FINAL RELEASE OUTLINE/CHECKLIST

Date: May 15, 2013

Plant Breeder: George Vandemark

BreedingTeam Members and Percentage of Contribution: George Vandemark (30%), Fred Muehlbauer (30%), Weidong Chen (20%), Kevin McPhee (20%).

(note: a breeding team is defined for potential distribution of royalty income; the extent of the team is up to the character of the breeder)

Identification:

1. Crop kind and market class

   Large kabuli chickpea

2. Selection no.

   CA04900851C Royal

3. Proposed name

   'Royal'

4. Pedigree and experimental designation

   HB-19/CA9783142

General Situation:

1. Unique cultivar characteristics / release justification

a. It is required the variety be an improvement over existing varieties in one or more important characteristics and has demonstrated potential for use in commercial agriculture.
b. It is required the variety be sufficiently distinguishable from existing varieties to allow for seed certification and intellectual property protection.

CA04900851C has consistently demonstrated exceptional yield across trials in the Pacific Northwest. It has performed especially well compared to check cultivars in Lincoln County, WA.

2. Use-type

Canning and fresh market chickpea.

3. Description and general information

CA04900851C was evaluated by the USDA-ARS Grain Legume Genetics and Physiology Research Unit in advanced yield trials for 16 location-years (2008-2012) in the 'Palouse' region of eastern Washington and northwest Idaho. Over this time CA04900851C averaged 1526 kg/ha, which was 4.5% and 8.4% greater than the yields of Dwelley (1460 kg/ha) and Sierra (1408 kg/ha), respectively (see Table 1). The yield of CA04900851C across these trials was 3.6% less than the yield of Sawyer (1582 kg/ha).

CA04900851C was also evaluated over six location years (2010-2012) in independent variety trials conducted in central Washington (Lincoln County) by Central Washington Grain Growers, Inc. (Table 2). Over six location-years (2010-2012) the average yield of CA04900851C was 1477 kg/ha, which was 38.3% greater than the yield of Sierra (1068 kg/ha) across the same trials. Over four location-years (2010-2011) the mean yield of CA04900851C was 1445 kg/ha, which was 34.2% greater than the yield of Dwelley (1077 kg/ha) across the same trials. During trials conducted in 2011 and 2012 across four location-years the mean yield of CA04900851C was 1839 kg/ha, which was 43.6% greater than the mean yield of Sawyer.

With respect to agronomic traits (Table 3), CA04900851C is not significantly different than Dwelley, Sierra, or Sawyer in days to 50% flower, days to mature, plant height index (PHI), or resistance to Ascochyta blight. CA04900851C has a significantly higher canopy height than Sierra and Sawyer. CA04900851C produces significantly larger seed (55.5 g/100 seeds) than Dwelley (52.1 g/100 seeds), Sierra (52.8 g/100 seeds), and Sawyer (43.6 g/100 seeds).

Data is presented in Table 4 for seed mineral concentrations of four minerals of particular concern for child nutrition based on a single year of data (2010) obtained from three environments. CA04900851C had significantly lower concentrations of Calcium, Potassium, Magnesium, and Iron than Dwelley. CA04900851C also had significantly lower seed concentrations of Magnesium and Iron than Sierra and Sawyer.

4. Variety it is intended to replace (if any)

Dwelley and Sierra

Performance Evaluations: See tables below.

(*must include independent narrative statement/evaluation from respective scientist(s))

1. Yield
    a. Breeder trials (3 years)
    b. Variety Testing Program
    c. Regional performance testing data (legumes 2 years;)
2. Agronomic characteristics
3. *End-use quality assessment/data (legumes 3 years;) 2 years must have multiple locations
4. *Resistance to diseases, insects, other
5. Winterhardiness (if applicable)
6. Area of adaptation
7. Other important traits/unique characteristics
8. Weaknesses

(*must include independent narrative statement/evaluation from respective scientist(s))

Seed Source, Status and Availability:

Other Comments:

1. Variant clause (if applicable)

Provisions for Plant Variety Protection (PVP)—if applicable

Attachments:

1. Tables
2. Other supporting documentation
3. Draft variety release document
4. Draft PVP application (if applicable)

Table 4. Means[1] comparison between CA04900851C, Dwelley, Sierra and Sawyer for seed concentrations of nutrients of concern for child nutrition based on 2010 Advanced Yield Trials conducted at three locations (Pullman, WA; Genesee, ID, and Kendrick, ID).

