	1.12 (0.01) b	2.42 (0.04) c	1.65 (0.03) b

There were differences in the levels of the micro-minerals Mn, Se and Zn at the three locations. Kendrick had the lowest levels of Mn and Se, but the highest levels of Zn (Table 7.)

Table 7. Means of micro-mineral concentrations in seeds of peas grown at three locations in 2009. Means followed by different letters are significantly different (p<.01)

	Co (ug/g DW) Mean(se)	**Cu (ug/g DW) Mean (se)**	**Fe (ug/g DW) Mean (se)**	**Mn (ug/g DW) Mean (se)**	**Se (ug/g DW) Mean (se)**	**Zn (ug/g DW) Mean (se)**
Fairfield	0.04 (0.11) a	6.34 (0.09) a	50.34 (0.76) a	11.85 (0.19) b	0.25 (0.01) a	34.68 (0.54) b
Genesee	0.04 (0.14) a	6.19 (0.10) a	53.64 (0.98) a	13.89 (0.29) a	0.33 (0.02) b	33.23 (0.49) b
Kendrick	0.03 (0.11) a	6.05 (0.09) a	52.48 (1.03) a	9.30 (0.15) c	0.43 (0.02) c	41.65 (1.04) a

Market class of pea (green vs yellow) did not account for significant differences in levels of Ca, P or S, but green peas had significantly higher levels of K and Mg than did yellow peas (Table 8.).

Table 8. Means of macro-mineral concentrations in seeds offspring green vs spring yellow pea genotypes in 2009. Means followed by different letters are significantly different (p<.01)

	Ca (mg/g DW) Mean(se)	**K (mg/g DW) Mean (se)**	**Mg (mg/g DW) Mean (se)**	**P (mg/g DW) Mean (se)**	**S (mg/g DW) Mean (se)**
Green	0.97 (0.03)a	9.29 (0.06) a	1.25 (0.01) a	3.11 (0.07) a	1.72 (0.02) a
Yellow	0.87(0.77) a	9.01 (0.08) b	1.16 (0.01) b	2.91 (0.06) a	1.70 (0.02) a

There were no significant differences in the levels of Fe, Mn, Se or Zn in green vs yellow peas. Yellow peas had higher levels of Co and green peas had higher levels of Cu (Table 9.)

Table 9. Means of micro-mineral concentrations in seeds offspring green vs spring yellow pea genotypes in 2009. Means followed by different letters are significantly different ($p<.01$)

	Co (ug/g DW) Mean(se)	**Cu (ug/g DW) Mean (se)**	**Fe (ug/g DW) Mean (se)**	**Mn (ug/g DW) Mean (se)**	**Se (ug/g DW) Mean (se)**	**Zn (ug/g DW) Mean (se)**
Green	0.09 (0.003) b	6.33 (0.08) a	51.68 (0.73) a	11.66 (0.24) a	0.29 (0.01) a	37.39 (0.08) a
Yellow	0.15 (0.007 a	6.00 (0.07) b	52.86 (0.81) a	11.71 (0.37) a	0.34 (0.02) a	35.31 (0.06) a

The analyses will be repeated with seed harvested from each plot/location of each variety in the 2010 advanced yield trials. This will allow us to determine the relative importance variation due to the genotype, the environment and the genotype-by-environment interaction. Knowing this information will allow us to develop practical approaches to breed successfully for increased mineral nutrient concentrations.

Agronomic Data for the Advanced Green Pea Yield Trial (1001)

Name	FW 1	PM	PEMV	Days to Flower	Days to Maturity	Flower Node	Pods/ Peduncle	Pod Height	Pod Ht Maturity	Pod Ht Index	Vine Length	Canopy Height	Plant Ht Index	# Repr Nodes	100 Seed Weight
								..cm..	..cm..		..cm..	..cm..			..g..
PS05100632	R	R	S	64.00	97.30	10.90	2.00	27.50	24.80	0.91	62.50	45.80	0.73	5.00	18.60
PS07100470	R	R	S	71.00	102.7	15.40	2.00	37.20	28.20	0.76	65.70	40.90	0.62	2.90	19.20
PS06100490	R	S	S	69.70	98.00	13.50	2.00	20.80	13.90	0.67	68.80	30.30	0.44	4.30	19.80
PS07100471	R	R	S	72.00	104.0	14.70	2.00	35.30	26.00	0.72	69.00	39.70	0.57	4.10	18.10
PS05100120	R	R	R	70.30	102.7	14.90	2.00	17.40	14.70	0.84	66.20	34.80	0.53	4.40	16.60
PS05100736	R	R	R	74.00	104.0	13.70	2.00	29.50	23.00	0.76	58.00	35.10	0.60	4.20	18.40
PS07100474	R	S	S	71.00	100.7	15.10	2.00	31.20	22.20	0.71	70.20	31.90	0.45	3.10	42.70
PS06100542	R	R	S	71.00	100.0	15.10	2.00	21.40	19.20	0.90	73.30	33.70	0.46	3.50	18.40
PS05100735	R	R	R	74.00	104.0	14.50	2.00	35.00	22.50	0.64	62.60	42.80	0.68	3.70	18.80
PS06100760	R	R	S	70.70	102.0	15.00	2.00	27.00	18.80	0.71	59.90	31.90	0.54	3.20	17.70
PS04100462	R	R	R	71.70	104.0	13.50	2.00	28.10	18.40	0.67	54.80	33.40	0.62	3.80	19.20
PS03101445	R	R	S	69.70	100.0	14.50	2.00	24.10	19.20	0.79	65.90	32.70	0.50	3.00	17.10
PS05100840	R	R	S	73.00	102.7	16.50	2.00	35.60	30.10	0.84	67.10	40.20	0.60	3.50	17.10
PS07100396	S	R	S	71.30	104.0	15.70	2.00	22.20	12.40	0.56	68.30	23.70	0.35	4.40	15.30
Banner	S	S	S	68.70	98.70	13.10	2.00	22.00	17.00	0.77	66.50	31.50	0.47	3.70	17.60
PRO-081-6118	R	R	S	71.00	98.70	16.60	2.00	21.40	14.70	0.69	68.40	34.40	0.51	3.40	16.80
Ariel	R	S	S	71.00	98.70	14.90	2.00	27.50	23.20	0.84	65.50	42.50	0.65	4.90	15.60
Aragorn	R	S	S	69.70	98.00	14.60	2.00	32.90	24.00	0.72	66.80	38.80	0.58	4.10	18.80
Stirling	R	R	S	68.70	101.3	11.70	2.00	24.30	17.10	0.70	60.40	32.40	0.54	4.40	17.80
PS07100480	R/S	R	S	70.70	104.0	15.20	2.00	28.90	23.90	0.84	75.70	41.90	0.56	4.80	18.50
PS07100170	R	R	S	71.30	104.0	16.10	2.00	37.80	31.00	0.83	71.10	50.20	0.71	3.90	19.40
PS05100522	R	S	S	68.70	98.00	14.20	2.00	29.50	25.30	0.86	73.70	46.30	0.62	4.20	20.80
PS06100617	R	R	S	71.30	104.0	16.00	2.00	31.40	24.80	0.81	72.70	45.90	0.64	4.40	19.20
Columbian L1	R	S	S	59.00	101.7	8.40	1.00	11.30	7.90	0.70	112.5	32.20	0.30	6.50	18.20
Lifter	R	R	R	71.00	104.0	14.50	2.00	13.90	10.50	0.77	70.30	26.00	0.37	4.60	17.80
GRAND MEAN				70.17	101.5	14.34	1.95	26.92	20.52	0.76	68.63	36.75	0.55	4.09	19.09
CV				1.36	1.54	6.39	5.93	16.82	26.38	16.45	8.67	21.09	21.69	19.92	42.98
LSD				1.30	2.13	1.26	0.16	6.20	7.41	0.17	8.14	10.62	0.16	1.11	11.24

FW 1 = Fusarium Wilt Race 1; R = resistant; S = susceptible. PM = Powdery Mildew; R = resistant; S = susceptible. PEMV = Pea Enation Mosiac Virus; R = resistant; S = susceptible,
Pod height was measured at the green pod stage and at harvest maturity. Pod height index = pod height at harvest maturity divided by the pod height at the green pod stage.
Plant height was measured at the green pod stage and at harvest maturity. Plant height index = plant height at harvest maturity divided by the green plant height at the green pod stage.
Repr Nodes = average number of reproductive nodes on a plant.

Agronomic data are means of three replications at Pullman, WA. Planting Date 04/20/10 Harvest Date: 08/10/10
Check variety = Aragorn

Name	Leaf Type	Vine Type	Fairfield Seed Yield	Genesee Seed Yield	Dayton Seed Yield	Pullman Seed Yield	Mean Seed Yield	% of Aragon
			kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	
PS05100632	-	-	2386.20	1459.50	2008.70	1895.70	1937.50	137
PS07100470	-	-	2179.00	1279.00	1820.90	1909.70	1797.20	127
PS06100490	-	-	1862.20	1390.80	1964.70	1879.30	1774.30	125
PS07100471	-	-	2274.40	1335.90	1729.50	1701.20	1760.30	124
PS05100120	-	-	1880.60	1532.90	1836.50	1761.80	1753.00	124
PS05100736	-	-	1531.50	1495.40	2173.20	1787.40	1746.90	123
PS07100474	-	-	2031.90	905.80	2010.20	1884.00	1708.00	121
PS06100542	-	-	2066.20	1222.60	1620.60	1795.60	1676.30	118
PS05100735	-	-	1381.10	1351.10	1997.40	1949.00	1669.70	118
PS06100760	-	-	1677.30	1589.90	1501.30	1905.70	1668.60	118
PS04100462	-	-	1572.20	1040.60	2189.90	1714.60	1629.30	115
PS03101445	-	-	2042.00	941.50	1608.70	1916.90	1627.30	115
PS05100840	-	-	1916.10	1173.20	1747.10	1671.00	1626.90	115
PS07100396	-	-	1476.90	1241.30	1984.00	1784.60	1621.70	115
Banner	-	-	1948.40	1163.80	1679.00	1559.70	1587.70	112
PRO-081-6118			1939.20	967.20	1554.70	1651.90	1528.30	108
Ariel	-	-	1755.20	1109.90	1597.40	1434.60	1474.30	104
Aragorn	-	-	1769.40	971.70	1479.40	1444.40	1416.20	100
Stirling	-	-	1705.60	954.70	1296.60	1664.40	1405.30	99.2
PS07100480	-	-	1554.50	949.20	1444.70	1672.00	1405.10	99.2
PS07100170	-	-	1803.70	733.30	1501.40	1542.60	1395.30	98.5
PS05100522	-	-	1519.20	929.10	1465.10	1590.40	1376.00	97.2
PS06100617	-	-	1678.10	790.70	1390.40	1541.90	1350.30	95.4
Columbian L1	+	+	1331.20	773.50	1264.00	1649.70	1254.60	88.6
Lifter	+	-	1176.90	1178.90	1240.50	1333.60	1232.50	87.0
GRAND MEAN			1778.36	1139.27	1684.24	1705.66	1576.88	
CV			12.28	15.80	8.90	11.87	12.01	
LSD			429.49	353.91	294.73	398.04	201.20	

Leaf Type: + = normal leaf; - = afila or semi-leafless.
Vine Type: + = tall vine; - = short vine.
Yield data are means of three replications at each location.

Mean Yields of the Green Dry Pea Advanced Yield Trial, 2006 - 2010.

Name	Leaf Type	Vine Type	2006	2007	2008	2009	2010
			kg/ha	kg/ha	kg/ha	kg/ha	kg/ha
PS05100632	-	-	…	…	2016	2188	1938
PS07100470	-	-	…	…	…	…	1797
PS06100490	-	-	…	…	…	2224	1774
PS07100471	-	-	…	…	…	…	1760
PS05100120	-	-	…	…	2098	2131	1753
PS05100736	-	-	…	…	2023	2148	1747
PS07100474	-	-	…	…	…	…	1708
PS06100542	-	-	…	…	…	2063	1676
PS05100735	-	-	…	…	1860	2071	1670
PS06100760	-	-	…	…	…	2322	1669
PS04100462	-	-	…	1991	1800	2165	1629
PS03101445	-	-	…	…	1986	2158	1627
PS05100840	-	-	…	…	2015	2271	1627
PS07100396	-	-	…	…	…	…	1622
BANNER	-	-	…	…	1959	1883	1588
PRO-081-6118	-	-	…	…	…	…	1528
ARIEL	-	-	2242	1958	2044	1965	1474
ARAGORN	-	-	2208	1999	1850	2025	1416
STIRLING	-	-	2200	2014	1839	1899	1405
PS07100480	-	-	…	…	…	…	1405
PS07100170	-	-	…	…	…	…	1395
PS05100522	-	-	…	…	1836	2090	1376
PS06100617	-	-	…	…	…	2055	1350
COLUMBIAN(LOT-I)	+	+	2019	2007	1604	1612	1255
LIFTER	+	-	2068	2072	1774	2209	1233
Grand Mean			2222	1929	1867	2048	1577
LSD $_{(a=0.05)}$			193	186	191	190	201

Leaf Type: + = normal leaf; - = afila or semi-leafless.
Vine Type: + = tall vine; - = short vine.

Yield data are means of three replications per location, four locations per year except 2006(three locations).

Agronomic Data for the Yellow Pea Advanced Yield Trial (1002)

Name	FW 1	PM	PEMV	Days to Flower	Days to Maturity	Flower Node	Pods/ Peduncle	Pod Height	Pod Ht Maturity	Pod Ht Index	Vine Length	Canopy Height	Plant Ht Index	# Repr Nodes	100 Seed Weight
								..cm..	..cm..		..cm..	..cm..			..g..
PS04100710	R/S	R/S	S	71.00	98.70	16.10	2	21.10	7.50	0.35	57.70	23.80	0.42	3.00	17.50
PS03101822	R	R	S	68.30	98.70	15.30	2	25.80	11.20	0.43	60.90	32.60	0.54	2.90	20.70
Universal	R/S	S	S	68.30	98.70	17.50	2	40.40	21.90	0.54	69.10	52.30	0.76	3.20	19.10
PS02101137	R	R	S	69.00	100.7	18.00	2	23.30	10.10	0.44	68.90	26.00	0.38	2.60	19.00
PS06101119	R	R	S	68.70	100.7	16.70	2	28.20	9.70	0.35	63.00	30.10	0.48	3.00	21.40
DS ADMIRAL	R	R	S	71.00	100.0	18.00	2	47.90	29.40	0.62	73.40	60.20	0.82	3.00	17.60
PS07100914	R	R	S	69.70	104.0	15.50	2	13.70	5.60	0.44	70.90	19.20	0.27	3.90	21.90
PS06101338	R	S	S	71.00	102.7	17.90	2	39.50	23.00	0.58	87.10	50.00	0.58	3.50	20.00
PRO-5187	R	R	S	71.70	102.0	19.10	2	48.30	29.40	0.61	73.60	60.50	0.82	2.90	17.80
CAROUSEL	R	S	S	71.00	104.0	16.70	2	43.10	20.90	0.48	67.70	54.10	0.80	3.10	19.40
PS06101043	R	S	S	70.30	104.0	17.30	2	32.60	11.60	0.35	82.50	40.70	0.49	4.20	21.80
PS05101142	R	R	S	70.30	104.0	16.80	2	20.60	6.00	0.29	72.00	25.60	0.36	4.40	16.30
Delta	R	S	S	69.70	98.00	18.20	2	38.00	22.80	0.61	63.50	41.30	0.65	2.50	17.80
PS05101240	R	R	S	71.00	100.7	17.30	2	30.10	8.50	0.26	69.20	31.10	0.46	3.20	17.50
Pro-Prl-415	S	R	S	72.00	104.0	18.10	2	34.60	14.30	0.41	68.40	38.50	0.56	3.10	17.30
PS06101004	R	R	S	68.30	104.0	14.80	2	29.50	9.40	0.32	65.30	30.90	0.47	3.30	21.50
GRAND MEAN				70.08	101.5	17.09	2	32.29	15.09	0.44	69.58	38.56	0.55	3.25	19.16
CV				0.96	1.97	6.80	2	11.51	28.06	25.62	7.86	14.03	15.05	20.09	4.45
LSD				0.93	2.77	1.61	2	5.15	5.87	0.16	7.58	7.50	0.12	0.91	1.18

FW 1 = Fusarium Wilt Race 1; R = resistant; S = susceptible. PM = Powdery Mildew; R = resistant; S = susceptible. PEMV = Pea Enation Mosiac Virus; R = resistant; S = susceptible.
Pod height was measured at the green pod stage and at harvest maturity. Pod height index = pod height at harvest maturity divided by the pod height at the green pod stage.
Plant height was measured at the green pod stage and at harvest maturity. Plant height index = plant height at harvest maturity divided by the green plant height at the green pod stage.
Repr Nodes = average number of reproductive nodes on a plant.
Agronomic data are means of three replications at Pullman, WA. Planting Date 04/20/2010 Harvest Date: 08/11/2010
Check variety = Delta

Name	Leaf Type	Vine Type	Fairfield Seed Yield	Genesee Seed Yield	Dayton Seed Yield	Pullman Seed Yield	Mean Seed Yield	% of Delta
			kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	
PS04100710	-	-	2800.30	1581.90	1993.50	1967.50	2085.80	133
PS03101822	-	-	2870.60	1579.20	2017.60	1830.20	2074.40	132
Universal	-	-	2462.40	1367.00	1990.80	1949.00	1942.30	124
PS02101137	-	-	2317.20	1493.50	1897.70	1849.60	1889.50	120
PS06101119	-	-	2261.70	1285.70	1741.10	1796.90	1771.40	113
DS ADMIRAL	-	-	2496.40	1096.80	1862.10	1606.20	1765.40	113
PS07100914	+	-	2515.20	1213.40	1522.00	1593.40	1711.00	109
PS06101338	-	-	1856.30	1278.80	1702.40	1981.30	1704.70	109
PRO-5187			2018.10	986.20	1965.20	1780.00	1687.40	108
CAROUSEL	-	-	2076.80	926.70	1770.90	1744.40	1629.70	104
PS06101043	-	-	2221.50	958.40	1489.60	1819.40	1622.20	103
PS05101142	-	-	1830.20	1513.10	1606.30	1382.50	1583.00	101
Delta	-	-	2264.20	818.80	1685.70	1504.20	1568.20	100
PS05101240	-	-	2011.80	1016.70	1587.20	1564.10	1545.00	98.5
Pro-Prl-415			2175.20	1016.10	1494.60	1441.10	1531.80	97.7
PS06101004	-	-	1500.90	1118.80	1320.10	1622.80	1390.70	88.7
GRAND MEAN			2229.93	1203.18	1727.91	1714.52	1718.90	
CV			12.53	12.47	7.75	9.31	11.04	
LSD			561.66	301.65	269.35	320.77	202.74	

Leaf Type: + = normal leaf; - = afila or semi-leafless.
Vine Type: + = tall vine; - = short vine.
Yield data are means of three replications at each location.

Mean Yields of the Yellow Dry Pea Advanced Yield Trial, 2006 - 2010.

