

**NEBRASKA AGRICULTURAL EXPERIMENT STATION
UNIVERSITY OF NEBRASKA-LINCOLN
DEPARTMENT OF AGRONOMY**

and

**UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
WASHINGTON, D. C.**

RELEASE OF NE06545 HARD RED WINTER WHEAT

NE06545 is a hard red winter wheat (*Triticum aestivum* L.) cultivar developed cooperatively by the Nebraska Agricultural Experiment Station and the USDA-ARS and released in 2013 by the developing institutions. It was released primarily for its superior adaptation to rainfed wheat production systems throughout Nebraska and in states north and west of Nebraska. NE06545 will be marketed as Husker Genetics Brand Freeman Hard Red Winter Wheat in honor of Daniel Freeman, who is recognized as the first person to file for a homestead under the Homestead Act of 1862 which celebrated its 150th anniversary in 2012.

NE06545 was selected from the cross KS92-946-B-15-1/Alliance where the pedigree of KS92-946-B-15-1 is ABI86*3414/Jagger/Karl 92. That cross was made in 2000. The F₁ generation was grown in the greenhouse in 2001 and the F₂ to F₃ generations were advanced using the bulk breeding method in the field at Mead, NE in 2002 to 2003. In 2004, single F₃-derived F₄ rows were planted for selection. There was no further selection thereafter. The F_{3.5} was evaluated as a single four row plot at Lincoln, NE and a single row at Mead, NE. NE06545 was identified in 2006 as the experimental line, and selected for further testing.

NE06545 was evaluated in Nebraska replicated yield nurseries starting in 2007, in the Southern Regional Performance Nursery in 2009 and 2010, in the Northern Regional Performance Nursery in 2011, and in Nebraska cultivar performance trials in 2010, 2011 and 2012. In the Nebraska Intrastate Nursery (2008 to 2012, Table 1), NE06545 performed well across Nebraska and was not significantly different from Husker Genetics Brand Overland, the most widely grown cultivar in Nebraska. These data are supported by the 2009 and 2010 USDA-ARS Southern Regional Performance Nursery where NE06545 ranked 2 and 34 region-wide of the 46 and 48 entries tested in those years (data available at <http://www.ars.usda.gov/Research/docs.htm?docid=11932>). NE06545 was also tested in the Northern Regional Performance Nursery in 2011 where it ranked second out of 29 entries tested region-wide in that year. In the three years that it has been tested in the Nebraska State Variety Trials (Table 2, full data available at <http://cropwatch.unl.edu/web/varietytest/wheat>), NE06545 was among the highest yielding lines across the state and was the highest yielding line in western NE. Based upon these data, NE06545 is adapted to all of Nebraska, but particularly to rainfed western NE wheat production.

Other measurements of performance from comparison trials indicate that NE06545 is moderately early in maturity (146.6 d after Jan.1, data from 8 observations in eastern NE), about 2 d earlier flowering than Wesley and Goodstreak and 3 days earlier flowering than 'Overland'.

NE06545 is a semi-dwarf wheat cultivar and contains the *RhtB1b* (formerly *Rht1*, data provided by Dr. Guihua Bai). The mature plant height of NE06545 (85 cm) is 5 cm shorter than Overland and 4 cm taller than Wesley. NE06545 has moderate straw strength (6% lodged), similar to Camelot (6%) and McGill (8%), but higher than Wesley (3%) and Overland (3%). The winter hardiness of NE06545 is good and comparable to other winter wheat cultivars adapted and commonly grown in Nebraska.