Entry	Calcium (mg/g DW)	Potassium (mg/g DW)	Magnesium (mg/g DW)	Iron (ug/g DW)
CA04900851C	0.89 b	11.73 b	1.32 c	45.82 c
Dwelley	0.99 a	12.01 a	1.45 a	52.65 a
Sierra	0.86 b	11.58 b	1.40 ab	51.23 a
Sawyer	0.92 ab	11.77 ab	1.38 b	48.42 b

[1]Means within a column followed by the same letter are not significantly different ($P \leq 0.1$).

Table 3. Means comparison[1] between CA04900851C, Dwelley, Sierra and Sawyer based on measurements obtained from advanced yield trial plots grown at the WSU Spillman Research Farm (Pullman, WA) during 2008-2012.

Entry	Days to 50% Flower	Days to Maturity	Canopy Height (cm)	Plant Height Index	Weight 100 seeds (g)	Reaction to Ascochyta blight[2]
CA04900851C	60.3 a	104.0 a	45.5 a	0.90 a	55.5 a	4.3 a
Dwelley	60.8 a	107.5 a	43.7 ab	0.91 a	52.1 b	4.1 a
Sierra	59.2 a	107.5 a	40.4 b	0.91 a	52.8 b	3.5 a
Sawyer	57.9 a	104.9 a	40.8 b	0.87 a	43.6 c	3.8 a

[1]Means within a column followed by the same letter are not significantly different ($P \leq 0.1$).

[2] Plots were rated using a scale of 0-9 as follows: 1 = no visible lesions on any plants; 3 = lesions visible on less than 10% of plants, no visible stem girdling; 5 = lesions visible on up to 25% of the plants, visible stem girdling on less than 10% of plants; 7 = lesions on most plants, stem girdling on less than 50% of the plants, and 9 = lesions on all plants, stem girdling on more than 50% of the plants. Blight data is from 2008, 2009, 2011, and 2012 field seasons.

Table 2. Yield (kg/ha) of CA04900851C, Dwelley, Sierra, and Sawyer along with trial mean of six yield trials conducted by Central Washington Grain Growers, Inc. across three years (2010-2012).

Year	Location	CA04900851C	Dwelley	Sierra	Sawyer	Test Mean	LSD[1]
2010	Wilbur, WA	1002	824	687	-	970	262
2010	Davenport, WA	508	457	242	-	595	349
2011	Wilbur, WA	2295	1432	1544	1905	1865	350
2011	Davenport, WA	1975	1595	1436	1710	1626	531
2012	Wilbur, WA	1053	-	811	651	830	264
2012	Davenport, WA	2031	-	1686	856	1639	345
Grand Mean		1477		1068			
		$1445_{2010\text{-}11}$	1077				
		$1839_{2011\text{-}12}$			1281		

[1]LSD = Least significant difference between means based on the analysis of all entries tested ($\alpha = 0.1$).

Table 1. Yield (kg/ha) of CA04900851C, Dwelley, Sierra, and Sawyer along with trial mean of 16 yield trials conducted by the USDA-ARS across five years (2008-2012).

Year	Location	CA04900851C	Dwelley	Sierra	Sawyer	Test Mean	LSD[1]
2008	Genesee, ID	1111	906	730	1192	960	615
2008	Waitsburg, WA	1690	1326	1522	1626	1420	440
2008	Pullman, WA	1624	1340	1530	1287	1491	316
2009	Genesee, ID	1196	1386	1132	1488	1258	533
2009	Kendrick, ID	1538	1420	1328	1527	1469	224
2009	Pullman, WA	1511	1487	1404	1509	1549	343
2010	Genesee, ID	688	559	631	930	763	171
2010	Kendrick, ID	1614	1370	1262	1416	1444	180
2010	Pullman, WA	1014	881	836	995	923	195
2011	Genesee, ID	1613	2365	1947	2232	2296	551
2011	Kendrick, ID	1986	1758	1798	1953	1906	199
2011	Pullman, WA	3092	2393	2397	2610	2770	441
2012	Genesee, ID	1981	2218	2094	2374	2547	494
2012	Kendrick, ID	1439	1333	1308	1199	1509	266
2012	Dayton, WA	423	798	627	1075	1028	385
2012	Pullman, WA	1901	1821	1985	1901	1860	454
Grand Mean		1526	1460	1408	1582	1575	

[1]LSD = Least significant difference between means based on the analysis of all entries tested ($\alpha = 0.1$).