Name	Leaf Type	Vine Type	2006	2007	2008	2009	2010
			kg/ha	kg/ha	kg/ha	kg/ha	kg/ha
PS04100710	-	-	…	2013	1819	2273	2086
PS03101822	-	-	2976	2207	2235	2320	2074
UNIVERSAL	-	-	2547	2111	2271	2124	1942
PS02101137	-	-	…	…	…	…	1890
PS06101119	-	-	…	…	…	2332	1771
DS ADMIRAL	-	-	…	1661	1762	2053	1765
PS07100914	+	-	…	…	…	…	1711
PS06101338	-	-	…	…	…	2072	1705
PRO-5187	-	-	…	…	…	…	1687
CAROUSEL	-	-	2594	1420	2130	2193	1630
PS06101043	-	-	…	…	…	2239	1622
PS05101142	-	-	…	…	1991	2152	1583
DELTA	-	-	2419	1972	2116	1782	1568
PS05101240	-	-	…	…	2044	1876	1545
PRO-PRL-415	-	-	…	…	…	…	1532
PS06101004	-	-	…	…	…	2158	1391
Grand Mean			2511	1917	2013	2111	1719
LSD $_{(a=0.05)}$			166	267	175	173	203

Leaf Type: + = normal leaf; - = afila or semi-leafless.
Vine Type: + = tall vine; - = short vine.

Yield data are means of three replications per location, four locations per year except 2006 (three locations).

Agronomic and Yield Data for the Green Dry Pea Preliminary Yield Trial (1003)

Name	Leaf Type	Vine Type	FW 1	PM	PEMV	Days to Flower	Days to Maturity	Flower Node	Pods/ Peduncle	Pod Height	Pod Ht Maturity	Pod Ht Index	Vine Length	Canopy Height	Plant Ht Index	# Repr Nodes	100 Seed Weight	Seed Yield	% of Aragorn
										..cm..	..cm..		..cm..	..cm..			..g..	kg/ha	
PS07100262	-	-	R	R	R	69.70	104.0	16.40	2.00	29.50	20.00	0.67	53.60	33.50	0.64	2.80	20.20	1990	120.1
PS08100133	-	-	R	R	R	74.70	104.0	15.20	2.00	35.80	26.70	0.74	70.80	38.80	0.55	3.80	16.60	1982	119.7
PS08100582	-	-	R	R	S	72.00	104.0	18.80	2.00	39.10	28.20	0.72	75.40	41.70	0.56	4.30	17.70	1936	116.9
PS08100094	-	-	R	R	R	71.00	104.0	16.60	2.00	31.10	15.80	0.52	62.40	25.40	0.41	3.10	18.60	1915	115.6
PS08100193	-	-	R	R	R	71.00	104.0	16.40	2.00	28.30	15.40	0.55	67.80	25.60	0.38	3.50	13.60	1865	112.6
PS08100678	-	-	R	R	R	71.00	104.0	17.30	2.00	38.10	23.80	0.62	81.80	33.10	0.41	3.10	18.10	1856	112.1
PS08100556	-	-	R	S	S	69.00	104.0	17.50	2.00	41.90	33.90	0.81	80.60	50.70	0.64	3.50	20.00	1842	111.2
PS07100192	-	-	R	S	S	70.30	102.7	16.70	2.00	34.90	25.60	0.72	66.60	36.40	0.54	2.90	17.60	1820	109.9
PS07100056	-	-	R	S	S	65.70	101.3	14.30	2.00	29.70	21.10	0.71	62.90	34.70	0.55	4.00	19.80	1782	107.6
PS08100655	-	-	R	S	S	67.30	101.3	15.10	2.00	21.40	16.10	0.76	66.80	28.40	0.43	3.70	19.40	1752	105.8
PS08100198	-	-	R	R	R	68.70	102.7	15.00	2.00	20.30	15.40	0.77	74.30	27.80	0.38	4.00	15.00	1749	105.6
PS08100108	-	-	R	R	S	76.00	104.0	16.40	2.00	37.20	31.80	0.86	59.00	40.50	0.69	3.50	14.60	1720	103.9
PS07100448	-	-	R	R	S	69.00	104.0	16.30	2.00	27.70	19.30	0.69	75.90	33.40	0.44	3.30	18.70	1680	101.4
PS08100630	-	-	R	R	R	71.30	104.0	17.60	2.00	43.30	35.40	0.82	78.00	46.10	0.59	3.00	16.70	1679	101.4
PS08100743	-	-	R	R/S	S	66.30	100.0	14.50	1.00	25.60	20.20	0.78	69.00	36.40	0.53	3.70	17.10	1662	100.3
Aragorn	-	-	R	S	S	69.70	102.7	17.80	2.00	34.80	28.60	0.83	69.20	45.50	0.66	4.10	19.10	1656	100.0
Lifter	+	-	R	R	R	71.00	104.0	16.20	2.00	17.70	12.40	0.70	72.40	27.50	0.38	4.00	18.00	1643	99.21
PS08100217	-	-	R	R	R	74.70	104.0	17.40	2.00	36.40	17.90	0.51	70.20	27.80	0.39	3.90	16.80	1642	99.16
PS07100482	-	-	R	S	S	68.30	104.0	14.30	1.00	24.90	20.50	0.83	54.90	33.00	0.62	3.20	20.30	1500	90.60
PS08100729	-	-	R	S	S	72.00	104.0	18.50	2.00	50.00	46.40	0.93	68.30	58.30	0.86	2.40	17.20	1270	76.69
Stirling	-	-	R	R	S	67.00	102.7	14.00	2.00	19.40	15.00	0.77	58.70	32.60	0.56	4.30	17.20	1214	73.32
GRAND MEAN						70.27	103.3	16.30	1.92	31.76	23.31	0.73	68.50	36.07	0.53	3.53	17.72	1722	
CV						1.39	1.13	7.31	10.98	14.58	18.17	14.78	8.88	13.26	14.78	16.43	5.03	10.48	
LSD						1.34	1.60	1.64	0.29	6.37	5.83	0.15	8.36	6.58	0.11	0.80	1.22	357.5	

Leaf Type: + = normal leaf; - = afila or semi-leafless. Vine Type: + = tall vine; - = short vine.

FW 1 = Fusarium Wilt Race 1; R = resistant; S = susceptible. PM = Powdery Mildew; R = resistant; S = susceptible. PEMV = Pea Enation Mosiac Virus; R = resistant; S = susceptible.

Pod height was measured at the green pod stage and at harvest maturity. Pod height index = pod height at harvest maturity divided by the pod height at the green pod stage.

Plant height was measured at the green pod stage and at harvest maturity. Plant height index = plant height at harvest maturity divided by the green plant height at the green pod stage.

Repr Nodes = average number of reproductive nodes on a plant.

Agronomic data are means of three replications at Pullman, WA. Planting Date 04/20/10 Harvest Date: 08/11/10

Agronomic and Yield Data for the Yellow and Marrowfat Dry Pea Preliminary Yield Trial (1004)

Name	Leaf Type	Vine Type	FW 1	PM	PEMV	Days to Flower	Days to Maturity	Flower Node	Pods/ Peduncle	Pod Height	Pod Ht Maturity	Pod Ht Index	Vine Length	Canopy Height	Plant Ht Index	# Repr Nodes	100 Seed Weight	Seed Yield	% of Delta
										..cm..	..cm..		..cm..	..cm..			..g..	kg/ha	
PS07100925	-	-	R	R	S	71.30	104.0	14.20	2.00	38.00	20.80	0.57	55.40	45.60	0.82	3.80	21.30	2232	112.9
PS08101147	-	-	R	R	S	71.00	104.0	14.80	2.00	37.30	11.10	0.30	62.40	31.00	0.50	3.00	18.60	2209	111.8
PS08101108	-	-	R	R	S	67.70	100.0	12.90	2.00	33.70	22.40	0.67	53.40	45.60	0.85	2.80	18.70	2176	110.1
PS08101022	-	-	S	R	S	69.00	100.0	14.00	2.00	35.40	15.70	0.44	63.40	44.00	0.70	3.80	21.80	2119	107.2
PS08101109	-	-	R	R	S	67.00	104.0	13.80	2.00	34.20	15.30	0.45	61.90	48.50	0.78	4.30	17.60	2116	107.1
PS08101038	-	-	R	R	S	67.30	98.00	13.50	2.00	18.70	5.90	0.32	65.70	21.50	0.33	3.80	20.70	2048	103.7
PS08100962	-	-	R	R	S	65.30	98.00	15.80	2.00	21.60	3.90	0.17	71.50	19.00	0.27	3.20	17.30	2042	103.3
PS07100680	-	-	R	R	S	71.00	104.0	15.00	2.00	33.00	19.50	0.59	50.70	42.00	0.83	3.40	21.80	2024	102.4
PS08101028	-	-	S	R	S	69.70	100.0	13.40	2.00	28.20	10.90	0.38	62.00	29.90	0.49	4.10	17.30	2008	101.6
PS08100383	-	-	R	R	S	76.00	104.0	14.70	2.00	37.50	14.30	0.38	68.40	36.50	0.53	3.20	17.20	1986	100.5
Delta	-	-	R	S	S	69.70	98.00	16.60	2.00	38.60	18.10	0.48	63.30	47.60	0.76	2.30	19.20	1976	100.0
PS07100930	-	-	S	R	S	74.70	104.0	15.40	2.00	26.20	5.90	0.23	63.30	22.90	0.36	3.80	17.20	1971	99.71
PS08101085	-	-	R	R	S	67.00	98.00	15.20	2.00	34.10	14.70	0.43	68.10	42.50	0.62	3.40	22.50	1940	98.18
PS07100828	-	-	R	R	S	69.00	102.0	14.30	2.00	24.60	9.80	0.40	63.30	28.20	0.45	3.70	23.10	1901	96.18
PS08101004	-	-	R	R	S	69.70	100.0	16.20	2.00	41.30	20.40	0.50	65.80	49.40	0.75	2.70	19.60	1890	95.61
PS08100996	-	-	R	R	S	69.00	100.0	13.60	2.00	24.80	11.40	0.44	58.70	31.00	0.53	2.80	19.70	1864	94.32
Universal	-	-	R/S	S	S	68.30	98.00	14.70	2.00	42.10	27.60	0.65	61.00	57.50	0.94	2.70	19.10	1856	93.94
PS08101030	-	-	R	R	S	69.00	98.70	13.30	2.00	25.40	7.30	0.28	61.00	27.30	0.45	3.60	17.00	1843	93.25
PS07100834	-	-	R	R	S	72.00	104.0	14.70	2.00	30.40	12.90	0.43	52.10	37.70	0.72	4.30	19.80	1817	91.95
PS08101001	-	-	S	R	S	71.00	104.0	15.60	2.00	42.60	17.90	0.42	71.80	46.10	0.64	2.80	22.20	1814	91.77
PS07100836	-	-	R	R	S	74.70	104.0	16.20	2.00	36.40	4.90	0.13	67.70	19.60	0.29	3.90	18.50	1813	91.74
PS07100888	-	-	R	R	S	72.70	100.0	12.70	2.00	30.60	7.60	0.25	54.70	26.40	0.48	3.10	19.50	1808	91.51
PS07100716	-	-	R	R	S	73.00	104.0	16.00	2.00	45.30	26.40	0.59	68.40	59.90	0.88	4.30	19.10	1807	91.44
PS08101060	-	-	R	R	S	64.00	104.0	15.20	2.00	33.90	15.90	0.46	67.70	41.20	0.61	3.50	19.10	1787	90.42
PS07100918	-	-	R	R	S	71.00	104.0	14.80	2.00	35.30	21.40	0.61	57.80	39.80	0.69	3.30	21.60	1767	89.44
GRAND MEAN						70.00	101.6	14.66	1.99	33.16	14.48	0.42	62.38	37.63	0.61	3.42	19.58	1953	
CV						3.29	1.73	7.06	5.81	12.74	21.47	20.72	7.00	14.83	13.94	17.88	7.10	11.33	
LSD						3.16	2.41	1.42	0.16	5.79	4.26	0.12	5.98	7.64	0.12	0.84	1.90	434.9	

Leaf Type: + = normal leaf; - = afila or semi-leafless. Vine Type: + = tall vine; - = short vine.

FW 1 = Fusarium Wilt Race 1; R = resistant; S = susceptible. PM = Powdery Mildew; R = resistant; S = susceptible. PEMV = Pea Enation Mosiac Virus; R = resistant; S = susceptible.
Pod height was measured at the green pod stage and at harvest maturity. Pod height index = pod height at harvest maturity divided by the pod height at the green pod stage.
Plant height was measured at the green pod stage and at harvest maturity. Plant height index = plant height at harvest maturity divided by the green plant height at the green pod stage.
Repr Nodes = average number of reproductive nodes on a plant.
Agronomic data are means of three replications at Pullman, WA. Planting Date 04/20/10 Harvest Date: 08/11/10

Agronomic and Yield Data for the Green Dry Pea Observation Nursery (1005G)

Name	Leaf Type	Vine Type	FW 1	PM	PEMV	Days to Flower	Days to Maturity	Flower Node	Pods/ Peduncle	Pod Height	Pod Ht Maturity	Pod Ht Index	Vine Length	Canopy Height	Plant Ht Index	# Repr Nodes	100 Seed Weight	Seed Yield	% of Aragorn
										..cm..	..cm..		..cm..	..cm..			..g..	kg/ha	
PS09100034	-			R		72.00	104.0	18.50	2.00	36.50	17.30	0.47	75.50	43.30	0.57	3.50	18.80	2079	109.5
PS09100114	-			R	R	69.00	104.0	14.80	2.00	35.00	12.00	0.34	63.30	24.30	0.38	3.00	17.40	2076	109.3
PS08100585	-	-		R		69.00	104.0	19.00	2.00	47.50	22.00	0.46	68.80	42.50	0.62	4.80	19.00	2048	107.8
PS09100014	-			S		69.00	104.0	17.30	2.00	56.50	34.50	0.61	72.00	67.30	0.93	3.80	21.50	2025	106.6
PS09100001	-				R	69.00	104.0	13.30	2.00	37.80	22.00	0.58	62.30	47.50	0.76	3.80	19.70	2009	105.7
PS09100029	-			S	R	72.00	104.0	17.00	2.00	38.50	24.30	0.63	69.80	49.50	0.71	4.80	19.40	1953	102.8
PS09100035	-			R/S	R/S	71.00	104.0	19.30	2.00	49.50	25.00	0.51	74.80	60.50	0.81	2.30	20.70	1940	102.1
PS09100015	-			S		72.00	104.0	15.80	2.00	28.00	11.30	0.40	73.50	24.30	0.33	5.50	17.10	1935	101.9
Aragorn	-	-	R	S	S	71.00	98.00	13.80	2.00	41.30	21.00	0.51	62.80	47.30	0.75	3.50	17.40	1899	100.0
PS09100004	-				R/S	71.00	104.0	18.50	2.00	30.00	11.00	0.37	76.30	30.80	0.40	3.30	16.60	1895	99.8
PS09100123	-			S		69.00	104.0	14.50	2.00	37.00	24.30	0.66	58.00	47.30	0.82	3.80	19.40	1832	96.4
PS09100012	-		R	S	R	71.00	104.0	17.30	2.00	40.50	16.00	0.40	71.00	30.50	0.43	4.00	19.70	1826	96.1
PS08100747	-	-				66.00	104.0	17.50	2.00	49.00	21.30	0.43	78.00	59.50	0.76	2.50	17.40	1803	94.9
PS08100858	-	-				71.00	104.0	13.00	2.00	40.30	22.50	0.56	57.50	45.30	0.79	3.00	18.20	1767	93.0
PS09100031	-			S	R/S	72.00	104.0	18.50	2.00	27.00	17.30	0.64	83.30	28.30	0.34	3.80	16.20	1738	91.5
PS09100109	-			S	R	69.00	104.0	17.00	2.00	19.50	4.00	0.21	69.50	14.80	0.21	3.80	17.70	1727	90.9
PS09100147	-			S	S	71.00	104.0	16.50	2.00	30.50	17.30	0.57	64.30	34.30	0.53	3.50	20.10	1715	90.3
PS08100397	-	-				72.00	104.0	16.00	2.00	31.00	4.50	0.15	74.50	15.50	0.21	4.30	17.20	1681	88.5
Stirling	-	-	R	R	S	66.00	104.0	12.50	2.00	27.50	9.80	0.36	56.50	23.80	0.42	5.30	15.50	1677	88.3
PS08100772	-	-			S	72.00	104.0	16.30	2.00	53.00	34.80	0.66	68.00	61.00	0.90	3.00	16.30	1675	88.2
PS08100606	-	-		R		69.00	104.0	11.00	2.00	36.50	14.00	0.38	58.50	31.50	0.54	3.80	16.70	1640	86.3
PS09100006	-		R/S		R/S	76.00	104.0	16.50	2.00	41.30	15.00	0.36	62.30	34.30	0.55	3.80	18.20	1637	86.2
PS09100002	-				R/S	69.00	104.0	13.30	2.00	23.30	8.80	0.38	61.00	23.50	0.39	5.30	17.70	1637	86.2
PS08100218	-	-				76.00	104.0	16.80	2.00	40.80	11.50	0.28	60.80	32.80	0.54	3.80	18.20	1622	85.4
PS09100146	-			S		71.00	104.0	17.50	2.00	32.50	8.50	0.26	64.50	27.50	0.43	3.50	19.80	1619	85.2
PS08100888	-	-				69.00	104.0	13.80	2.00	46.30	25.80	0.56	74.80	46.00	0.61	5.30	16.60	1597	84.1
PS08100885	-	-				76.00	104.0	14.80	2.00	33.00	24.30	0.74	56.00	46.50	0.83	3.50	17.20	1596	84.0
PS08100821	-	-				69.00	104.0	13.30	1.00	39.30	19.00	0.48	75.30	47.00	0.62	5.50	17.30	1582	83.3
PS09100157	+			S		71.00	104.0	12.30	2.00	18.30	3.30	0.18	59.30	16.00	0.27	4.00	16.70	1579	83.1

Leaf Type: + = normal leaf; - = afila or semi-leafless. Vine Type: + = tall vine; - = short vine.

FW 1 = Fusarium Wilt Race 1; R = resistant; S = susceptible. PM = Powdery Mildew; R = resistant; S = susceptible. PEMV = Pea Enation Mosiac Virus; R = resistant; S = susceptible.

Pod height was measured at the green pod stage and at harvest maturity. Pod height index = pod height at harvest maturity divided by the pod height at the green pod stage.

Plant height was measured at the green pod stage and at harvest maturity. Plant height index = plant height at harvest maturity divided by the green plant height at the green pod stage.

Repr Nodes = average number of reproductive nodes on a plant.