NE06545 is resistant to *Soilborne wheat mosaic virus*. It is moderately resistant to moderately susceptible to stem rust (caused by *Puccinia graminis Pers.: Pers. f. sp. tritici* Eriks & E. Henn.) in field nursery tests inoculated with a composite of stem rust races (RCRSC, QFCSC, QTHJC, RKQQC, and TPMKC) at St. Paul, MN. and using field stem rust races, in Kenya. In greenhouse seedling tests, it is resistant to races QFCSC, QTHJC, MCCFC, SCCSC, QCCSM, heterogeneous to RCRSC and RKQQC, but susceptible to race TMPKC and TTKSK (data provided by Y. Jin at the USDA Cereal Disease Laboratory). It is moderately resistant to moderately susceptible to leaf rust (caused by *P. triticina* Eriks, data provided by J. Kolmer at the USDA Cereal Disease Laboratory). It is moderately resistant to susceptible to stripe rust (caused by *P. striiformis* Westendorp f. sp. *tritici*, data obtained from field observations in the Great Plains). It is moderately susceptible to Fusarium head blight (caused by *Fusarium graminearum*, data from greenhouse and field observations in Nebraska). NE06545 is moderately susceptible to susceptible to Hessian fly (*Mayetiola destructor* Say, data provided by Ming-Shun Chen, USDA and Kansas State University). It is susceptible to *Barley yellow dwarf virus* and *Wheat Streak mosaic virus* (data obtained from the Southern Regional Performance Nursery and field observations in NE).

NE06545 is lower in grain volume weight (72.5 kg/hl), which is similar to Camelot (73.2 kg/hl) and Wesley (73.0 lbs/bu) and lower than Overland (75.0 kg/hl). The milling and baking properties of NE06545 were determined for five years by the Nebraska Wheat Quality Laboratory. In these tests, Wesley, an excellent milling and baking wheat, was used for comparison. The average wheat and flour protein content of NE06545 (134 and 109 g kg⁻¹) were lower than Wesley (142 and 121 g kg⁻¹) for the corresponding years. The lower grain protein content was confirmed by the Nebraska State Variety Trials (Table 2) where NE06545 had 120 g protein kg⁻¹ compared to Wesley with a value of 128 g kg⁻¹. The average flour extraction on the Buhler Laboratory Mill for NE06545 (722 g kg⁻¹) was lower than Wesley (747 g kg⁻¹). The flour ash content (3.9 g kg⁻¹) was lower than Wesley (4.5 g kg⁻¹) as well. Dough mixing properties of NE06545 were acceptable (mixtime peak was 5.34 minutes and mixtime tolerance was scored as 4.2 on a scale of 1 to 7 with 1 being very low tolerance and 7 being high tolerance to mixing) which were stronger than Wesley (mixtime peak of 4.40 minutes and mixtime tolerance scored as 3.90). Average baking absorption (611 H₂O g kg⁻¹) was similar to Wesley (610 H₂O g kg⁻¹) for the corresponding years. The average loaf volume of NE06545 (799 cm³) was lower than Wesley (849 cm³). The scores for the internal crumb grain and texture ranged were 3.6 and 3.8 which were lower than Wesley (4.4 and 4.7, respectively). The overall end-use quality characteristics for NE06545 (scored as 3.8, where 3 is fair, 4 is good and 7 is excellent) was lower than Wesley (4.6) and similar to many commonly grown wheat cultivars. NE06545 should be acceptable to the milling and baking industries.

In positioning NE06545, based on performance data to date, it should be well adapted to most rainfed wheat production systems in southeastern, south-central, west-central, and western Nebraska and in adjacent areas of the Great Plains. NE06565 is not recommended for irrigated wheat production due to its average straw strength and does not have the yield potential of the

best available irrigated wheat cultivars (data not shown). NE06545 has an excellent grain yield record in organic production systems in eastern NE (highest yielding line using the average of three years for the 22 lines tested in all three years). However, NE06545 is not recommended for organic production due to its quality characteristics. Where it is adapted, NE06545 should be a replacement for Camelot, Millennium, and Wesley (for rainfed production), though Wesley has better straw strength. For the lines listed in Table 2, only NE06545, McGill, and Wesley have excellent wheat soilborne mosaic virus resistance which is needed in southeastern and south-central NE for early planted wheat or wheat that is planted at the recommended seeding date followed by a warm fall. NE06545 is genetically complementary to virtually all wheat cultivars grown in Nebraska except for Alliance and Karl 92.