Planting Date 4/20/10 Harvest Date 8/12/10

Agronomic and Yield Data for the Green Dry Pea Observation Nursery (1005G)

Name	Leaf Type	Vine Type	FW 1	PM	PEMV	Days to Flower	Days to Maturity	Flower Node	Pods/ Peduncle	Pod Height	Pod Ht Maturity	Pod Ht Index	Vine Length	Canopy Height	Plant Ht Index	# Repr Nodes	100 Seed Weight	Seed Yield	% of Aragorn
										..cm..	..cm..		..cm..	..cm..			..g..	kg/ha	
PS08100827						69.00	104.0	13.50	1.00	40.00	29.00	0.73	71.30	57.30	0.80	5.30	20.60	1572	82.7
PS08100709	-	-			S	71.00	104.0	19.00	2.00	38.80	6.50	0.17	72.50	23.80	0.33	3.80	18.30	1563	82.3
PS09100026	-			S	R	71.00	104.0	14.80	2.00	24.80	12.80	0.52	72.80	21.80	0.30	4.80	16.10	1562	82.2
PS09100154	+			S		72.00	104.0	14.00	2.00	20.30	5.50	0.27	69.00	14.80	0.21	6.00	14.00	1561	82.2
PS09100052	-			R	S	71.00	104.0	16.80	2.00	45.80	34.30	0.75	66.00	52.00	0.79	2.50	17.50	1543	81.2
PS08100703	-	-				69.00	104.0	12.00	2.00	40.00	29.50	0.74	58.30	52.30	0.90	3.30	14.60	1541	81.1
PS09100144	-			S		71.00	104.0	16.30	2.00	30.30	12.80	0.42	69.30	28.80	0.42	5.00	17.90	1539	81.0
PS09100019	-			S		72.00	104.0	14.80	2.00	35.00	17.00	0.49	72.00	34.00	0.47	2.80	17.10	1539	81.0
PS08100467	-	-				69.00	104.0	15.30	2.00	36.80	11.00	0.30	60.30	40.80	0.68	4.30	21.20	1530	80.5
PS08100872	-	-				71.00	104.0	15.30	2.00	44.50	26.00	0.58	65.30	49.80	0.76	3.80	18.60	1504	79.2
PS08100088	-	-			S	76.00	104.0	18.00	2.00	47.00	24.80	0.53	61.30	47.50	0.77	3.00	16.90	1492	78.6
PS08100825	-	-				62.00	98.00	11.50	1.00	33.80	15.30	0.45	64.50	43.00	0.67	7.00	19.70	1489	78.4
PS08100763	-	-			S	72.00	104.0	13.80	2.00	58.80	37.30	0.63	70.00	62.00	0.89	3.00	17.60	1484	78.1
PS09100038	-				R	71.00	98.00	13.80	2.00	20.30	3.50	0.17	57.80	14.50	0.25	5.80	16.90	1483	78.1
PS09100156	+			S		72.00	104.0	13.80	2.00	19.00	2.50	0.13	63.80	14.00	0.22	5.00	15.80	1475	77.7
PS08100090	-	-				76.00	104.0	15.30	2.00	50.80	33.50	0.66	71.50	63.30	0.89	4.80	18.00	1461	76.9
PS09100112	-			S	R	72.00	104.0	17.80	2.00	25.30	6.30	0.25	76.00	13.00	0.17	4.80	14.10	1459	76.8
PS08100561	-	-				72.00	104.0	19.30	2.00	50.00	25.00	0.50	72.50	43.80	0.60	4.30	16.00	1459	76.8
PS09100155	+			S		71.00	104.0	12.30	2.00	20.80	2.00	0.10	61.00	12.00	0.20	4.80	16.60	1434	75.5
PS08100413	-	-				71.00	104.0	14.80	2.00	35.50	12.80	0.36	55.50	39.80	0.72	3.50	18.90	1429	75.2
PS09100022	-		R	S	R	72.00	104.0	13.50	2.00	26.00	15.00	0.58	73.30	29.50	0.40	3.50	16.50	1395	73.4
PS09100040	-					71.00	104.0	13.80	2.00	28.80	13.50	0.47	57.00	32.30	0.57	4.30	21.30	1381	72.7
PS09100136	-			S	S	67.00	104.0	11.80	2.00	26.00	12.80	0.49	46.30	33.80	0.73	3.30	19.50	1373	72.3
PS08100659	-	-				69.00	104.0	16.80	2.00	41.50	14.30	0.34	63.00	32.80	0.52	5.80	19.00	1368	72.0
PS09100008	-		R	S	R	72.00	104.0	15.30	2.00	21.80	4.50	0.21	74.50	13.50	0.18	5.50	16.70	1358	71.5
PS09100009	-		R	S	R	72.00	107.0	19.50	2.00	56.00	34.30	0.61	85.50	63.00	0.74	4.00	22.70	1352	71.1
PS09100062	-					69.00	104.0	17.30	2.00	29.80	7.00	0.23	68.50	22.50	0.33	4.00	17.80	1343	70.7
PS08100862	-	-				72.00	104.0	15.50	2.00	46.80	34.00	0.73	63.00	54.00	0.86	3.50	17.20	1329	69.9
PS08100624	-	-			S	72.00	104.0	13.30	2.00	36.30	16.30	0.45	55.80	33.50	0.60	4.00	18.20	1318	69.4

Leaf Type: + = normal leaf; - = afila or semi-leafless. Vine Type: + = tall vine; - = short vine.

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Pod height was measured at the green pod stage and at harvest maturity. Pod height index = pod height at harvest maturity divided by the pod height at the green pod stage.

Plant height was measured at the green pod stage and at harvest maturity. Plant height index = plant height at harvest maturity divided by the green plant height at the green pod stage.

Repr Nodes = average number of reproductive nodes on a plant.

Planting Date 4/20/10 Harvest Date 8/12/10

Agronomic and Yield Data for the Green Dry Pea Observation Nursery (1005G)

Name	Leaf Type	Vine Type	FW 1	PM	PEMV	Days to Flower	Days to Maturity	Flower Node	Pods/ Peduncle	Pod Height	Pod Ht Maturity	Pod Ht Index	Vine Length	Canopy Height	Plant Ht Index	# Repr Nodes	100 Seed Weight	Seed Yield	% of Aragorn
										..cm..	..cm..		..cm..	..cm..			..g..	kg/ha	
PS08100470	-	-			S	71.00	104.0	16.00	2.00	44.50	25.00	0.56	68.30	48.80	0.71	4.00	20.00	1305	68.7
PS09100110	-			S	S	71.00	104.0	13.50	2.00	21.30	5.50	0.26	69.00	14.50	0.21	5.80	16.60	1289	67.8
PS09100043	-			S	R	72.00	104.0	14.30	2.00	24.50	5.50	0.22	60.80	19.30	0.32	2.50	19.40	1240	65.2
PS09100140	-			S		69.00	104.0	14.50	2.00	20.50	5.30	0.26	69.50	14.50	0.21	5.00	15.30	1193	62.8
PS08100662	-	-				76.00	104.0	14.50	2.00	42.80	27.80	0.65	68.00	43.50	0.64	2.50	13.30	1144	60.2
PS08100777	-	-			S	76.00	98.00	16.00	2.00	33.30	19.50	0.59	61.30	37.30	0.61	5.50	15.30	213.0	11.2
GRAND MEAN						70.97	103.7	15.37	1.95	35.70	17.03	0.45	66.67	36.31	0.55	4.13	17.80	1571	
CV						3.54	1.46	13.95	10.82	28.92	56.45	39.14	11.06	42.06	41.25	24.70	10.58	17.95	

Leaf Type: + = normal leaf; - = afila or semi-leafless. Vine Type: + = tall vine; - = short vine.

FW 1 = Fusarium Wilt Race 1; R = resistant; S = susceptible. PM = Powdery Mildew; R = resistant; S = susceptible. PEMV = Pea Enation Mosiac Virus; R = resistant; S = susceptible.

Pod height was measured at the green pod stage and at harvest maturity. Pod height index = pod height at harvest maturity divided by the pod height at the green pod stage.

Plant height was measured at the green pod stage and at harvest maturity. Plant height index = plant height at harvest maturity divided by the green plant height at the green pod stage.

Repr Nodes = average number of reproductive nodes on a plant.

Planting Date 4/20/10 Harvest Date 8/12/10

Agronomic and Yield Data for the Yellow Dry Pea Observation Nursery (1005Y)

Name	Leaf Type	Vine Type	FW 1	PM	PEMV	Days to Flower	Days to Maturity	Flower Node	Pods/ Peduncle	Pod Height	Pod Ht Maturity	Pod Ht Index	Vine Length	Canopy Height	Plant Ht Index	# Repr Nodes	100 Seed Weight	Seed Yield	% of Delta
										..cm..	..cm..		..cm..	..cm..			..g..	kg/ha	
PS09100071	-				R	71.00	104.0	14.50	2.00	14.30	6.00	0.42	80.30	14.00	0.17	3.50	19.90	2502	228.5
PS09100093	-			R		71.00	98.00	13.00	2.00	12.00	7.00	0.58	53.50	20.50	0.38	3.50	19.20	2113	193.0
PS09100080	-					69.00	104.0	14.50	2.00	24.80	8.30	0.33	55.50	29.30	0.53	2.50	22.10	2110	192.7
PS09100081	-			S		71.00	104.0	14.30	2.00	21.50	11.50	0.53	61.50	24.00	0.39	2.80	16.70	2088	190.7
PS08101212	-	-			S	72.00	104.0	16.00	2.00	46.80	33.00	0.71	70.50	66.50	0.94	3.00	16.70	2031	185.5
PS08101167	-	-				69.00	98.00	10.80	1.00	18.30	14.50	0.79	46.00	25.00	0.54	3.30	17.80	1969	179.9
PS09100067	-					71.00	104.0	13.00	2.00	14.00	5.30	0.38	57.00	17.80	0.31	3.80	21.90	1961	179.1
PS08101171	-	-				69.00	98.00	12.50	1.00	15.80	6.30	0.40	56.50	21.30	0.38	2.80	17.40	1929	176.2
PS09100174	-			S	S	72.00	104.0	14.80	2.00	33.80	10.80	0.32	70.30	27.50	0.39	3.50	19.80	1905	174.0
PS09100082	-					71.00	98.00	15.30	2.00	32.30	15.50	0.48	66.50	35.00	0.53	3.80	24.20	1902	173.8
PS08101069	-	-				71.00	104.0	12.80	2.00	36.80	26.30	0.71	56.80	46.80	0.82	2.80	23.20	1886	172.3
PS08101066	-	-				69.00	104.0	12.80	2.00	23.80	17.00	0.71	51.80	41.30	0.80	3.80	21.80	1868	170.6
PS09100169	-				S	71.00	104.0	15.50	2.00	25.30	11.30	0.45	67.00	22.30	0.33	4.00	22.50	1865	170.4
PS08101242	-	-				67.00	98.00	13.50	2.00	24.50	21.50	0.88	56.00	39.00	0.70	4.30	18.60	1852	169.1
PS08101245						69.00	104.0	17.50	1.00	34.80	21.80	0.63	75.00	46.80	0.62	5.00	20.40	1831	167.3
PS08101054	-	-				69.00	100.0	15.50	2.00	23.00	14.00	0.61	57.00	23.00	0.40	4.50	17.20	1815	165.7
PS08100940						69.00	104.0	15.30	2.00	40.00	16.50	0.41	59.30	49.00	0.83	2.50	22.20	1808	165.2
PS08101268	-	-				72.00	104.0	15.80	2.00	54.00	39.30	0.73	76.00	70.00	0.92	3.50	18.40	1801	164.5
PS09100165	-			S	S	71.00	104.0	15.00	2.00	39.30	14.00	0.36	59.50	33.00	0.55	3.30	18.80	1795	163.9
PS09100173	-			S	S	71.00	104.0	14.50	2.00	31.00	14.80	0.48	61.30	33.00	0.54	3.30	20.40	1747	159.6
PS09100066	-				S	76.00	104.0	12.50	2.00	24.30	16.30	0.67	57.00	32.30	0.57	3.00	20.70	1740	158.9
PS09100175	-			S	S	76.00	104.0	15.50	2.00	38.50	25.00	0.65	57.50	44.80	0.78	3.30	19.20	1722	157.3
PS08100933	-	-				69.00	104.0	13.50	2.00	26.00	14.00	0.54	53.50	40.50	0.76	3.80	23.80	1717	156.8
PS08100943	-	-			S	69.00	104.0	13.50	2.00	29.80	18.30	0.61	51.80	41.80	0.81	2.50	24.00	1703	155.6
Universal	-	-	R/S	S	S	69.00	98.00	15.80	2.00	35.50	29.30	0.83	52.30	50.80	0.97	2.80	17.50	1695	154.8
PS09100158	-			S	S	72.00	104.0	17.00	2.00	39.50	10.30	0.26	66.80	20.00	0.30	4.30	17.60	1667	152.3
PS08101021	-	-				71.00	104.0	13.50	2.00	26.80	18.00	0.67	52.80	30.80	0.58	2.50	17.90	1665	152.1
PS09100171	-			S	S	72.00	104.0	14.30	2.00	30.80	12.30	0.40	65.80	25.00	0.38	4.00	19.70	1663	151.9
PS09100172	-			S	S	69.00	104.0	13.30	2.00	28.50	11.80	0.41	55.80	30.30	0.54	2.80	19.10	1663	151.9
PS08101178	-	-				71.00	104.0	16.30	2.00	27.30	10.50	0.38	70.30	35.50	0.50	2.80	18.70	1652	150.9

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Planting Date 4/20/10 Harvest Date 8/12/10

Agronomic and Yield Data for the Yellow Dry Pea Observation Nursery (1005Y)

Name	Leaf Type	Vine Type	FW 1	PM	PEMV	Days to Flower	Days to Maturity	Flower Node	Pods/ Peduncle	Pod Height	Pod Ht Maturity	Pod Ht Index	Vine Length	Canopy Height	Plant Ht Index	# Repr Nodes	100 Seed Weight	Seed Yield	% of Delta
										..cm..	..cm..		..cm..	..cm..			..g..	kg/ha	
PS09100176	-			S	S	71.00	104.0	14.80	2.00	24.50	15.80	0.64	56.30	25.80	0.46	2.50	18.60	1647	150.5
PS08101068	-	-				71.00	104.0	12.80	2.00	32.00	20.30	0.63	57.50	45.30	0.79	4.00	18.80	1633	149.1
PS08101002	-	-				71.00	98.00	16.50	2.00	46.00	22.30	0.48	67.30	43.30	0.64	2.80	17.40	1631	149.0
PS08100909	-	-				69.00	98.00	12.80	2.00	22.50	12.00	0.53	53.00	32.00	0.60	2.80	23.00	1611	147.2
PS08100950	-	-				76.00	104.0	18.30	2.00	39.30	20.50	0.52	57.80	49.00	0.85	2.80	19.40	1608	146.8
PS08101062	-	-			S	71.00	104.0	12.50	2.00	28.80	9.50	0.33	52.80	25.50	0.48	4.00	18.20	1594	145.6
PS09100092	-			S		69.00	104.0	11.00	2.00	26.30	7.80	0.30	60.30	20.00	0.33	3.00	19.40	1557	142.2
PS09100075	+					72.00	104.0	15.00	2.00	15.50	4.50	0.29	68.80	16.50	0.24	3.50	17.20	1538	140.4
PS09100076	+					72.00	104.0	14.80	2.00	14.30	7.80	0.55	69.80	23.00	0.33	4.00	15.40	1524	139.2
PS08101071	-	-				69.00	104.0	12.30	2.00	30.30	15.30	0.50	55.50	33.80	0.61	4.00	23.00	1504	137.3
PS08100934	-	-				69.00	104.0	13.00	2.00	21.00	9.30	0.44	48.00	33.80	0.70	2.50	20.40	1499	136.9
PS08101192	-	-				72.00	104.0	11.50	1.00	31.50	25.80	0.82	56.80	54.30	0.96	2.80	17.90	1498	136.8
PS08100930	-	-				69.00	104.0	13.50	2.00	35.50	10.30	0.29	61.80	41.80	0.68	4.30	22.50	1491	136.2
PS08100963	-	-				71.00	104.0	16.30	2.00	35.30	31.50	0.89	59.30	51.80	0.87	2.80	17.30	1491	136.1
PS08101342	+	-		S		69.00	104.0	14.50	2.00	13.80	9.50	0.69	55.80	30.80	0.55	4.00	30.50	1477	134.9
PS08101266	-	-				76.00	104.0	13.50	2.00	45.30	31.00	0.68	65.80	65.80	1.00	3.50	17.40	1415	129.2
PS09100170	-				S	72.00	104.0	16.00	2.00	38.00	12.50	0.33	62.80	24.50	0.39	3.30	18.60	1391	127.1
PS08101079	-	-				71.00	104.0	12.00	2.00	34.50	21.00	0.61	55.80	48.30	0.87	3.80	21.90	1290	117.8
PS08100347	-	-			S	76.00	104.0	13.80	2.00	34.30	16.30	0.48	57.30	32.50	0.57	3.50	17.90	1219	111.3
PS08101395	-	-		S		69.00	107.0	14.30	2.00	25.50	15.30	0.60	69.80	37.00	0.53	6.30	30.10	1193	108.9
PS08101029	-	-				71.00	104.0	15.30	2.00	26.00	13.80	0.53	58.00	23.00	0.40	2.80	22.30	1192	108.9
Delta	-	-	R	S	S	71.00	98.00	16.80	2.00	36.30	13.30	0.37	53.30	32.00	0.60	2.80	16.90	1095	100.0
PS08101080	-	-				69.00	104.0	10.80	2.00	30.30	26.80	0.88	54.30	46.50	0.86	4.30	23.20	1082	98.8
GRAND MEAN						70.85	103.0	14.23	1.92	29.43	16.09	0.54	59.98	35.34	0.60	3.42	20.09	1676	
CV						2.91	2.28	11.95	13.73	31.33	47.92	31.18	12.16	36.48	35.49	21.56	15.01	16.16	

Leaf Type: + = normal leaf; - = afila or semi-leafless. Vine Type: + = tall vine; - = short vine.

FW 1 = Fusarium Wilt Race 1; R = resistant; S = susceptible. PM = Powdery Mildew; R = resistant; S = susceptible. PEMV = Pea Enation Mosiac Virus; R = resistant; S = susceptible.

Pod height was measured at the green pod stage and at harvest maturity. Pod height index = pod height at harvest maturity divided by the pod height at the green pod stage.

Plant height was measured at the green pod stage and at harvest maturity. Plant height index = plant height at harvest maturity divided by the green plant height at the green pod stage.

Repr Nodes = average number of reproductive nodes on a plant.

Planting Date 4/20/10 Harvest Date 8/12/10

Agronomic and Yield Data for the Dry Winter Pea Advanced Yield Trial (1022)

Name	Leaf Type	Vine Type	FW 1	PM	PEMV	Days to Flower	Days to Maturity	Flower Node	Pods/ Peduncle	Pod Height	Pod Ht Maturity	Pod Ht Index	Vine Length	Canopy Height	Plant Ht Index	# Repr Nodes	100 Seed Weight	Seed Yield	% of WINDHAM
										..cm..	..cm..		..cm..	..cm..			..g..	kg/ha	
Windham	-	-	R	S	S	247.7	289.7	13.60	2.00	14.30	8.30	0.54	56.80	34.50	0.62	5.50	13.00	2730	100.0
PS05300234W	-	-	R	S	S	245.7	295.3	10.00	2.00	13.20	4.90	0.35	56.50	30.90	0.55	6.50	14.40	2706	99.12
PS0230F092	-	-	R	S	S	251.0	294.7	12.10	2.00	9.40	6.10	0.62	49.90	22.60	0.45	5.30	11.20	2624	96.13
PS03101160W	-	-	R	S	S	250.0	290.0	11.90	2.00	14.30	6.30	0.43	55.80	28.30	0.51	5.70	13.00	2214	81.09
Specter	-	+	R	S	S	247.0	289.0	15.30	2.00	13.30	6.20	0.47	51.40	31.40	0.62	5.30	12.30	2004	73.39
PS03101269W	-	+	R	S	S	253.7	298.7	15.30	2.00	13.60	5.10	0.37	116.4	32.40	0.28	5.70	13.60	1616	59.21
PS0017018W	+	+	R	S	S	256.0	298.7	17.30	2.00	13.90	7.40	0.52	92.00	31.80	0.38	5.70	12.50	1549	56.74
PS0230F063	-	-	R	S	S	248.3	294.0	14.50	2.00	10.10	4.40	0.40	65.50	28.40	0.45	6.40	13.40	1533	56.15
PS05300180W	-	-	R	S	S	251.0	296.3	10.80	2.00	13.00	6.20	0.49	53.90	35.30	0.67	6.20	11.50	1331	48.75
PS05300225W	+	-	R	S	S	250.0	299.7	12.30	2.00	11.50	3.30	0.28	62.00	23.80	0.38	8.20	15.20	1159	42.45
PS03100848W	+	+	R	S	R/S	252.0	301.0	14.10	2.00	13.40	2.10	0.17	92.60	25.90	0.28	6.70	14.90	1079	39.52
PS05300239W	-	-	R	S	S	245.7	298.7	7.80	1.00	11.30	5.30	0.45	49.80	29.60	0.60	6.90	16.70	702.0	25.71
GRAND MEAN						249.8	295.5	12.91	1.89	12.62	5.48	0.43	66.90	29.57	0.48	6.18	13.48	1771	
CV						0.71	1.33	14.45	8.82	23.38	48.27	38.60	14.97	22.64	28.75	23.46	6.35	17.05	
LSD						2.50	5.52	2.62	0.23	4.14	3.71	0.23	14.04	9.39	0.19	2.03	1.20	620.4	

Leaf Type: + = normal leaf; - = afila or semi-leafless. Vine Type: + = tall vine; - = short vine.

FW 1 = Fusarium Wilt Race 1; + = resistant; - = susceptible. PM = Powdery Mildew; - = resistant; + = susceptible. PEMV = Pea Enation Mosiac Virus; + = resistant; - = susceptible.

Pod height was measured at the green pod stage and at harvest maturity. Pod height index = pod height at harvest maturity divided by the pod height at the green pod stage.

Plant height was measured at the green pod stage and at harvest maturity. Plant height index = plant height at harvest maturity divided by the green plant height at the green pod stage.

Repr Nodes = average number of reproductive nodes on a plant.

Agronomic data are means of three replications at Pullman, WA. Planting Date 10/5/2009 Harvest Date: 08/6/2010

Agronomic and Yield Data for the Winter Dry Pea Preliminary Yield Trial (1023)

Name	Leaf Type	Vine Type	FW 1	PM	PEMV	Days to Flower	Days to Maturity	Flower Node	Pods/ Peduncle	Pod Height	Pod Ht Maturity	Pod Ht Index	Vine Length	Canopy Height	Plant Ht Index	# Repr Nodes	100 Seed Weight	Seed Yield	% of Windham
										..cm..	..cm..		..cm..	..cm..			..g..	kg/ha	
Windham	-	-	R	S	S	247.7	289.0	14.50	2.00	18.20	13.50	0.74	50.90	32.00	0.63	5.50	12.30	1762	100.0
PS07300050W	-	-				168.0	201.7	14.60	2.00	11.10	7.00	0.65	45.40	33.30	0.74	5.00	14.30	1694	96.11
Specter	-	+	R	S	S	247.7	290.3	15.90	2.00	13.60	8.30	0.62	58.30	29.90	0.51	6.10	11.90	1468	83.32
PS06300048W	-	+				247.0	296.3	15.30	2.00	16.60	7.90	0.49	108.3	41.20	0.38	6.00	10.80	1385	78.60
PS06300064W	-	+				259.3	293.0	17.90	2.00	17.10	11.80	0.69	102.6	34.70	0.34	5.30	9.90	1204	68.33
PS06300063W	-	+				262.3	303.0	17.00	2.00	15.30	5.90	0.40	100.9	35.50	0.35	6.50	12.00	1066	60.50
PS06300008W	-	+				252.0	298.7	16.00	2.00	16.20	7.60	0.44	102.3	33.90	0.33	6.40	11.60	1060	60.14
PS07300046W	-	+				0.00	0.00	12.10	1.00	11.30	2.40	0.22	40.80	20.20	0.49	4.00	15.40	352.4	20.00
GRAND MEAN						210.5	246.5	15.42	1.83	14.93	8.05	0.53	76.18	32.59	0.47	5.62	12.27	1249	
CV						24.60	25.15	8.63	18.82	26.69	27.52	22.71	8.99	20.73	20.69	15.71	15.93	28.69	
LSD						90.70	108.6	2.33	0.60	6.98	3.88	0.21	11.99	9.72	0.17	1.54	3.42	775.3	

Leaf Type: + = normal leaf; - = afila or semi-leafless. Vine Type: + = tall vine; - = short vine.

FW 1 = Fusarium Wilt Race 1; + = resistant; - = susceptible. PM = Powdery Mildew; - = resistant; + = susceptible. PEMV = Pea Enation Mosiac Virus; + = resistant; - = susceptible.

Pod height was measured at the green pod stage and at harvest maturity. Pod height index = pod height at harvest maturity divided by the pod height at the green pod stage.

Plant height was measured at the green pod stage and at harvest maturity. Plant height index = plant height at harvest maturity divided by the green plant height at the green pod stage.

Repr Nodes = average number of reproductive nodes on a plant.

Agronomic data are means of three replications at Pullman, WA. Planting Date 10/05/2010 Harvest Date: 08/06/2010

Agronomic and Yield Data for the Winter Dry Pea Observation Nursery (1025)

Name	Leaf Type	Vine Type	FW 1	PM	PEMV	Days to Flower	Days to Maturity	Flower Node	Pods/ Peduncle	Pod Height	Pod Ht Maturity	Pod Ht Index	Vine Length	Canopy Height	Plant Ht Index	# Repr Nodes	100 Seed Weight	Seed Yield
										..cm..	..cm..		..cm..	..cm..			..g..	kg/ha
Windham	-	-		S		249.0	287.0	12.30	2.00	13.30	3.80	0.29	55.00	31.30	0.57	5.50	7.00	891.4
ASSAS	+	+				0.00	0.00	10.30	1.00	8.30	1.00	0.12	75.50	19.30	0.26	6.50	8.60	32.10
CHEYENNE	-	-				256.0	291.0	12.50	1.00	12.50	4.50	0.36	31.50	18.00	0.57	2.80	10.60	59.10
EFB333	+	+				249.0	294.0	14.80	2.00	9.50	3.30	0.35	93.80	25.00	0.27	4.00	5.40	799.0
PICARD	+	+				252.0	294.0	11.80	2.00	10.30	3.50	0.34	85.50	20.30	0.24	6.30	6.00	404.7
PRO 024-7510	-	-																
PS06300190W	-	+				256.0	296.0	12.50	1.00	8.80	2.30	0.26	84.30	17.50	0.21	5.80	6.30	66.00
PS07300027W	-	+				254.0	301.0	17.50	2.00	12.80	4.50	0.35	96.30	22.50	0.23	6.30	5.00	478.3
PS07300028W	-	+				258.0	301.0	14.50	2.00	16.30	4.50	0.28	104.0	28.00	0.27	5.50	3.60	834.6
PS07300045W	-	-		R		249.0	289.0	14.00	1.00	14.80	5.80	0.39	42.00	31.00	0.74	3.00	6.20	292.3
PS07300047W	-	-		R		252.0	294.0	14.80	2.00	16.30	8.80	0.54	53.50	43.80	0.82	4.80	7.00	769.4
PS07300054W	-	-				247.0	294.0	11.50	1.00	14.50	6.30	0.43	61.50	33.00	0.54	5.80	10.60	867.4
PS07300062W	-/+	-				254.0	287.0	15.50	2.00	19.30	9.00	0.47	42.00	31.80	0.76	3.30	5.60	212.9
PS07300070W	-	-		R		249.0	289.0	11.50	2.00	14.30	5.50	0.38	37.80	25.30	0.67	4.00	7.00	233.4
PS07300082W	+	+		R/S														
PS07300150W	-	+				256.0	301.0	13.80	2.00	17.80	1.50	0.08	79.30	16.50	0.21	5.80	8.90	117.1
PS07300169W	+/-	+				252.0	294.0	12.50	2.00	8.50	2.50	0.29	84.80	27.80	0.33	7.00	7.80	620.4
PS07300178W	-	-		R		247.0	287.0	12.00	2.00	7.00	1.50	0.21	45.00	25.50	0.57	5.50	9.80	808.9
GLACIER	+	-		S		249.0	287.0	13.00	2.00	9.80	3.30	0.34	46.30	18.80	0.41	3.50	7.00	413.3
GRAND MEAN						251.8	292.7	13.22	1.71	12.59	4.21	0.32	65.77	25.61	0.45	5.02	7.18	441.4
CV						1.32	1.66	13.16	26.71	28.24	53.62	34.67	34.46	27.23	46.29	25.69	25.88	71.25
LSD																		

Leaf Type: + = normal leaf; - = afila or semi-leafless. Vine Type: + = tall vine; - = short vine.
FW 1 = Fusarium Wilt Race 1: R = resistant; S = susceptible; PM = Powdery Mildew: R = resistant; S = susceptible; PEMV = Pea Enation Mosiac Virus: R = resistant; S = susceptible.
Pod height was measured at the green pod stage and at harvest maturity. Pod height index = pod height at harvest maturity divided by the pod height at the green pod stage.
Plant height was measured at the green pod stage and at harvest maturity. Plant height index = plant height at harvest maturity divided by the green plant height at the green pod stage.
Repr Nodes = average number of reproductive nodes on a plant.
Planting Date 10/05/2009 Harvest Date: 08/06/2010

PROGRESS REPORT: LENTIL BREEDING

LENTIL YIELD TRIALS

Advanced lentil yield trials were planted at three locations in 2010: Pullman, WA; Fairfield, WA, and Kendrick, ID. Each location had individual yield trials for advanced breeding lines representing the lentil market classes: Large- Seeded Yellow cotyledons, Turkish Red, Eston, Spanish Brown (Pardina), and Zero-Tannin. The entire Kendrick trial was abandoned due to extensive and severe Aphanomyces root.

Twenty nine entries and four check varieties (Brewer, Merrit, Richlea and Riveland) were included in the advanced large-seeded, yellow cotyledon lentil yield trial in 2010. The mean yield at Pullman was 800 kg/ha and the mean yield at Fairfield was 2420 kg/ha. The breeding line LC01602300R, did not perform as well as in the three previous years. Eight breeding lines and three checks had higher average yields. The highest yielding check was Merrit (1757 kg/ha) while the lowest was Brewer (1586 kg/ha). Sixteen breeding lines had greater yields than Brewer and five had yields greater than Merrit. The largest seed weight among checks was observed for Riveland (6.8 g/100 seeds) and the smallest was Richlea (5.3 g/100 seeds). Fifteen breeding lines had seed weights that were statistically equivalent to Riveland (6.3 – 7.2 g/100sd), four lines had seed weights that were greater than Riveland (>7.2g/100sd). Several advanced breeding lines also exhibited superior lodging tolerance and plant height when compared to the commercial check varieties. Preliminary breeding lines (N = 17) of large seeded, yellow cotyledon lentils were also evaluated in 2010 at Pullman, WA. Several preliminary lines were identified that will be promoted into advanced yield trials conducted in 2011 based on superior yield, seed quality, and lodging tolerance. Breeding objectives for this broad class of lentils include improving seed color and seed shape while increasing yields and seed size.

Advanced yield trials for the Turkish Red market class included 11 advanced breeding lines and the check variety ‘Crimson’. The mean yield at Pullman was 891kg/ha and the mean yield at Fairfield was 1340 kg/ ha. The grand mean over both locations was 1116 kg/ha. When averaged over all three locations, three advanced breeding lines yielded higher than Crimson (1165 kg/ka). One advanced breeding line, LC01602062T, had higher yields (929 kg/ha (Pullman) and 1696 kg/ha (Fairfield)) than Crimson (777kg/ha (Pullman) and 1653 kg/ha (Fairfield)) at both locations. This breeding line has a larger, more spherical seed than the check Crimson, and represents the seed shape that characterizes the ‘Turkish Red’ lentil class. All 11 advanced breeding lines had significantly larger seed size (100 seed weight) than Crimson. Data collected on the advanced breeding lines indicate that progress has been made in improving yield and seed size. Breeding efforts will continue to improve other important traits, including height and tolerance to lodging, and introgress these desirable traits into lines with excellent seed quality and high yields.

Six Eston type advanced breeding lines were compared to the check variety Eston and the new variety Essex (tested as LC01602307E) in 2010. The mean yield at Pullman was 808 kg/ha and the mean yield at Fairfield was 2207 kg/ha. The grand mean over both locations was 1508 kg/ha. Four advanced breeding lines (LC08600039E, LC08600005E, LC01602273E, and LC05600812E) had yields that were greater than Eston at all three locations. Breeding line

LC005600812E had the highest yield (1811 kg/ha) of all entries. The three highest yielding advanced breeding lines (LC005600812E, LC01602273E and LC08600005E) had average yields that were 34%, 24%, and 20% greater than that of Eston. These three breeding lines had seed weights that were slightly larger that Eston (3.3 g/100 seeds). These three breeding lines also were similar to Eston with respect to lodging tolerance, plant height, and maturity. Data collected on the nine advanced breeding lines indicate that excellent progress is being made on developing breeding lines that greatly exceed the yield of Eston while maintaining desirable seed size and agronomic characters required for this market class.

Eleven Spanish Brown advanced breeding lines were compared to the check variety Pardina in 2010. The mean yield at Pullman was 634 kg/ha and the mean yield at Fairfield was 2135 kg/ha. The grand mean over both locations was 1400 kg/ha. Seven advanced breeding lines (LC08600113P, LC08600114P, LC08600109P and LC08600116P, LC02601144P, LC08600115P and LC06600907P) had yields that were greater than Pardina (1400 kg/ha). Plant Height Index, an indicator of lodging tolerance, and canopy height, another indicator of ease of harvesting, were both equivalent to Pardina in six of the lines. LC08600116P has a plant height index that is statistically better than Pardina. The seed weights of the three highest yielding entries tended to be slightly greater that of Pardina. Data collected from the 11advanced breeding lines indicates that progress is being made in improving yield, height, and lodging tolerance in Spanish Brown breeding lines. LC02601144P is being released and has been named 'Morena'.

Six Zero-Tannin advanced breeding lines were compared to the yellow-seeded Zero-Tannin check Shasta and the red-seeded Zero-Tannin check Cedar in 2010. The mean yield at Pullman was 761 kg/ha and the mean yield at Fairfield was 1265 kg/ ha. The grand mean over both locations was 1013 kg/ha. Cedar was the highest yielding (1564 kg/ha) entry at Fairfield and LC06600939YZ was the highest yielding (919 kg/ha) entry at Pullman. The advanced breeding line LC06600939YZ, had the best plant height index (tolerance to lodging) and pod height index (high pods at harvest). As in 2009, the second highest yielding breeding line was the red cotyledon line LC99602585RZ. Results suggest gains are being made in developing high yielding Zero-Tannin lentils with both yellow and red cotyledons.

Variety Release

Morena is a high yielding Pardina type lentil. Over thirteen location-years of advanced yield trials Morena has averaged 1348 kg/ha, a 13.1% increase over Pardina during the same trials (1192 kg/ha). The seed size of Morena is very similar to that of Pardina (≈ 3.8 g/100 seed). Besides high yield and good seed characteristics, Morena is considerably taller than Pardina and has better tolerance to lodging (Table 1). Foundation seed of 'Morena' was produced in 2010. Plant Variety Protection has been applied for. Morena will be distributed through a licensing agreement with the Washington State Crop Improvement Association. Please contact Ron Whittum (509.335.8250) for more information.

Table 1. Comparison of Morena (LC02601144P) and Pardina based on 13 location-years of data from advanced yield trials conducted in Washington and Idaho (2005-2009).

Line	Canopy Height (cm)	Days to Maturity	Plant Height Index[a]	Seed Weight (gm/100 seeds)	Yield (kg/ha)
LC02601144P	33	93.8	0.85	3.8	1348
Pardina	25.4	92.4	0.79	3.9	1192

[a]Plant Height Index = Plant Height mature green stage/Plant Height harvest stage.

Potential Variety Releases

LC01602062T is a large seeded Turkish Red type lentil that averaged 1146 kg/ha over 12 location-years of evaluation in advanced yield trials, which represents a 17.9% increase in yield over the cultivar Crimson (972 kg/ha) over the same trials. LC01602062T has a much larger seed than Crimson (Table 2), which makes it much more amenable to splitting. In 2010 the line will be proposed for release and breeder seed will be produced.

Table 2. Comparison of LC01602062T and Crimson based on 12 location-years of data from advanced yield trials conducted in Washington and Idaho (2005-2009).

Line	Canopy Height (cm)	Days to Maturity	Plant Height Index[a]	Seed Weight (gm/100 seeds)	Yield (kg/ha)
LC01602062T	30.5	94	0.90	4.6	1146
Crimson	28.1	92.6	0.88	3.3	972

[a]Plant Height Index = Plant Height mature green stage/Plant Height harvest stage.

For two consecutive years (2008-2009) LC01602300R has placed first in the large seeded green lentil advanced yield trials. LC01602300R has a seed that is similar in size to Richlea (≈ 5 g/100 seeds) and has yielded an average of 1174 kg/ha over 10 location-years of advanced yield trials (Table 3). This represents a yield increase of 10.3% over Richlea. In 2010 LC01602300R will be proposed for release and breeder seed will be produced.

Table 3. Comparison of LC01602300R and Richlea based on 10 location-years of data from advanced yield trials conducted in Washington and Idaho (2005-2009).

Line	Canopy Height (cm)	Days to Maturity	Plant Height Index[a]	Seed Weight (gm/100 seeds)	Yield (kg/ha)
LC01602300R	34.4	97.5	0.95	4.9	1174
Richlea	33.4	96.5	0.91	5.2	1064

[a]Plant Height Index = Plant Height mature green stage/Plant Height harvest stage.

WINTER LENTIL YIELD TRIALS

Advanced yield trials for fall sown winter-hardy Turkish Red lentils, which included 12 advanced breeding lines and the variety Morton, were planted in three locations in WA: Pullman, Rosalia, and Garfield. Reliable yield data was only obtained from the Pullman location. Yields were high at this location, averaging 2350 kg/ha. The highest yield among entries was 3194 kg/ha, for the advanced breeding line LC05600512T, a small seeded red lentil. The second and third highest yields were 3090 kg/ha and 2905 kg/ha, observed for breeding line LC03600232T and the cultivar Morton, respectively. The most promising entry among winter hardy lentil breeding lines is LC03600232T, which has been observed over 10 site/years of advanced yield trials to average 1319 kg/ha, which is approximately 91% the yield of Morton (1436 kg/ha). LC03600232T has an oval shape that is characteristic of Turkish Red lentils and a mean seed size of 3.6 g/100 seeds, which is considerably larger than the seed size of Morton (3.2 g/100 seeds), which has a flatter seed shape. These seed characters may make LC03600232T an acceptable lentil for decorticating and polishing prior to marketing.

OTHER PROGRESS TO REPORT

Mineral Nutrition

A preliminary survey of the diversity of the mineral nutrients in lentils was conducted from the 2009 harvest. Seed samples harvested from each entry in the Kendrick and Fairfield 2009 Turkish Red, Eston, Pardina, Large-Seeded Yellow and Winter lentil advanced yield trials were analyzed for mineral concentration using inductively-coupled plasma atomic-emission spectroscopy. Concentrations of the macro-nutrients Ca, K, P, Mg and S and the micro-nutrients Co, Cu, Fe, Mn, Se and Zn were determined. There was significant variation among the entries and among the locations for the minerals evaluated. An additional year of analysis will allow partitioning the sources of variance into that due to genotype, to environment and the genotype-by-environment interaction. Some summary statistics are presented below. Summary statistics for each entry are available.

There were significant differences between the market classes for levels of the macro-nutrient minerals. Typically, winter lentils had among the highest levels of the macro-nutrient minerals, except for P. (Table 4.)