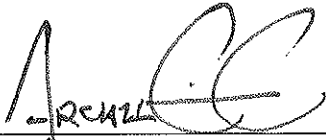
NE06545 is an awned, ivory-glumed cultivar. Its field appearance is most similar to Wesley, but can be easily separated from Wesley because Wesley has a bronze chaff. After heading, the canopy is moderately closed and erect. The flag leaf is erect and twisted at the boot stage. The foliage is green with a light waxy bloom on the leaf sheath, with a little waxy bloom on the spike at anthesis and on the leaves. The leaves are glabrous. The spike is tapering, narrow, mid-long, and middense. The glume is long and wide, and the glume shoulder is oblique to rounded. The beak is long in length with an acuminate tip. Kernels are red colored, hard textured, and mainly ovate in shape. The kernel has no collar, a large brush of long length, rounded cheeks, mid-size germ, and a wide and mid-deep crease.

NE06545 has been uniform and stable since 2010. Less than 0.5 % of the plants were rogued from the Breeder's seed increase in 2010-12. The rogued variant plants were taller in height (5 - 15 cm) or were awnless and/or with red chaff. Up to 1% (10:1000) variant plants may be encountered in subsequent generations. The Nebraska Crop Improvement Association provided technical assistance in describing the cultivar characteristics and accomplishing technology transfer. The Nebraska Foundation Seed Division, Department of Agronomy and Horticulture, University of Nebraska-Lincoln, Lincoln, NE 68583 will have foundation seed available to qualified certified seed enterprises in 2013. The U.S. Department of Agriculture will not have commercial seed for distribution. The seed classes will be Breeder, Foundation, Registered, and Certified. NE06545 will be submitted for plant variety protection under P.L. 10577 with the certification option. A research and development fee will be assessed on all certified seed sales. Small quantities of seed for research purposes may be obtained from Dr. P. S. Baenziger and the Department of Agronomy and Horticulture, University of Nebraska-Lincoln for at least 5 yr from the date of this release. In addition, a seed sample has been deposited in the USDA-ARS National Small Grains Collection, Aberdeen, ID and seed is freely available to interested researchers.

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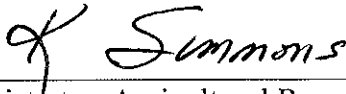
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Approval



Director, Nebraska Agricultural
Experiment Station

1/23/2013
date



Administrator, Agricultural Research Service
United States Department of Agriculture
Washington, D. C.

1/20/2012
date

Table 1. Data on grain yield from the Nebraska Intrastate Nursery from 2008 to 2012 at seven rainfed locations (Mead, Lincoln, Clay Center, North Platte, McCook, Sidney, and Alliance) in Nebraska and one organic location (Mead) for a total of 31 rainfed environments (locations * years) and 4 organic environments for the named lines that were in common all five years.

	Mead	Lincoln	C. Center	N. Platte	McCook	Sidney	Alliance	Average	RANK	Mead Org.	Rank
	4*	5	5	5	3	4	5	31		4	
	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha		kg/ha	
Camelot	3476	4202	3120	4032	4543	4443	3804	3333	7	3779	3
Goodstreak	3405	4031	3052	3928	4112	4189	4129	3279	8	3799	2
McGill	3659	4784	3588	4123	5458	4212	3660	3606	4	3525	6
NE06545	3727	4882	3730	4535	5428	4466	4189	3803	1	3896	1
Robidoux	3549	4538	3751	4072	5609	4501	4220	3675	2	3233	8
Overland	3863	4389	3726	3998	5512	4255	4043	3638	3	3566	5
Scout 66	2345	2744	2079	3013	3856	3527	3147	2447	9	2638	9
Settler CL	3358	4316	3491	3993	5238	4297	4124	3509	5	3633	4
Wesley	3427	4131	3188	3888	5065	3976	3860	3362	6	3405	7
Mean	3355	4113	3201	3905	4911	4165	3871	3342		3427	

* number of years tested at that location

Table 3. End-use quality data for NE06545 and Wesley (control sample) for 5 years of testing using composite samples from nurseries grown throughout Nebraska.