Table 4. Concentration of the macro-nutrient minerals by market class (means followed by different letters are significantly different, $p<.01$)

Market Class	Ca (mg/g DW)	
Pardina	0.17 (0.03)	a
Turkish Red	0.16 (0.03)	ab
Winter	0.16 (0.02)	abc
Eston	0.15 (0.03)	abc
Large Seeded Yellow	0.13 (0.04)	bc
Zero Tannin	0.12 (0.03)	c

Market Class	P (mg/g DW)	
Turkish Red	4.95 (0.09)	a
Zero Tannin	4.69 (0.16)	a
Large Seeded Yellow	4.63 (0.08)	a
Eston	4.62 (0.13)	a
Pardina	4.56 (0.14)	a
Winter	3.60 (0.05)	b

Market Class	Mg (mg/g DW)	
Zero Tannin	1.27 (0.01)	a
Eston	1.16 (0.02)	b
Winter	1.15 (0.02)	b
Turkish Red	1.11 (0.01)	bc
Large Seeded Yellow	1.11 (0.01)	bc
Pardina	1.06 (0.02)	c

Market Class	S (mg/g DW)	
Winter	2.08 (0.02)	a
Large Seeded Yellow	1.94 (0.02)	b
Zero Tannin	1.94 (0.02)	b
Eston	1.81 (0.03)	c
Turkish Red	1.77 (0.02)	c
Pardina	1.65 (0.02)	d

There were significant differences among the market classes for all the micro-nutrient minerals except Fe. (Table 5.)

Table 5. Concentration of the micro-nutrient minerals by market class (means followed by different letters are significantly different, $p<.01$).

Market Class	Ni (ug/g DW)
Winter	3.95 (0.19) a
Zero Tannin	2.95 (0.06) b
Large Seeded Yellow	2.85 (0.06) b
Turkish Red	2.64 (0.14) bc
Eston	2.60 (0.10) bc
Pardina	2.35 (0.08) c

Market Class	Cu (ug/g DW)
Turkish Red	11.72 (0.28) a
Winter	9.52 (0.21) b
Pardina	9.32 (0.20) b
Zero Tannin	9.29 (0.13) b
Eston	9.12 (0.17) b
Large Seeded Yellow	9.08 (0.12) b

Market Class	Mn (ug/g DW)
Zero Tannin	22.90(0.44) a
Large Seeded Yellow	17.60(0.29) b
Winter	17.10(0.47) bc
Turkish Red	17.01(0.50) bc
Pardina	16.13(0.26) bc
Eston	15.31(----) c

Market Class	Co (ug/g DW)
Pardina	0.17 (0.01) a
Turkish Red	0.16 (0.01) ab
Winter	0.16 (0.01) abc
Eston	0.15 (0.01) abc
Large Seeded Yellow	0.13 (0.005) bc
Zero Tannin	0.12 (0.005) c

Market Class	K (ug/g DW)
Large Seeded Yellow	10.64 (0.07) a
Turkish Red	10.13 (0.05) b
Eston	9.98 (0.14) bc
Pardina	9.53 (0.08) cd
Zero Tannin	9.31 (0.18) d
Winter	8.90 (0.13) d

Market Class	Zn (ug/g DW)
Large Seeded Yellow	55.86 (0.90) a
Zero Tannin	54.07 (0.70) ab
Eston	51.54 (0.70) ab
Turkish Red	51.08 (1.30) b
Pardina	45.59 (0.71) c
Winter	37.21 (-----) d

Market Class	Fe (ug/g DW)
Pardina	87.84 (4.23) a
Turkish Red	87.27 (2.54) a
Eston	85.72 (2.87) a
Large Seeded Yellow	81.71 (1.08) a
Zero Tannin	79.57 (1.22) a
Winter	79.21 (2.07) a

Market Class	Se (ug/g DW)
Winter	0.55 (0.02) a
Pardina	0.53 (0.02) a
Eston	0.50 (0.02) ab
Turkish Red	0.45 (0.02) abc
Zero Tannin	0.41 (0.03) bc
Large Seeded Yellow	0.38 (----) c

There were significant differences between locations for most of the mineral nutrients. There were no significant differences in Calcium, Manganese or Selenium concentration between the two locations. For Copper, Potassium, Magnesium, Nickel, Phosphorus and Sulfur concentrations were higher at Fairfield and only Zinc and Iron were higher at Kendrick (Tables 6 and 7).

Table 6. Effect of location on micro-nutrient mineral content in Lentils (means followed by different letters are significantly different: p< .01).

	Cu (ug/g DW)	Fe (ug/g DW)	Mn (ug/g DW)	Ni (ug/g DW)	Se (ug/g DW)	Zn (ug/g DW)
Fairfield	9.84 a	80.9 b	17.5 a	2.9 a	0.43 a	49.1 b
Kendrick	9.38 b	86.9 a	18.2 a	2.5 b	0.44 a	55.8 a

Table 7. Effect of location on macro-nutrient mineral content in Lentils (means followed by different letters are significantly different: p< .01).

	Ca (mg/g DW)	K (mg/g DW)	Mg (mg/g DW)	P (mg/g DW)	S (mg/g DW)
Fairfield	0.84 a	10.4 a	1.2 a	5.2 a	1.9 a
Kendrick	0.80 a	9.7 b	1.1 b	4.2 b	1.8 b

Agronomic Data for the Eston Type Advanced Yield Trial (1051E)

Name	Days to Flower	Days to Maturity	Pods/ Peduncle	Pod Height	Pod Ht Maturity	Pod Ht Index	Vine Length	Canopy Height	Plant Ht Index	100 Seed Weight
				..cm..	..cm..		..cm..	..cm..		..g..
LC05600812E	66.00	103.0	2.00	11.40	7.40	0.64	33.90	28.50	0.85	3.80
LC01602273E	66.30	102.0	2.00	8.50	6.60	0.78	34.40	29.40	0.85	3.50
LC08600005E	67.30	104.0	2.00	9.60	5.90	0.60	33.10	30.00	0.91	4.50
ESSEX	68.00	105.0	2.00	9.40	5.70	0.61	35.40	31.00	0.88	4.10
LC08600039E	66.00	104.0	2.00	7.40	4.40	0.60	31.40	26.80	0.86	3.80
Eston	68.70	105.0	2.00	7.30	4.50	0.65	27.30	27.00	0.99	3.30
LC08600069E	65.30	103.0	2.00	7.90	5.00	0.66	30.80	27.60	0.90	3.80
LC07600198E	45.70	105.0	2.00	7.40	4.40	0.63	29.00	26.00	0.89	3.40
GRAND MEAN	64.17	103.7	1.88	8.63	5.49	0.65	31.92	28.29	0.89	3.78
CV	22.09	1.78	18.86	19.01	19.33	24.93	7.46	6.32	8.59	2.70
LSD	24.83	3.24	0.62	2.87	1.86	0.28	4.17	3.13	0.13	0.18

Planting Date: 04/20/2010. Harvest Date: 08/17/2010.

Pod height was measured at the green pod stage and at harvest maturity. Pod height index = pod height at harvest maturity divided by the pod height at the green pod stage.

Plant height was measured at the green pod stage and at harvest maturity. Plant height index = plant height at harvest maturity divided by the green plant height at the green pod stage.

Agronomic data are means of three replications at Pullman, WA

Check Variety = Eston

Location Yield Summary for the Eston Type Lentil Advanced Yield Trial (1051E)

Name	Pullman Seed Yield kg/ha	Kendrick Seed Yield kg/ha	Fairfield Seed Yield kg/ha	Farmington Seed Yield kg/ha	Mean Seed Yield kg/ha	% of Eston kg/ha
LC05600812E	1092.00	Not Harvested	2530.40	Not Planted	1811.20	134.00
LC01602273E	972.40		2379.70		1676.10	124.00
LC08600005E	978.20		2267.60		1622.90	120.00
ESSEX	957.00		2151.60		1554.30	115.00
LC08600039E	699.30		2083.50		1391.40	103.00
Eston	560.90		2140.90		1350.90	100.00
LC08600069E	739.10		1964.40		1351.80	100.00
LC07600198E	465.80		2139.10		1302.50	96.00
GRAND MEAN	808.09		2207.17		1507.62	
CV	12.02		3.77		6.00	
LSD	139.63		120.36		106.95	

Yield data are means of three replications at each location.
Check variety = Eston

Mean Yields of the Eston Type Lentil Advanced Yield Trial, 2006 - 2010.

Name	2006	2007	2008	2009	2010
	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha
LC05600812E	...	1639	914	1265	1811
LC01602273E	1149	1630	1000	1272	1676
LC08600005E	...	...	...	...	1623
ESSEX	...	...	...	...	1554
LC08600039E	...	...	...	...	1391
LC08600069E	...	...	...	...	1352
ESTON	639	1348	954	1143	1351
LC07600198E	...	...	...	1298	1303
Grand Mean	698	1499	943	1221	1508
LSD $_{(a=0.05)}$	127	171	93	133	107

Yield data are means of three replications per location,three locations per year except 2006 (two locations).

Agronomic Data for the Pardina Type Advanced Yield Trial (1051P)

Name	Days to Flower	Days to Maturity	Pods/ Peduncle	Pod Height	Pod Ht Maturity	Pod Ht Index	Vine Length	Canopy Height	Plant Ht Index	100 Seed Weight
				..cm..	..cm..		..cm..	..cm..		..g..
LC08600113P	73.00	109.0	2.00	7.10	4.60	0.64	35.90	26.00	0.73	4.30
LC08600114P	71.30	106.0	2.00	5.70	4.50	0.79	39.80	27.80	0.70	4.70
LC08600109P	70.70	102.0	2.00	7.50	6.00	0.76	36.60	25.50	0.70	4.20
LC08600116P	72.30	106.0	2.00	9.50	8.20	0.85	35.80	30.40	0.85	4.80
Morena	71.00	103.0	2.00	9.40	7.60	0.81	38.00	27.80	0.73	3.60
LC06600907P	73.00	107.0	2.00	8.10	5.10	0.62	36.40	23.40	0.65	3.50
LC08600115P	72.00	104.0	2.00	6.90	5.30	0.77	37.80	28.20	0.74	4.30
LC05600995P	71.30	105.0	2.00	3.50	2.80	0.78	36.00	27.50	0.76	4.00
Pardina	70.30	108.0	2.00	3.10	2.30	0.82	35.20	25.50	0.73	3.90
LC0860B014P	72.00	105.0	2.00	8.60	7.40	0.85	38.40	29.70	0.77	3.90
LC07600176P	70.30	104.0	2.00	3.50	2.70	0.75	34.10	25.40	0.74	3.40
LC08600112P	70.30	106.0	2.00	5.70	4.50	0.79	35.50	25.10	0.71	4.30
GRAND MEAN	71.47	105.3	1.97	6.55	5.08	0.77	36.63	26.86	0.74	4.07
CV	1.53	2.44	8.45	31.14	39.21	16.35	5.80	6.86	7.64	3.80
LSD	1.85	4.35	0.28	3.45	3.38	0.21	3.59	3.12	0.10	0.26

Pod height was measured at the green pod stage and at harvest maturity. Pod height index = pod height at harvest maturity divided by the pod height at the green pod stage.
Plant height was measured at the green pod stage and at harvest maturity. Plant height index = plant height at harvest maturity divided by the green plant height at the green pod stage.
Agronomic data are means of three replications at Pullman, WA
Check Variety = Pardina
Planting Date: 04/20/2010. Harvest Date: 8/17/2010.

Location Yield Summary for the Pardina Type Lentil Advanced Yield Trial (1051P)

Name	Pullman Seed Yield kg/ha	Kendrick Seed Yield kg/ha	Fairfield Seed Yield kg/ha	Farmington Seed Yield kg/ha	Mean Seed Yield kg/ha	% of Pardina kg/ha
LC08600113P	961.10	Not Harvested	2481.00	Not Planted	1721.10	123.00
LC08600114P	1018.70		2178.70		1598.70	114.00
LC08600109P	802.20		2283.60		1542.90	110.00
LC08600116P	967.00		2021.90		1494.50	107.00
Morena	1014.10		1941.40		1477.80	106.00
LC06600907P	869.60		2036.20		1452.90	104.00
LC08600115P	902.10		2009.10		1455.60	104.00
LC05600995P	845.90		1940.50		1393.20	100.00
Pardina	663.50		2135.40		1399.50	100.00
LC0860B014P	921.70		1765.80		1343.80	96.00
LC07600176P	511.60		2038.90		1275.30	91.00
LC08600112P	555.20		1930.40		1242.80	89.00
GRAND MEAN	836.05		2063.59		1449.82	
CV	13.13		11.74		12.97	
LSD	154.27		340.41		218.86	

Yield data are means of three replications at each location.
Check variety = Pardina

Mean Yields of the Pardina Type Lentil Advanced Yield Trial, 2006-2010.

Name	2006	2007	2008	2009	2010
	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha
LC08600113P	…	…	…	…	1721
LC08600114P	…	…	…	…	1599
LC08600109P	…	…	…	…	1543
LC08600116P	…	…	…	…	1495
LC02601144P	899	1439	1147	1507	1478
LC08600115P	…	…	…	…	1456
LC06600907P	…	…	1001	1454	1453
PARDINA	1069	1370	943	1444	1400
LC05600995P	…	…	…	…	1393
LC0860B014P	…	…	…	…	1344
LC07600176P	…	…	…	…	1275
LC08600112P	…	…	…	…	1243
Grand mean	940	1257	871	1389	1450
LSD $_{(a=0.05)}$	199	179	115	137	219

Yield data are means of three replications per location, three locations per year except 2006 and 2010 (two locations) .

Agronomic Data for the Turkish Red Type Advanced Yield Trial (1051T)

Name	Days to Flower	Days to Maturity	Pods/ Peduncle	Pod Height	Pod Ht Maturity	Pod Ht Index	Vine Length	Canopy Height	Plant Ht Index	100 Seed Weight
				..cm..	..cm..		..cm..	..cm..		..g..
LC01602062T	65.70	100.0	2.00	6.20	4.50	0.73	35.10	30.00	0.85	4.40
LC0860B098T	67.30	103.0	2.00	6.10	4.00	0.66	35.30	21.30	0.60	3.50
LC05600043T	65.30	102.0	2.00	4.50	2.40	0.61	37.80	28.30	0.75	4.50
Crimson	69.00	104.0	2.00	6.50	5.30	0.79	31.20	22.40	0.72	3.40
LC08600132T	64.70	99.00	2.00	6.30	4.00	0.62	37.70	24.60	0.65	4.00
LC0860B085T	67.00	101.0	2.00	4.40	3.40	0.77	39.60	26.70	0.67	4.80
LC06601228T	66.00	100.0	2.00	6.20	4.90	0.78	37.90	27.80	0.73	4.50
LC08600185T	67.00	100.0	2.00	5.50	3.40	0.62	37.00	23.70	0.64	4.10
LC0860B096T	64.70	101.0	2.00	5.40	4.10	0.78	37.50	26.30	0.71	4.70
LC0860B094T	67.00	102.0	2.00	5.30	3.40	0.61	36.20	24.70	0.69	3.90
LC06601934T	65.70	101.0	2.00	7.20	5.20	0.73	37.50	25.60	0.69	4.10
LC08600198T	68.00	103.0	2.00	8.60	7.60	0.87	37.70	28.10	0.75	4.00
GRAND MEAN	66.44	101.4	1.94	6.02	4.36	0.71	36.71	25.79	0.71	4.16
CV	1.92	1.82	12.39	32.36	43.14	22.98	7.33	11.38	13.12	4.00
LSD	2.16	3.13	0.41	3.30	3.18	0.28	4.55	4.97	0.16	0.28

Pod height was measured at the green pod stage and at harvest maturity. Pod height index = pod height at harvest maturity divided by the pod height at the green pod stage.
Plant height was measured at the green pod stage and at harvest maturity. Plant height index = plant height at harvest maturity divided by the green plant height at the green pod stage.
Agronomic data are means of three replications at Pullman, WA
Check Variety = Crimson
Planting Date: 04/20/2010. Harvest Date: 8/18/2010.

Location Yield Summary for the Turkish Red Type Lentil Advanced Yield Trial (1051T)

Name	Pullman Seed Yield kg/ha	Kendrick Seed Yield kg/ha	Fairfield Seed Yield kg/ha	Farmington Seed Yield kg/ha	Mean Seed Yield kg/ha	% of Crimson kg/ha
LC01602062T	929.40	Not Harvested	1696.30	Not Planted	1312.90	108.00
LC0860B098T	962.80		1603.20		1283.00	106.00
LC05600043T	996.60		1546.20		1271.40	105.00
Crimson	777.10		1652.70		1214.90	100.00
LC08600132T	1031.00		1299.50		1165.30	96.00
LC0860B085T	890.50		1428.90		1159.70	95.00
LC06601228T	895.90		1290.70		1093.30	90.00
LC08600185T	885.10		1311.70		1098.40	90.00
LC0860B096T	923.00		1128.00		1025.50	84.00
LC0860B094T	810.60		1171.20		990.90	82.00
LC06601934T	888.80		1003.30		946.10	78.00
LC08600198T	697.70		954.00		825.90	68.00
GRAND MEAN	890.71		1340.48		1115.59	
CV	13.66		32.74		28.86	
LSD	170.99		616.53		374.67	

Yield data are means of three replications at each location.
Check variety = Crimson

Mean Yields of the Turkish Type Lentil Advanced Yield Trial, 2006-2010.

Name	2006	2007	2008	2009	2010
	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha
LC01602062T	995	1789.3	934	1329	1313
LC0860B098T	…	…	…	…	1283
LC05600043T	…	1343.4	693	1199	1271
CRIMSON	1025	1046.8	614	1099	1215
LC08600132T	…	…	…	…	1165
LC0860B085T	…	…	…	…	1160
LC08600185T	…	…	…	…	1098
LC06601228T	…	…	735	1372	1093
LC0860B096T	…	…	…	…	1026
LC0860B094T	…	…	…	…	991
LC06601934T	…	…	790	1127	946
LC08600198T	…	…	…	…	826
Grand Mean	903	1334	683	1138	1116
LSD $_{(a=0.05)}$	122	282	108	174	375

Yield data are means of three replications per location, three locations per year except 2006 (two locations).

Agronomic Data for the Large Yellow Type Lentil Advanced Yield Trial (1052)

Name	Days to Flower	Days to Maturity	Pods/ Peduncle	Pod Height	Pod Ht Maturity	Pod Ht Index	Vine Length	Canopy Height	Plant Ht Index	100 Seed Weight
				..cm..	..cm..		..cm..	..cm..		..g..
LC06601734L	67.00	110.0	2.00	12.40	8.10	0.66	37.00	35.70	0.97	6.10
LC07600591R	66.70	110.0	2.00	10.40	7.20	0.70	36.60	31.40	0.86	5.50
LC06600517L	69.00	110.0	2.00	11.30	9.30	0.81	38.80	32.00	0.83	6.00
LC06600839L	66.30	108.0	2.00	10.80	9.50	0.88	36.30	29.10	0.81	6.80
LC07600553R	69.00	111.0	2.00	11.40	8.30	0.71	36.60	32.00	0.88	5.30
Merrit	66.30	108.0	2.00	9.00	8.20	0.91	38.90	29.90	0.77	6.20
LC07600151R	65.30	109.0	2.00	11.00	7.30	0.66	37.80	32.90	0.88	5.20
LC07600559L	65.70	111.0	1.00	12.40	7.20	0.58	39.00	30.10	0.77	6.50
Richlea	69.00	112.0	2.00	9.90	7.90	0.81	34.50	29.60	0.86	5.30
LC07600376L	70.30	109.0	2.00	13.10	10.50	0.81	37.50	29.10	0.78	7.00
Riveland	66.30	111.0	2.00	10.90	8.70	0.80	38.50	31.50	0.82	6.80
LC01602300R	68.30	112.0	2.00	11.40	10.30	0.91	33.70	30.70	0.92	5.20
LC06601616R	69.00	111.0	2.00	10.90	8.40	0.76	38.50	32.30	0.84	5.80
LC04600633C	67.30	111.0	2.00	12.00	11.50	0.96	41.40	33.60	0.81	7.10
LC07600524L	67.30	110.0	2.00	11.50	10.50	0.91	36.60	31.30	0.85	6.80
LC07600517L	64.70	112.0	2.00	12.90	11.00	0.84	38.40	34.20	0.90	6.40
LC07600536L	69.00	111.0	2.00	14.30	9.60	0.68	37.40	31.70	0.85	6.30
LC06601388L	66.70	110.0	2.00	10.60	9.00	0.85	38.00	33.10	0.87	6.60
LC07600545L	67.00	110.0	2.00	11.40	10.00	0.88	37.40	30.70	0.82	6.70
Brewer	64.70	111.0	2.00	9.90	5.70	0.59	34.90	31.70	0.91	5.60
LC07600586R	69.00	112.0	2.00	11.70	10.50	0.90	37.10	32.60	0.88	5.80
LC03600854L	65.70	111.0	2.00	7.60	5.70	0.75	40.10	30.80	0.78	6.90
LC06601609L	67.70	110.0	2.00	12.90	10.80	0.84	35.80	32.50	0.91	6.80
LC07600368L	70.30	109.0	2.00	15.60	11.90	0.77	35.90	32.70	0.91	7.30
LC07600364L	69.70	110.0	2.00	11.90	8.00	0.67	37.90	31.60	0.84	6.70
LC02600793L	66.00	110.0	2.00	10.40	6.80	0.69	36.10	31.20	0.87	6.80
LC07600760L	66.00	112.0	1.00	9.80	5.10	0.54	41.20	29.60	0.72	7.20
LC06600880L	65.30	109.0	2.00	10.80	7.70	0.73	37.40	32.80	0.88	6.00

Pod height was measured at the green pod stage and at harvest maturity. Pod height index = pod height at harvest maturity divided by the pod height at the green pod stage.
Plant height was measured at the green pod stage and at harvest maturity. Plant height index = plant height at harvest maturity divided by the green plant height at the green pod stage.
Agronomic data are means of three replications at Pullman, WA.

Check Variety = Merrit

Planting Date: 04/20/2010 Harvest Date: 08/18/2010

Agronomic Data for the Large Yellow Type Lentil Advanced Yield Trial (1052)

Name	Days to Flower	Days to Maturity	Pods/ Peduncle	Pod Height	Pod Ht Maturity	Pod Ht Index	Vine Length	Canopy Height	Plant Ht Index	100 Seed Weight
				..cm..	..cm..		..cm..	..cm..		..g..
LC07600705L	68.00	110.0	2.00	12.10	8.00	0.65	36.00	28.20	0.79	6.70
LC07600380L	68.70	111.0	2.00	13.20	11.80	0.89	41.90	35.20	0.84	6.80
LC07600241L	67.70	112.0	1.00	11.40	10.30	0.90	35.20	30.40	0.87	7.40
LC07600738L	65.30	109.0	2.00	9.90	7.00	0.72	36.70	31.60	0.86	7.10
LC07600684L	69.70	110.0	2.00	12.40	11.20	0.90	37.50	32.90	0.88	7.50
GRAND MEAN	67.39	110.3	1.83	11.44	8.87	0.78	37.48	31.66	0.85	6.43
CV	1.62	1.73	20.86	17.28	25.56	19.65	7.91	6.38	8.05	3.68
LSD	1.78	3.12	0.62	3.22	3.70	0.25	4.84	3.30	0.11	0.39

Pod height was measured at the green pod stage and at harvest maturity. Pod height index = pod height at harvest maturity divided by the pod height at the green pod stage.
Plant height was measured at the green pod stage and at harvest maturity. Plant height index = plant height at harvest maturity divided by the green plant height at the green pod stage.
Agronomic data are means of three replications at Pullman, WA.
Check Variety = Merrit
Planting Date: 04/20/2010 Harvest Date: 08/18/2010

Name	Pullman Seed Yield kg/ha	Kendrick Seed Yield kg/ha	Fairfield Seed Yield kg/ha	Farmington Seed Yield kg/ha	Mean Seed Yield kg/ha	% of Merrit kg/ha
LC06601734L	1037.00	Not Harvested	2773.60	Not Planted	1905.30	120.00
LC07600591R	841.20		2799.40		1820.30	115.00
LC06600517L	791.60		2788.50		1790.10	113.00
LC06600839L	963.00		2623.90		1793.50	113.00
LC07600553R	928.00		2618.70		1773.40	112.00
Merrit	801.40		2712.90		1757.20	111.00
LC07600151R	994.30		2504.40		1749.40	110.00
LC07600559L	978.50		2505.30		1741.90	110.00
Richlea	833.20		2635.80		1734.50	109.00
LC07600376L	848.00		2576.20		1712.10	108.00
Riveland	772.10		2662.50		1717.30	108.00
LC01602300R	729.10		2670.90		1700.00	107.00
LC06601616R	780.10		2613.60		1696.90	107.00
LC04600633C	873.10		2474.00		1673.60	106.00
LC07600524L	847.20		2517.00		1682.10	106.00
LC07600517L	771.00		2518.90		1645.00	104.00
LC07600536L	790.80		2495.90		1643.40	104.00
LC06601388L	759.80		2500.30		1630.10	103.00
LC07600545L	754.50		2461.40		1608.00	101.00
Brewer	751.70		2420.70		1586.20	100.00
LC07600586R	764.20		2356.20		1560.20	98.00
LC03600854L	934.10		2147.40		1540.80	97.00
LC06601609L	639.10		2429.00		1534.10	97.00
LC07600368L	786.50		2288.70		1537.60	97.00
LC07600364L	655.60		2353.90		1504.80	95.00
LC02600793L	774.50		2206.90		1490.70	94.00
LC07600760L	917.90		2042.90		1480.40	93.00
LC06600880L	803.50		2049.10		1426.30	90.00
LC07600705L	638.80		2173.80		1406.30	89.00
LC07600380L	606.80		2182.50		1394.70	88.00
LC07600241L	639.80		2095.50		1367.70	86.00
LC07600738L	786.60		1898.60		1342.60	85.00
LC07600684L	631.00		1765.00		1198.00	76.00
GRAND MEAN	800.73		2420.10		1610.42	
CV	14.44		15.07		16.80	
LSD	157.62		497.06		309.03	

Yield data are means of three replications at each location.
Check variety = Merrit

Mean Yields of the Large Yellow Lentil Advanced Yield Trial, 2006 - 2010.

Name	2006	2007	2008	2009	2010
	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha
LC06601734L	…	…	…	1457	1905
LC07600591R	…	…	…	…	1820
LC06600839L	…	…	…	1366	1794
LC06600517L	…	…	…	1485	1790
LC07600553R	…	…	…	…	1773
MERRIT	798	1543	991	1433	1757
LC07600151R	…	…	…	…	1749
LC07600559L	…	…	…	…	1742
RICHLEA	616	1646	1128	1502	1735
RIVELAND	723	1726	1079	1261	1717
LC07600376L	…	…	…	…	1712
LC01602300R	899	1716	1200	1563	1700
LC06601616R	…	…	…	1482	1697
LC07600524L	…	…	…	…	1682
LC04600633C	…	…	…	1311	1674
LC07600517L	…	…	…	…	1645
LC07600536L	…	…	…	…	1643
LC06601388L	…	…	…	1455	1630
LC07600545L	…	…	…	…	1608
Brewer	…	…	…	1292	1586
LC07600586R	…	…	…	…	1560
LC03600854L	668	1673	982	1338	1541
LC07600368L	…	…	…	…	1538
LC06601609L	…	…	…	1294	1534
LC07600364L	…	…	…	…	1505
LC02600793L	713	1508	975	1260	1491
LC07600760L	…	…	…	…	1480
LC06600880L	…	…	…	1303	1426
LC07600705L	…	…	…	…	1406
LC07600380L	…	…	…	…	1395
LC07600241L	…	…	…	…	1368
LC07600738L	…	…	…	…	1343
LC07600684L	…	…	…	…	1198
Grand Mean	589	1482	969	1343	1610
LSD $_{(a=0.05)}$	112	166	107	168	309

Yield data are means of three replications per location, three locations per year except 2006 and 2010 (two locations).

Agronomic Data for the Zero Tannin Type Advanced Yield Trial (1061)

Name	Days to Flower	Days to Maturity	Pods/ Peduncle	Pod Height	Pod Ht Maturity	Pod Ht Index	Vine Length	Canopy Height	Plant Ht Index	100 Seed Weight
				..cm..	..cm..		..cm..	..cm..		..g..
Cedar	65.30	110.0	2.00	7.80	5.40	0.69	31.60	26.90	0.85	4.10
LC06600939YZ	65.70	114.0	2.00	7.80	7.20	0.92	32.90	29.90	0.91	5.60
LC99602585RZ	66.00	110.0	2.00	7.30	4.30	0.59	29.00	25.40	0.88	3.70
Shasta	65.70	114.0	2.00	8.80	7.30	0.83	32.50	29.40	0.91	5.10
LC07600224YZ	66.30	114.0	2.00	9.30	8.50	0.91	33.60	29.10	0.87	5.30
LC04600415YZ	66.70	114.0	2.00	7.90	7.00	0.88	33.40	29.80	0.90	5.70
LC04600389YZ	67.30	113.0	2.00	10.00	9.30	0.92	29.90	25.30	0.84	5.60
LC06600930YZ	66.00	113.0	2.00	9.50	7.30	0.79	33.30	29.30	0.88	4.90
GRAND MEAN	66.13	112.7	1.83	8.53	7.02	0.82	32.03	28.15	0.88	5.00
CV	1.77	1.15	21.04	18.61	24.34	9.18	7.24	8.17	6.85	3.25
LSD	2.05	2.28	0.68	2.78	2.99	0.13	4.06	4.03	0.11	0.28

Pod height was measured at the green pod stage and at harvest maturity. Pod height index = pod height at harvest maturity divided by the pod height at the green pod stage.
Plant height was measured at the green pod stage and at harvest maturity. Plant height index = plant height at harvest maturity divided by the green plant height at the green pod stage.
Agronomic data are means of three replications at Pullman, WA
Check Variety = Cedar
Planting Date: 04/20/2010. Harvest Date: 08/18/10.

Location Yield Summary for the Zero Tannin Type Lentil Advanced Yield Trial (1061)

Name	Pullman Seed Yield kg/ha	Kendrick Seed Yield kg/ha	Fairfield Seed Yield kg/ha	Farmington Seed Yield kg/ha	Mean Seed Yield kg/ha	% of Cedar kg/ha
Cedar	825.70	Not Harvested	1564.00	Not Planted	1194.90	100.00
LC06600939YZ	918.50		1384.70		1151.60	96.00
LC99602585RZ	704.20		1522.60		1113.40	93.00
Shasta	778.50		1249.90		1014.20	85.00
LC07600224YZ	823.20		1061.10		942.20	79.00
LC04600415YZ	666.50		1161.50		914.00	76.00
LC04600389YZ	613.90		1162.40		888.20	74.00
LC06600930YZ	755.20		1017.50		886.40	74.00
GRAND MEAN	760.70		1265.45		1013.09	
CV	11.32		17.82		16.85	
LSD	124.55		326.02		201.84	

Yield data are means of three replications at each location.
Check variety = Cedar

Agronomic and Yield Data for the Large Yellow Lentil Preliminary Yield Trail (1054)

Name	Days to Flower	Days to Maturity	Pods/ Peduncle	Pod Height	Pod Ht Maturity	Pod Ht Index	Vine Length	Canopy Height	Plant Ht Index	100 Seed Weight	Seed Yield	% of Merrit
				..cm..	..cm..		..cm..	..cm..		..g..	kg/ha	
LC0860B123L	67.70	110.0	2.00	10.30	9.00	0.88	40.20	29.40	0.73	8.20	1175	116.9
LC0860B132L	68.00	107.0	2.00	11.20	8.30	0.74	43.90	34.00	0.77	6.70	1144	113.9
LC07600541L	71.00	110.0	2.00	13.10	8.90	0.68	41.50	33.40	0.80	6.70	1076	107.1
Riveland	69.00	108.0	2.00	12.00	10.00	0.83	44.40	33.30	0.75	6.60	1074	106.9
LC0860B130L	68.00	107.0	2.00	11.30	8.60	0.77	38.40	33.30	0.87	6.60	1032	102.7
LC0860B133L	68.00	108.0	2.00	10.10	8.00	0.75	44.10	32.80	0.75	6.80	1012	100.8
Merrit	67.30	107.0	2.00	11.50	8.00	0.72	42.30	31.60	0.75	5.80	1005	100.0
LC07600233e	69.00	111.0	2.00	11.00	8.00	0.71	42.90	36.20	0.85	5.20	996.2	99.15
LC0860B113L	72.00	108.0	2.00	15.70	12.20	0.78	42.50	31.80	0.75	6.20	995.9	99.12
Brewer	66.70	108.0	2.00	8.40	6.20	0.73	38.30	28.60	0.75	5.60	982.4	97.77
LC07600556L	71.00	108.0	2.00	13.50	11.90	0.88	41.90	35.50	0.85	5.70	954.0	94.95
LC07600378L	73.70	109.0	2.00	14.60	11.20	0.77	39.10	33.80	0.86	6.90	933.0	92.86
LC07600247L	69.00	108.0	2.00	10.40	8.30	0.77	39.30	31.20	0.80	6.50	909.4	90.51
LC0860B110L	71.70	108.0	2.00	11.80	9.90	0.81	41.40	33.50	0.81	6.10	904.9	90.07
LC0860B121L	69.00	107.0	2.00	14.70	11.30	0.75	43.50	31.60	0.73	7.50	886.0	88.19
LC07600689L	73.30	110.0	2.00	13.40	11.60	0.87	45.00	36.50	0.81	6.30	824.1	82.03
LC0860B107L	74.70	110.0	2.00	15.30	9.90	0.65	41.70	32.00	0.77	6.80	818.3	81.45
LC07600570L	69.00	108.0	2.00	11.50	10.10	0.88	43.50	34.60	0.79	6.40	803.8	80.00
LC07600780R	70.30	110.0	2.00	12.80	9.70	0.77	40.00	32.00	0.80	5.50	761.7	75.81
LC0860B115L	74.70	107.0	2.00	13.50	10.80	0.81	41.50	29.00	0.70	6.20	713.8	71.04
GRAND MEAN	70.15	108.5	1.98	12.30	9.60	0.78	41.77	32.71	0.78	6.42	950.1	
CV	1.58	1.37	6.51	19.83	27.61	17.97	5.96	7.89	7.65	3.87	14.43	
LSD	1.83	2.45	0.21	4.03	4.38	0.23	4.12	4.27	0.10	0.41	188.8	

Pod height was measured at the green pod stage and at harvest maturity. Pod height index = pod height at harvest maturity divided by the pod height at the green pod stage.
Plant height was measured at the green pod stage and at harvest maturity. Plant height index = plant height at harvest maturity divided by the green plant height at the green pod stage.
Agronomic data are means of three replications at Pullman, WA.
Check Variety Merrit
Planting Date 04/20/2010 Harvest Date: 08/18/2010

Agronomic and Yield Data for the Laird Type Lentil Observation Nursery (1055L)

Name	Days to Flower	Days to Maturity	Pods/ Peduncle	Pod Height	Pod Ht Maturity	Pod Ht Index	Vine Length	Canopy Height	Plant Ht Index	100 Seed Weight	Seed Yield
				..cm..	..cm..		..cm..	..cm..		..g..	kg/ha
LC09600414L	67.00	107.0	2.00	10.00	10.00	1.00	36.50	33.00	0.90	7.10	1176
LC09600425L	66.00	107.0	2.00	8.00	6.30	0.79	38.30	25.50	0.67	6.80	1027
LC09600180L	71.00	109.0	2.00	18.00	17.50	0.97	43.00	37.30	0.87	6.60	985.1
LC09600246L	66.00	106.0	2.00	12.00	10.80	0.90	39.80	31.50	0.79	6.80	961.7
LC09600173L	69.00	107.0	1.00	11.30	6.80	0.60	40.00	30.00	0.75	6.80	927.2
LC09600284L	66.00	109.0	2.00	15.30	12.30	0.80	39.30	33.30	0.85	6.80	916.3
LC09600282L	68.00	107.0	2.00	13.00	12.00	0.92	42.00	31.50	0.75	6.80	891.2
LC09600432L	67.00	106.0	2.00	9.80	8.00	0.82	41.30	28.50	0.69	5.70	890.6
LC09600410L	69.00	107.0	2.00	12.50	11.30	0.90	39.00	30.80	0.79	6.80	866.6
LC09600429L	69.00	107.0	2.00	11.00	10.00	0.91	40.00	34.50	0.86	6.00	865.0
LC09600241L	67.00	106.0	2.00	12.50	5.00	0.40	38.00	28.50	0.75	6.60	847.8
Riveland	67.00	107.0	2.00	11.30	9.50	0.84	44.00	32.80	0.75	7.00	843.7
LC09600307L	69.00	107.0	2.00	11.50	11.00	0.96	40.50	33.00	0.81	8.40	825.5
LC09600476L	69.00	106.0	2.00	8.80	6.50	0.74	41.00	28.80	0.70	6.50	780.6
LC09600500L	71.00	109.0	2.00	7.00	6.30	0.90	40.80	34.80	0.85	6.40	771.5
LC09600202L	71.00	106.0	2.00	14.00	9.80	0.70	43.30	29.80	0.69	5.80	737.8
LC09600292L	69.00	107.0	2.00	18.30	8.00	0.44	42.50	26.80	0.63	7.80	726.4
LC09600441L	66.00	106.0	2.00	8.50	7.50	0.88	35.30	30.50	0.86	6.90	726.4
LC09600481L	69.00	107.0	2.00	14.00	11.00	0.79	42.80	29.80	0.70	7.30	722.5
LC09600408L	69.00	109.0	2.00	10.50	8.80	0.84	37.50	30.80	0.82	7.10	721.7
LC09600305L	67.00	106.0	2.00	11.30	10.00	0.88	45.50	29.50	0.65	6.80	683.8
LC09600361L	67.00	107.0	2.00	14.00	11.30	0.81	44.50	31.80	0.71	6.70	680.7
LC09600499L	71.00	109.0	2.00	6.50	5.50	0.85	45.50	35.30	0.78	6.20	679.5
LC09600366L	64.00	111.0	2.00	13.50	12.00	0.89	41.30	33.30	0.81	6.50	673.7
LC09600309L	72.00	111.0	2.00	7.80	6.50	0.83	39.50	29.00	0.73	7.90	650.1
LC09600376L	66.00	111.0	2.00	11.30	9.30	0.82	38.80	33.80	0.87	7.90	648.1
LC09600308L	69.00	107.0	2.00	14.30	13.00	0.91	40.50	31.50	0.78	9.10	641.2

Pod height was measured at the green pod stage and at harvest maturity. Pod height index = pod height at harvest maturity divided by the pod height at the green pod stage.
Plant height was measured at the green pod stage and at harvest maturity. Plant height index = plant height at harvest maturity divided by the green plant height at the green pod stage.
Varieties without data were dropped in the field and no data was collected.
Planting Date 04/20/2010 Harvest Date: 08/19/2010