Sample ID	Year	Milling				Protein (14% mb)		Ash, %	Mixograph (14%mb)		Baking (14% mb)						Overall		
		Flour Yield, %	Bran Score	Short Score	Mill Type Score	in Wheat, %	in Flour, %		Water Abs, %	PT, min	Tol. , ppm	Oxidant , ppm	Water Abs, %	MT, min	Loaf Vol. mL	Ext. Score		Crumb Grain Score	Crumb Texture Score
NE06545	2007	69.9	1.0	1.5	1.5	12.1	11.1	0.41	60.0	4.17	4.0	2.5	62.0	6.75	770	3.8	3.5	3.5	3.6
	2008	72.3	2.5	3.5	2.5	15.5	12.4	0.38	60.0	6.53	5.5	0.0	61.0	7.16	733	3.8	3.5	3.5	3.6
	2009	73.5	2.5	2.5	2.5	12.0	11.4	0.35	60.0	4.71	4.0	0.0	61.0	5.30	760	3.5	4.0	3.8	3.8
	2010	71.2	0.5	0.5	0.5	12.8	9.3	0.41	61.0	5.95	4.2	0.0	61.0	6.02	873	4.5	3.3	3.5	3.8
	2011	73.9	3.0	2.5	2.5	12.8	10.2	0.41	63.5	5.34	3.3	0.0	60.3	6.05	823	4.3	4.3	4.5	4.3
Mean		72.2	1.9	2.1	1.9	13.4	10.9	0.39	60.9	5.34	4.2	0.5	61.1	6.26	799	4.1	3.6	3.8	3.8
Stdev		1.7	1.1	1.1	0.9	1.6	1.2	0.03	1.5	0.94	0.8	1.1	0.6	0.72	61	0.4	0.4	0.5	0.5
Sterr		0.7	0.5	0.5	0.4	0.8	0.5	0.01	0.7	0.42	0.4	0.5	0.3	0.32	31	0.2	0.2	0.3	0.3
WESLEY	2007	73.3	3.5	3.5	2.5	14.7	13.9	0.43	60.0	3.55	4.3	0.0	60.0	5.68	800	4.0	4.8	5.0	4.8
	2008	76.0	3.5	3.5	3.5	14.2	11.1	0.53	60.0	3.97	4.8	0.0	60.0	7.16	880	5.0	5.0	6.0	5.6
	2009	75.1	3.5	3.5	3.5	14.0	13.3	0.41	60.0	3.02	3.5	0.0	62.0	5.92	860	4.8	4.5	4.5	4.6
	2010	74.1	3.5	3.5	4.5	4.0	10.7	0.40	62.3	4.93	4.9	0.0	62.0	7.07	870	4.3	4.3	4.5	4.3
	2011	75.1	3.5	3.5	4.5	4.0	11.5	0.46	63.5	4.01	4.6	0.0	61.1	6.21	815	4.3	3.4	3.6	3.8
Mean		74.7	3.5	3.5	3.7	14.2	12.1	0.45	61.2	4.40	3.90	0.0	61.0	6.41	849	4.5	4.4	4.7	4.6
Stdev		1.0	0	0	0.8	0.3	1.4	0.05	1.5	0.6	0.7	0.0	1.0	0.67	32	0.4	0.6	0.9	0.7
Sterr		0.5	0	0	0.4	0.2	0.2	0.02	0.7	0.3	0.31	0.0	0.4	0.30	14	0.2	0.3	0.4	0.3

a. Super (7), Rating: Excellent (6), Very Good (5), Good (4); Fair (3); Poor (2); Very Poor (1), Fair (0)