Agronomic and Yield Data for the Laird Type Lentil Observation Nursery (1055L)

Name	Days to Flower	Days to Maturity	Pods/ Peduncle	Pod Height	Pod Ht Maturity	Pod Ht Index	Vine Length	Canopy Height	Plant Ht Index	100 Seed Weight	Seed Yield
				..cm..	..cm..		..cm..	..cm..		..g..	kg/ha
LC09600413L	69.00	111.0	2.00	12.50	10.80	0.86	38.30	32.00	0.84	7.10	590.2
LC09600175L	67.00	107.0	2.00	12.00	9.30	0.78	43.00	30.00	0.70	7.00	584.0
LC09600300L	69.00	107.0	2.00	13.00	10.50	0.81	41.00	31.00	0.76	6.90	552.5
LC09600296L	67.00	106.0	2.00	5.80	4.80	0.83	35.50	27.00	0.76	7.20	550.9
LC09600306L	69.00	109.0	2.00	11.30	10.00	0.88	38.50	34.30	0.89	8.40	541.4
LC09600383L	69.00	113.0	2.00	15.00	13.50	0.90	37.80	34.00	0.90	6.80	447.5
GRAND MEAN	68.21	107.8	1.97	11.68	9.54	0.82	40.44	31.33	0.78	6.98	761.6
CV	2.65	1.71	8.70	24.89	28.39	15.54	6.45	8.35	9.64	10.31	20.77

Pod height was measured at the green pod stage and at harvest maturity. Pod height index = pod height at harvest maturity divided by the pod height at the green pod stage.
Plant height was measured at the green pod stage and at harvest maturity. Plant height index = plant height at harvest maturity divided by the green plant height at the green pod stage.
Varieties without data were dropped in the field and no data was collected.
Planting Date 04/20/2010 Harvest Date: 08/19/2010

Agronomic and Yield Data for the Richlea Type Lentil Observation Nursery (1055R)

Name	Days to Flower	Days to Maturity	Pods/ Peduncle	Pod Height	Pod Ht Maturity	Pod Ht Index	Vine Length	Canopy Height	Plant Ht Index	100 Seed Weight	Seed Yield
				..cm..	..cm..		..cm..	..cm..		..g..	kg/ha
LC09600235R	69.00	106.0	2	16.50	15.80	0.96	48.30	35.50	0.73	6.20	1144
LC09600228R	71.00	106.0	2	13.80	11.30	0.82	42.50	33.30	0.78	5.50	876.1
Richlea	71.00	104.0	2	10.50	10.00	0.95	40.30	33.30	0.83	5.10	840.0
LC09600381R	71.00	106.0	2	10.00	9.30	0.93	47.00	38.00	0.81	6.50	840.0
LC09600392R	71.00	109.0	2	13.30	12.50	0.94	44.00	38.50	0.88	6.20	834.4
LC09600226R	69.00	106.0	2	11.30	9.50	0.84	43.80	36.00	0.82	5.40	817.4
LC09600221R	76.00	106.0	2	10.00	9.30	0.93	42.80	31.50	0.74	5.30	770.1
LC09600450R	71.00	107.0	2	13.80	13.30	0.96	39.50	34.50	0.87	5.80	635.4
LC09600183R	72.00	106.0	2	12.50	11.50	0.92	39.30	31.00	0.79	6.10	620.3
LC09600212R	76.00	109.0	2	2.30	1.80	0.78	40.80	29.80	0.73	6.70	553.8
LC09600017R	71.00	104.0	2	10.80	10.00	0.93	36.00	32.00	0.89	5.20	498.8
LC09600211R	76.00	107.0	2	11.50	10.50	0.91	32.80	29.80	0.91	5.80	478.5
GRAND MEAN	72.00	106.3	2	11.36	10.40	0.91	41.43	33.60	0.82	5.82	742.4
CV	3.40	1.40	2	29.01	30.60	6.25	10.03	8.43	7.44	8.68	24.71

Pod height was measured at the green pod stage and at harvest maturity. Pod height index = pod height at harvest maturity divided by the pod height at the green pod stage.
Plant height was measured at the green pod stage and at harvest maturity. Plant height index = plant height at harvest maturity divided by the green plant height at the green pod stage.
Varieties without data were dropped in the field and no data was collected.
Planting Date 04/20/2010 Harvest Date: 08/19/2010

Agronomic and Yield Data for the Eston Type Lentil Observation Nursery (1055E)

Name	Days to Flower	Days to Maturity	Pods/ Peduncle	Pod Height	Pod Ht Maturity	Pod Ht Index	Vine Length	Canopy Height	Plant Ht Index	100 Seed Weight	Seed Yield
				..cm..	..cm..		..cm..	..cm..		..g..	kg/ha
LC09600020E	66.00	106.0	1.00	13.80	11.00	0.80	38.80	30.30	0.78	3.50	1114
LC09600021E	66.00	106.0	1.00	13.00	11.50	0.88	35.80	27.50	0.77	3.90	956.6
LC09600054E	69.00	104.0	2.00	9.80	8.30	0.85	33.80	28.80	0.85	3.70	775.8
LC09600068E	66.00	104.0	2.00	7.30	5.00	0.68	33.00	30.30	0.92	4.00	734.9
LC09600066E	69.00	106.0	2.00	11.30	10.50	0.93	36.30	31.50	0.87	3.80	721.9
LC09600018E	66.00	104.0	2.00	11.00	10.80	0.98	36.30	27.80	0.77	4.20	712.8
LC09600065E	67.00	104.0	2.00	11.80	9.30	0.79	34.50	27.50	0.80	4.30	646.4
Eston	69.00	104.0	2.00	8.00	7.50	0.94	34.30	29.00	0.85	3.50	354.0
GRAND MEAN	67.25	104.8	1.75	10.75	9.24	0.86	35.35	29.09	0.83	3.86	752.0
CV	2.07	0.92	24.74	19.79	22.36	10.69	4.86	4.79	6.20	7.20	27.64

Pod height was measured at the green pod stage and at harvest maturity. Pod height index = pod height at harvest maturity divided by the pod height at the green pod stage.
Plant height was measured at the green pod stage and at harvest maturity. Plant height index = plant height at harvest maturity divided by the green plant height at the green pod stage.
Varieties without data were dropped in the field and no data was collected.
Planting Date 04/20/2010 Harvest Date: 08/19/2010

Agronomic and Yield Data for the Pardina Type Lentil Observation Nursery (1055P)

Name	Days to Flower	Days to Maturity	Pods/ Peduncle	Pod Height	Pod Ht Maturity	Pod Ht Index	Vine Length	Canopy Height	Plant Ht Index	100 Seed Weight	Seed Yield
				..cm..	..cm..		..cm..	..cm..		..g..	kg/ha
LC09600508P	64.00	104.0	2.00	13.30	10.30	0.77	35.00	26.30	0.75	4.70	869.3
LC09600014P	67.00	104.0	2.00	12.30	4.30	0.35	34.00	24.30	0.71	4.10	867.2
Pardina	67.00	104.0	2.00	9.00	4.50	0.50	31.30	27.80	0.89	4.00	834.8
LC09600507P	68.00	106.0	2.00	8.30	7.80	0.94	37.00	25.80	0.70	4.60	832.5
LC09600505P	66.00	106.0	2.00	15.50	13.50	0.87	38.30	29.30	0.77	4.80	759.9
LC09600003P	67.00	104.0	2.00	10.30	10.30	1.00	34.00	22.50	0.66	3.60	745.9
LC09600089P	67.00	107.0	1.00	11.00	10.00	0.91	43.50	36.30	0.83	4.10	668.7
GRAND MEAN	66.57	105.0	1.86	11.39	8.67	0.76	36.16	27.47	0.76	4.27	796.9
CV	1.77	1.14	18.84	20.46	35.85	29.74	10.11	15.09	9.72	9.51	8.65

Pod height was measured at the green pod stage and at harvest maturity. Pod height index = pod height at harvest maturity divided by the pod height at the green pod stage.
Plant height was measured at the green pod stage and at harvest maturity. Plant height index = plant height at harvest maturity divided by the green plant height at the green pod stage.
Varieties without data were dropped in the field and no data was collected.
Planting Date 04/20/2010 Harvest Date: 08/19/2010

Agronomic and Yield Data for the Turkish Red Type Lentil Observation Nursery (1055T)

Name	Days to Flower	Days to Maturity	Pods/ Peduncle	Pod Height	Pod Ht Maturity	Pod Ht Index	Vine Length	Canopy Height	Plant Ht Index	100 Seed Weight	Seed Yield
				..cm..	..cm..		..cm..	..cm..		..g..	kg/ha
LC09600545T	66.00	101.0	2	4.80	4.50	0.94	34.00	23.30	0.69	3.40	1063
LC09600532T	67.00	106.0	2	6.50	6.00	0.92	36.30	30.00	0.83	4.30	1033
LC09600037T	71.00	101.0	2	11.30	9.50	0.84	35.80	27.00	0.75	3.90	999.2
LC09600579T	66.00	104.0	2	6.00	3.80	0.63	33.30	25.50	0.77	3.20	973.3
LC09600319T	43.00	107.0	2	5.80	4.50	0.78	37.30	26.30	0.71	3.50	934.2
LC09600148T	66.00	106.0	2	14.00	10.50	0.75	40.30	30.00	0.74	3.40	893.7
LC09600142T	64.00	101.0	2	9.00	7.50	0.83	37.80	27.00	0.71	4.30	848.8
LC09600539T	67.00	106.0	2	4.80	4.00	0.83	36.50	24.80	0.68	4.00	848.4
LC09600093T	69.00	101.0	2	11.50	7.80	0.68	38.00	32.80	0.86	2.40	800.7
LC09600113T	66.00	101.0	2	8.30	7.50	0.90	33.50	26.50	0.79	3.90	797.4
LC09600588T	66.00	106.0	2	3.80	3.30	0.87	32.50	24.80	0.76	3.60	789.3
LC09600542T	64.00	106.0	2	4.80	4.00	0.83	37.50	27.00	0.72	3.70	774.6
LC09600581T	64.00	104.0	2	5.50	4.50	0.82	29.30	22.00	0.75	3.40	754.3
LC09600153T	64.00	104.0	2	6.80	5.00	0.74	34.50	27.80	0.81	4.90	747.7
LC09600033T	68.00	104.0	2	9.30	6.80	0.73	38.50	27.00	0.70	3.90	745.2
LC09600598T	67.00	104.0	2	7.50	6.50	0.87	37.80	27.00	0.71	3.70	716.5
LC09600163T	64.00	101.0	2	11.30	10.30	0.91	35.30	27.50	0.78	4.00	711.7
LC09600596T	66.00	106.0	2	4.30	4.00	0.93	35.00	25.30	0.72	3.40	689.8
LC09600564T	67.00	101.0	2	6.00	5.00	0.83	30.30	26.80	0.88	3.90	689.0
Crimson	68.00	101.0	2	8.50	8.00	0.94	34.00	23.50	0.69	3.40	683.2
LC09600162T	67.00	101.0	2	12.00	11.00	0.92	38.80	33.80	0.87	4.60	666.3
LC09600095T	67.00	104.0	2	10.30	8.30	0.81	36.80	26.50	0.72	2.40	662.3
LC09600151T	66.00	104.0	2	10.00	7.50	0.75	35.50	28.30	0.80	4.10	660.9
LC09600164T	67.00	101.0	2	10.00	9.30	0.93	38.80	32.00	0.82	4.00	649.1
LC09600615T	69.00	104.0	2	8.80	7.30	0.83	34.30	28.80	0.84	3.30	647.2
LC09600332T	69.00	106.0	2	3.30	2.50	0.76	36.50	26.30	0.72	3.60	640.0
LC09600110T	66.00	104.0	2	7.00	6.30	0.90	33.00	28.00	0.85	3.90	635.9

Pod height was measured at the green pod stage and at harvest maturity. Pod height index = pod height at harvest maturity divided by the pod height at the green pod stage.
Plant height was measured at the green pod stage and at harvest maturity. Plant height index = plant height at harvest maturity divided by the green plant height at the green pod stage.
Varieties without data were dropped in the field and no data was collected.
Planting Date 04/20/2010 Harvest Date: 08/19/2010

Agronomic and Yield Data for the Turkish Red Type Lentil Observation Nursery (1055T)

Name	Days to Flower	Days to Maturity	Pods/ Peduncle	Pod Height	Pod Ht Maturity	Pod Ht Index	Vine Length	Canopy Height	Plant Ht Index	100 Seed Weight	Seed Yield
				..cm..	..cm..		..cm..	..cm..		..g..	kg/ha
LC09600028T	66.00	104.0	2	7.50	4.80	0.64	36.30	22.30	0.61	4.00	627.0
LC09600601T	67.00	104.0	2	6.30	5.50	0.87	32.00	25.80	0.81	4.30	619.9
LC09600145T	66.00	106.0	2	9.50	7.30	0.77	32.50	26.30	0.81	3.80	607.3
LC09600097T	69.00	101.0	2	8.00	6.00	0.75	30.80	30.30	0.98	2.40	543.0
LC09600335T	68.00	106.0	2	7.50	6.50	0.87	33.50	25.30	0.76	3.40	542.2
LC09600034T	67.00	104.0	2	8.30	5.50	0.66	40.30	32.50	0.81	4.10	541.4
LC09600407T	71.00	104.0	2	4.80	3.50	0.73	35.50	28.50	0.80	4.30	494.8
LC09600627T	66.00	101.0	2	6.30	5.30	0.84	30.50	26.30	0.86	4.30	476.2
LC09600166T	66.00	104.0	2	4.80	3.50	0.73	33.50	29.50	0.88	4.40	465.5
LC09600620T	67.00	104.0	2	6.00	5.50	0.92	35.50	24.00	0.68	3.80	408.8
LC09600405T	71.00	104.0	2	2.00	1.50	0.75	35.00	23.00	0.66	4.50	269.4
GRAND MEAN	66.26	103.6	2	7.43	6.06	0.82	35.17	27.09	0.77	3.77	701.3
CV	6.38	1.90	2	35.74	37.05	10.64	7.65	10.35	9.74	14.86	24.41

Pod height was measured at the green pod stage and at harvest maturity. Pod height index = pod height at harvest maturity divided by the pod height at the green pod stage.
Plant height was measured at the green pod stage and at harvest maturity. Plant height index = plant height at harvest maturity divided by the green plant height at the green pod stage.
Varieties without data were dropped in the field and no data was collected.
Planting Date 04/20/2010 Harvest Date: 08/19/2010

PROGRESS REPORT: CHICKPEA BREEDING

Twenty advanced breeding lines and four check varieties (Sierra, Dwelley, Dylan, and Sawyer) were included in the advanced large Kabuli chickpea yield trials conducted at Genesee, ID, Kendrick, ID and Pullman, WA in 2010. Mean yield of the trial at Spillman Farm (Pullman) was 923 kg/ha, 1008 kg/ha at Genesee, and 1531 kg/ha at Kendrick. The highest yielding check, Sawyer, averaged 909 kg/ha over three locations while the lowest yielding check was Sierra (768 kg/ha). Fourteen advanced breeding lines had mean yields greater than Sierra. The five best performing lines had yields that averaged 23% higher than Sierra. These lines ranged in seed size from relatively small (41 g/100 seed) to quite large (52 g/100 seed) and expressed moderate maturity rates (112-115 d).

The 2010 Preliminary Chickpea Yield Trial conducted at Pullman, WA included 29 kabuli lines, 14 Spanish White lines, 2 Desi lines and four commercial check cultivars (Sierra, Dwelley, Dylan and Sawyer). Among the check cultivars, the highest yields were observed for Sawyer (969 kg/ha) and Sierra (966 kg/ha), while Dylan had the lowest yield (705 kg/ha). The five best performing preliminary lines had yields that averaged 32% higher than Dwelley. Six breeding lines, including a Spanish White line, had yields greater than Sierra (966 kg/ha). These lines ranged from moderate (46 g/100 seed) to large (54 g/100 seed) seed size and tended to mature 1-2 d later than Sawyer or Sierra. Five Spanish White lines had yields that were greater than Dwelley. These five lines had yields that averaged 29% higher than the Spanish White cultivar Dylan. The top three Spanish White lines averaged 36% higher yields than Dylan.

A constant challenge of the breeding program is to correctly anticipate future market needs when developing breeding strategies for future variety development. In 2010 crosses were made among elite breeding lines with primary focus being given to high yield, large seed size, and light cafe or white seed color. In 2010 it is possible that a new disease of chickpea was also introduced to the Pacific Northwest. Both simple leaf and compound leaf type cultivars appeared to be susceptible. The disease was characterized by leaf browning and necrosis that initiated at the leaf tip and proceeded down the leaf. Root systems of affected plants exhibited excellent health. Extensive sampling of plants from affected fields was conducted and plants were examined for the presence of fungi or viruses. No fungi could be isolated from infected leaf tissue despite several attempts using a range of methods including PCR, tissue staining, microscopy and microbiology. The symptoms could not be reproduced by mechanical inoculation of plants with extracts of brown/necrotic leaves.

Samples were also sent to commercial laboratories to detect viruses. Leaf tissue expressing characteristic symptoms were screened for a panel of different viruses known to infect legumes. Positive detection of viruses by ELISA was very rarely observed, despite all of the sampled tissue expressing similar symptoms. These observations indicate that the cause of this apparent disease in chickpea has not been clearly determined at the present. Visual observations suggest that both preliminary and advanced chickpea breeding lines and cultivars exhibit some differences among lines for expression of the leaf necrosis typical of this malady. Special attention will be paid to chickpea yield trials and production fields in 2011 so that any emergence of the typical leaf necrosis is rapidly detected. Examination of affected plants will continue to determine the etiology of observed symptoms.

Breeder seed was produced in 2010 of CA0469C025C and CA04900421C. These lines are early maturing high yielding advanced breeding lines with enhanced levels of resistance to Ascochyta blight (Table 1). CA0469C025C, a small café Kabuli type, was approved for release as a new germplasm in 2010. This germplasm can serve as a source of genes for incorporating high yield, early maturity, and blight resistance into improved large Kabuli varieties.

Potential Chickpea Variety Releases

CA046900421C is a high yielding, fairly large size café Kabuli chickpea that could possibly serve as a replacement for Dwelley or Sierra. Over 4 years of evaluation, CA04900421C has outielded Dwelley and Sierra by 9% and 6%, respectively (Table 1). CA04900421C has similar maturity as Dwelley and Sierra and is more resistant to Ascochyta blight than Dwelley. CA04900421C has a seed size that is 95% that of Dwelley or Sierra. This breeding line will be examined in advanced yield trials in 2011 and will also be entered into yield trials conducted by collaborators in the Pacific Northwest and Northern Plains to gain an additional year of data prior to its final consideration for release as a new café Kabuli variety.

Table 1. Performance and Agronomic Characteristics of Promising Chickpea Advanced Breeding Lines and Commercial Check Varieties.

Line	Leaf Type[a]	Years in Advanced Yield Trials	Days to Maturity	Ascochyta Blight Score[b]	Seed size (g/100 seeds)	Yield (kg/ha)
CA0469C025	C	5	109	3.7	38.3	1427
CA04900421C	C	4	108	4.4	49.4	1270
Dwelley	S	5	110	5.7	51.7	1161
Sierra	S	5	109	4.4	51.8	1196
Sawyer	C	5	106	4.4	43.5	1327

[a]C = compound; S = Simple
[b]Scored using a 1(healthy) to 9 (dead plant) disease severity index.

OTHER PROGRESS TO REPORT

Mineral Nutrition

A preliminary survey of mineral nutrient contents was conducted on samples from the advanced chickpea breeding lines harvested in 2009 at Genesee and Kendrick, ID. Samples were examined for amounts of macronutrients Ca, K, P, Mg, and S and micronutrient minerals Co, Cu, Fe, Mn, Se and Zn. Chickpeas harvested at Kendrick had significantly higher levels of Cu, Fe, Se and Zn (Table 1A), while samples grown at Genesee has significantly higher levels of Ca, Co, Mn, and Ni (Table 1B). Not differences were observed between locations for the amount of K, Mg, P, and S detected in chickpea seed. A much more extensive analysis will be conducted on samples harvested during 2010. This analysis will provide the first indications as to the relative contributions of environmental and genetic variance on the mineral nutrient content of our advanced breeding lines. This knowledge will provide critical guidance for efforts to expand our cool season food legume breeding program into the area of improving seed nutritional profiles.

Table 1 (A and B). Means (standard deviation) comparison of various macronutrient and micronutrient mineral concentrations in advanced chickpea breeding lines and cultivars grown in Genesee, ID and Kendrick, ID in 2009.

A.

Location	Cu (ug/g)	Fe (ug/g)	Se (ug/g)	Zn (ug/g)	K (mg/g)	Mg (mg/g)
Genesee	7.16 (0.14) a	54.01 (0.68) a	0.32 (0.03) a	34.15 (0.74) a	10.69 (0.11) a	1.49 (0.02) a
Kendrick	7.70 (0.07) b	59.70 (0.77) b	0.47 (0.02) b	43.52 (0.58) b	10.37 (0.09) a	1.49 (0.02) a

B.

Location	Ca (mg/g)	Co (ug/g)	Mn (ug/g)	Ni (ug/g)	P (mg/g)	S (mg/g)
Genesee	1.16 (0.04) a	0.22 (0.01) a	61.85 (1.42) a	5.00 (0.13) a	3.85 (0.09) a	2.07 (0.02) a
Kendrick	1.01 (0.04) b	0.06 (0.01) b	47.33 (0.94) b	3.46 (0.07) b	4.11 (0.05) a	2.04 (0.01) a

Agronomic Data for the Large Kabuli Chickpea Advanced Yield Trial (1081)

Name	Days to Flower	Days to Maturity	Pod Height	Pod Ht Maturity	Pod Ht Index	Vine Length	Canopy Height	Plant Ht Index	100 Seed Weight
			..cm..	..cm..		..cm..	..cm..		..g..
CA0790B0042C	71.70	114.3	28.30	21.40	0.76	60.70	46.30	0.76	41.10
CA04900843C	72.00	113.7	24.50	19.80	0.81	52.00	43.30	0.83	52.40
CA0790B0733C	72.70	113.7	22.40	19.00	0.85	48.30	37.00	0.76	43.70
CA0690B0409C	71.70	115.0	28.40	21.50	0.76	62.00	46.70	0.75	47.40
CA0790B0155C	73.00	112.3	21.40	14.60	0.68	44.70	38.00	0.86	50.60
CA0790B0753C	69.00	115.0	21.30	16.60	0.79	48.70	37.30	0.76	38.30
CA0469C025C	69.00	112.3	20.00	16.50	0.83	48.70	35.00	0.72	34.80
CA0790B0034C	73.00	116.3	27.20	20.60	0.76	52.70	45.30	0.86	51.30
CA04900421C	69.00	80.30	22.90	16.90	0.75	52.00	40.70	0.78	43.30
Sawyer	71.70	111.7	23.60	20.60	0.87	50.70	41.30	0.81	43.50
CA0790B0549C	73.00	119.0	24.80	20.50	0.83	55.00	42.00	0.76	44.20
Dylan	69.00	112.3	22.20	15.00	0.69	45.70	39.00	0.85	50.10
CA0390B007C	74.70	119.0	26.80	18.00	0.68	57.00	49.00	0.86	48.00
CA04900851C	73.70	114.3	29.50	22.40	0.75	59.30	47.30	0.80	51.20
CA04900808C	71.00	112.3	26.90	21.50	0.79	53.70	45.30	0.84	47.10
CA0690B0250C	72.30	116.3	28.20	22.30	0.79	62.30	53.30	0.86	51.90
Dwelley	73.70	116.3	25.70	20.00	0.79	55.00	47.00	0.86	48.80
Sierra	71.70	113.0	22.50	16.30	0.73	43.70	37.30	0.86	49.20
CA0790B0054C	74.70	111.7	26.40	21.10	0.80	50.30	41.30	0.82	46.00
CA0790B0043C	74.00	119.0	32.40	23.90	0.74	65.70	52.30	0.79	49.00
CA0690B0427C	75.00	114.3	18.60	15.00	0.81	43.30	32.30	0.75	43.20
CA04900608C	74.30	115.7	24.00	18.40	0.77	56.70	44.00	0.78	54.30
CA0790B0053C	72.00	116.3	32.20	25.30	0.79	60.30	49.30	0.82	51.00
GRAND MEAN	72.25	113.2	25.23	19.46	0.78	53.41	43.07	0.81	46.97
CV	1.97	9.84	13.48	14.70	12.43	7.48	9.65	7.97	5.42
LSD	2.34	18.34	5.60	4.71	0.16	6.57	6.84	0.11	4.19

Pod height was measured at the green pod stage and at harvest maturity. Pod height index = pod height at harvest maturity divided by the pod height at the green pod stage.
Plant height was measured at the green pod stage and at harvest maturity. Plant height index = plant height at harvest maturity divided by the green plant height at the green pod stage.
Agronomic data are means of three replications at Pullman, WA
Check variety = Dwelley
Planting Date: 04/20/2010. Harvest Date: 09/07/2010.

Name	Leaf Type	Seed Type	Pullman Seed Yield	Kendrick Seed Yield	Genesee Seed Yield	Mean Seed Yield	% of Dwelley
			kg/ha	kg/ha	kg/ha	kg/ha	
CA0790B0042C	C	C	987.80	1528.00	1146.30	984.40	127.5
CA04900843C	C	C	1038.60	1597.10	989.80	978.70	126.8
CA0790B0733C	C	C	1033.80	1533.50	908.80	940.10	121.8
CA0690B0409C	S	C	1036.70	1560.90	676.40	930.30	120.5
CA0790B0155C	S	C	1008.00	1343.00	994.70	923.40	119.6
CA0790B0753C	C	C	915.30	1531.20	1008.40	920.50	119.2
CA0469C025C	C	C	902.70	1511.50	953.00	917.90	118.9
CA0790B0034C	C	C	987.70	1644.70	676.90	914.20	118.4
CA04900421C	C	C	1085.80	1516.60	687.70	913.50	118.3
Sawyer	S	C	995.20	1407.80	996.20	908.50	117.7
CA0790B0549C	C	C	908.90	1511.80	805.60	866.50	112.2
Dylan	C	W	884.30	1510.10	809.50	852.00	110.3
CA0390B007C	C	C	983.10	1437.30	720.20	851.30	110.3
CA04900851C	S	C	1013.90	1556.00	654.10	838.30	108.6
CA04900808C	S	C	969.80	1459.50	613.40	816.90	105.8
CA0690B0250C	C	C	1076.20	1324.10	632.40	808.50	104.7
Dwelley	S	C	881.40	1395.40	589.70	772.10	100.0
Sierra	S	C	836.20	1372.30	667.90	767.80	99.4
CA0790B0054C	C	C	819.20	1389.10	731.20	747.20	96.8
CA0790B0043C	C	C	742.20	1233.80	699.00	721.00	93.4
CA0690B0427C	C	C	740.30	1232.20	588.40	693.20	89.8
CA04900608C	S	C	684.10	1407.90	483.60	690.00	89.4
CA0790B0053C	C	C	702.80	1197.50	506.00	651.70	84.4
GRAND MEAN			923.21	1443.53	762.58	843.81	
CV			14.90	6.89	15.14	12.90	
LSD			188.74	136.56	158.44	87.72	

Leaf Type: C = compound leaf, S = simple leaf type. Seed type; W = white seed type, C = cafe seed type
Yield data are means of three replications at each location.

Agronomic and Yield Data for the Large Kabuli Chickpea Preliminary Yield Trial (1083)

Name	Days to Flower	Days to Maturity	Pods/ Peduncle	Pod Height	Pod Ht Maturity	Pod Ht Index	Vine Length	Canopy Height	Plant Ht Index	100 Seed Weight	Seed Yield	% of Dwelley
				..cm..	..cm..		..cm..	..cm..		..g..	kg/ha	
CA0890B0427C	74.30	112.3	2	22.70	17.00	0.75	49.30	40.30	0.82	46.40	1115	139.2
CA0890B0561C	70.00	113.0	2	22.40	16.10	0.72	45.00	35.30	0.79	46.80	1083	135.2
CA0890B0429C	70.30	112.3	2	26.80	19.20	0.72	54.00	41.70	0.77	49.50	1059	132.1
CA0890B0435C	76.00	114.3	2	28.90	25.30	0.87	62.00	54.70	0.88	53.50	1020	127.3
CA0890B0130C	73.70	112.3	2	16.80	13.80	0.82	42.00	35.30	0.84	46.00	998.4	124.6
CA0890B0356W	69.00	114.3	2	24.40	18.50	0.76	50.30	40.00	0.79	48.90	980.7	122.4
Sawyer	74.70	111.0	2	21.40	15.10	0.71	49.30	41.70	0.84	41.10	968.5	120.9
Sierra	73.70	111.0	2	23.70	16.40	0.69	48.70	40.70	0.84	50.40	965.6	120.5
CA0890B0074C	74.70	113.7	2	22.00	16.00	0.73	47.00	38.00	0.81	49.50	964.1	120.4
CA0890B0496C	76.00	112.3	2	24.50	15.60	0.64	51.70	41.30	0.80	48.90	955.5	119.3
CA0890B0437W	76.00	115.7	2	25.70	19.90	0.78	51.70	41.70	0.81	40.30	949.1	118.5
CA0790B0804W	72.00	114.3	2	24.80	17.30	0.70	47.30	37.30	0.79	49.00	934.2	116.6
CA0790B0642C	71.30	113.7	2	23.40	17.90	0.77	49.70	40.00	0.80	49.90	934.0	116.6
CA0890B0489C	78.70	112.3	2	28.20	22.00	0.78	56.70	46.30	0.82	46.40	925.5	115.5
CA0890B0434C	71.70	114.3	2	21.90	17.60	0.80	46.70	38.70	0.83	46.80	920.3	114.9
CA0790B0547C	76.00	113.0	2	22.70	16.80	0.75	47.30	39.00	0.83	48.30	906.1	113.1
CA0890B0531C	76.00	111.0	2	23.50	18.30	0.78	47.00	40.30	0.86	47.30	890.2	111.1
CA0890B0084C	72.00	114.3	2	20.40	16.40	0.80	45.00	37.70	0.84	49.40	883.9	110.3
CA0790B0808W	72.30	114.3	2	21.20	15.20	0.73	47.00	37.70	0.80	47.50	865.5	108.0
CA0890B0523C	72.30	113.7	2	30.40	24.50	0.81	56.30	45.30	0.81	43.60	862.0	107.6
CA0890B0581C	70.30	111.7	2	20.80	14.20	0.69	43.70	34.00	0.78	43.40	850.9	106.2
CA0890B0556D	71.30	111.0	2	18.70	14.40	0.77	42.70	37.00	0.87	16.70	830.5	103.7
CA0890B0589C	76.00	118.3	2	21.30	17.50	0.83	44.00	36.30	0.83	49.20	823.0	102.7
CA0890B0438W	75.30	115.0	2	25.90	22.90	0.88	55.70	46.70	0.84	43.50	806.1	100.6
CA0890B0551C	69.00	114.3	2	22.30	18.50	0.83	46.70	36.70	0.78	51.50	802.4	100.2
Dwelley	76.30	115.7	2	21.60	16.10	0.76	50.70	41.00	0.81	47.30	801.1	100.0

Pod height was measured at the green pod stage and at harvest maturity. Pod height index = pod height at harvest maturity divided by the pod height at the green pod stage.
Plant height was measured at the green pod stage and at harvest maturity. Plant height index = plant height at harvest maturity divided by the green plant height at the green pod stage.
Rep Nodes = average number of reproducing nodes to a plant.
Agronomic data are means of three replications at Pullman, WA.
Planting Date 04/20/2010. Harvest Date: 09/06/2010.

Mean Yields of the Large Kabul Chickpea Advanced Yield Trial, 2006 - 2010.

Name	Seed Type	Leaf Type	2006	2007	2008	2009	2010
			kg/ha	kg/ha	kg/ha	kg/ha	kg/ha
CA0790B0042C	C	C	…	…	…	…	984
CA04900843C	C	C	…	…	1382	1602	979
CA0790B0733C	C	C	…	…	…	…	940
CA0690B0409C	C	S	…	…	…	1538	930
CA0790B0155C	C	S	…	…	…	…	923
CA0790B0753C	C	C	…	…	…	…	921
CA0469C025C	C	C	…	1525	1501	1622	918
CA0790B0034C	C	C	…	…	…	…	914
CA04900421C	C	C	…	1415	1459	1369	914
SAWYER	C	S	…	…	…	1508	909
CA0790B0549C	C	C	…	…	…	…	867
DYLAN	W	C	1433	1302	1123	1339	852
CA0390B007C	C	C	1494	1553	1325	1532	851
CA04900851C	C	S	…	…	1492	1415	838
CA04900808C	C	S	…	…	1408	1495	817
CA0690B0250C	C	C	…	…	…	1645	809
DWELLEY*	C	S	1346	1242	1145	1431	772
SIERRA	C	S	1451	1253	1224	1288	768
CA0790B0054C	C	C	…	…	…	…	747
CA0790B0043C	C	C	…	…	…	…	721
CA0690B0427C	C	C	…	…	…	1436	693
CA04900608C	C	S	…	…	1384	1345	690
CA0790B0053C	C	C	…	…	…	…	652
Grand Mean			1308	1330	1290	1426	844
LSD $_{(a=0.05)}$			243	151	217	190	88

Yield data are means of three replications per location, three locations in year except 2006(two locations)

Agronomic and Yield Data for the Large Kabuli Chickpea Preliminary Yield Trial (1083)

Name	Days to Flower	Days to Maturity	Pods/ Peduncle	Pod Height	Pod Ht Maturity	Pod Ht Index	Vine Length	Canopy Height	Plant Ht Index	100 Seed Weight	Seed Yield	% of Dwelley
				..cm..	..cm..		..cm..	..cm..		..g..	kg/ha	
CA0890B0526D	79.00	113.0	2	22.70	18.70	0.83	45.30	37.00	0.82	29.10	795.9	99.35
CA0890B0628W	72.30	114.3	2	27.10	18.00	0.68	48.30	38.00	0.79	47.80	790.5	98.68
CA0790B0099C	71.70	117.7	2	28.00	20.80	0.75	54.30	45.30	0.83	53.30	780.0	97.36
CA0890B0648W	72.30	115.7	2	25.80	20.50	0.79	50.00	42.30	0.85	49.80	779.7	97.32
CA0890B0657W	74.00	113.7	2	26.90	22.00	0.82	52.70	43.70	0.83	42.90	760.8	94.96
CA0890B0575C	73.70	112.3	2	28.30	18.70	0.66	52.30	43.30	0.83	45.10	740.4	92.42
CA0890B0103W	76.00	112.3	2	19.70	13.90	0.72	44.70	35.70	0.80	48.10	712.6	88.95
Dylan	69.70	112.3	2	21.00	14.70	0.68	45.70	38.00	0.84	50.10	704.5	87.94
CA0890B0116W	76.70	117.7	2	21.20	16.10	0.77	49.70	42.00	0.85	47.00	684.3	85.41
CA0890B0498C	74.70	115.0	2	24.00	20.30	0.84	52.00	41.70	0.81	44.30	680.9	84.99
CA0890B0393W	72.30	114.3	2	23.40	18.40	0.79	50.30	41.00	0.81	45.00	661.1	82.52
CA0890B0555D	72.70	111.0	2	16.00	11.40	0.72	37.70	31.00	0.82	14.70	628.7	78.47
CA0890B0101W	78.30	115.0	2	20.20	14.40	0.71	43.30	33.30	0.77	48.70	625.5	78.08
CA0890B0283C	70.30	111.0	2	15.90	12.30	0.77	41.00	30.30	0.74	14.90	613.9	76.62
CA0890B0085W	76.00	120.0	2	26.90	21.00	0.78	52.30	42.70	0.82	51.90	567.1	70.78
CA0890B0113W	76.70	118.3	2	18.40	15.00	0.81	47.30	39.70	0.84	44.40	542.7	67.74
CA0890B0443C	79.30	121.3	2	27.30	18.30	0.68	54.00	41.00	0.76	47.00	535.4	66.83
CA0890B0286C	69.70	111.0	2	16.00	11.90	0.74	37.00	30.30	0.82	14.70	518.8	64.76
CA0890B0290C	69.70	111.0	2	15.30	11.10	0.74	38.30	30.30	0.79	16.00	497.8	62.13
CA0890B0293C	71.30	111.0	2	14.60	10.90	0.74	41.30	35.30	0.85	15.70	482.9	60.27
CA0890B0288C	69.00	111.7	2	13.50	10.10	0.76	37.70	28.30	0.77	15.10	474.2	59.19
CA0890B0281C	69.70	111.7	2	15.70	12.30	0.78	39.70	32.30	0.82	15.70	439.8	54.90
CA0890B0289C	69.70	111.0	2	17.30	12.00	0.70	41.00	31.70	0.77	10.20	435.3	54.34
CA0890B0287C	70.70	111.0	2	15.60	10.70	0.68	38.30	28.00	0.73	15.40	434.0	54.18
GRAND MEAN	73.29	113.7	2	22.14	16.71	0.76	47.43	38.54	0.81	40.56	779.6	
CV	1.96	2.04	2	13.40	14.26	11.73	7.96	7.21	7.60	6.00	17.90	

Pod height was measured at the green pod stage and at harvest maturity. Pod height index = pod height at harvest maturity divided by the pod height at the green pod stage.
Plant height was measured at the green pod stage and at harvest maturity. Plant height index = plant height at harvest maturity divided by the green plant height at the green pod stage.
Rep Nodes = average number of reproducing nodes to a plant.
Agronomic data are means of three replications at Pullman, WA.
Planting Date 04/20/2010. Harvest Date: 09/06/2010.

Agronomic and Yield Data for the Large Kabuli Chickpea Preliminary Yield Trial (1083)

Name	Days to Flower	Days to Maturity	Pods/ Peduncle	Pod Height	Pod Ht Maturity	Pod Ht Index	Vine Length	Canopy Height	Plant Ht Index	100 Seed Weight	Seed Yield	% of Dwelley
				..cm..	..cm..		..cm..	..cm..		..g..	kg/ha	
LSD	2.33	3.76	2	4.81	3.86	0.14	6.12	4.50	0.10	3.94	189.2	

Pod height was measured at the green pod stage and at harvest maturity. Pod height index = pod height at harvest maturity divided by the pod height at the green pod stage.
Plant height was measured at the green pod stage and at harvest maturity. Plant height index = plant height at harvest maturity divided by the green plant height at the green pod stage.
Rep Nodes = average number of reproducing nodes to a plant.
Agronomic data are means of three replications at Pullman, WA.
Planting Date 04/20/2010. Harvest Date: 09/06/2010.