

Registration of 'Lenetah' Spring Barley

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ABSTRACT

'Lenetah' (Reg. No. CV-338, PI 652440) two-rowed spring feed barley (*Hordeum vulgare* L.) was developed by the Agricultural Research Service, Aberdeen, ID, in cooperation with the Idaho Agricultural Experimental Station and released in December 2007. Lenetah was selected from the cross 94Ab12981/91Ab3148. 94Ab12981 has the pedigree 85Ab2323/'Camas'. 85Ab2323 has the pedigree 79Ab19042/'Crystal'. 79Ab19042 is a selection from the cross 'Klages'/'Hector'. Camas is a selection from the cross ND5976/ND7159. ND5976 has the pedigree 'Maris Concord'/'Klages'/'ND2679-4 and ND7159 has the pedigree Klages/ND1244/3/ND2685/ND1156/'Hector'. 91Ab3148 has the pedigree 'Gallatin'/'Targhee'/'Bowman'. Lenetah was selected as an F_{5.6} line in 2001 and given the experimental designation 01Ab11107. It was released due to its superior yield and test weight compared to 'Baronesse', the most widely grown feed barley in Idaho and Montana. The yield advantage over Baronesse is especially pronounced in northern Idaho and eastern Washington and under dryland conditions.

'Lenetah' (Reg. No. CV-338, PI 652440) two-rowed spring feed barley (*Hordeum vulgare* L.) was tested under the experimental line number 01Ab11107 and developed by the USDA-ARS and the Idaho Agricultural Experiment Station. It was publicly released in December 2007 due to its superior yield across Idaho, but especially in northern Idaho, and under dryland conditions. It was evaluated in the three northern Idaho counties of Lewis, Nez Perce, and Latah and was named for these three counties.

Lenetah was selected from the cross 94Ab12981/91Ab3148. 94Ab12981 has the pedigree 85Ab2323/'Camas'. 85Ab2323 has the pedigree 79Ab19042/'Crystal' (Wesen-

berg et al., 1991) and is also a parent of 'Tetonia' (Obert et al., 2008). Camas, released by the University of Idaho but not registered, is a selection from the cross ND5976/ND7159. ND5976 has the pedigree 'Maris Concord'/'Klages'/'ND2679-4, and ND7159 has the pedigree Klages/ND1244/3/ND2685/ND1156/'Hector' (Wells, 1973). 79Ab19042 is a selection from the cross Klages/Hector. Klages (Wesenberg et al., 1974) was the two-rowed malting standard for many years and is the progenitor of the majority of current two-rowed malting barleys. 91Ab3148 has the pedigree 'Gallatin'/'Targhee'/'Bowman'. Gallatin (Hockett et al., 1987) and Bowman (Franckowiak et al., 1985) are both two-rowed barleys that have performed well in Idaho. Targhee (Wesenberg et al., 1995) is a two-rowed spring feed barley best adapted to Idaho.

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Abbreviations: WRDSBN, Western Regional Dryland Barley Nursery; WRSBN, Western Regional Spring Barley Nursery.

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Methods

Early Generation Population Development

Lenetah was developed using a pedigree selection procedure with all early generation population and line development done under irrigation at Aberdeen, ID. The cross between the two parents was made in January 1997; F₁ seed was planted in April 1997 as a single 3.1-m row, and F₂ seed was harvested in bulk. In April 1998, F₂ seed was planted in four 3.1- by 1.4-m plots with 35-cm row spacing. Fifty F₃ spikes, 5 from each of 10 rows, were harvested in 1998 and planted as individual progeny rows in 1999. Of these 50 F₃ rows, 5 spikes from 10 superior rows, were individually harvested and planted in the spring of 2000 as F_{3:4} rows. Selection of superior rows was based on favorable maturity, height, and resistance to lodging.

Line Selection and Evaluation

Approximately 120 F_{4.5} spikes were randomly selected in 2000 and individually threshed; 100 were planted in 2-m rows for visual observation in 2001. Lenetah was selected from among F₅ progeny rows based on resistance to lodging, suitable maturity, acceptable height and spike characteristics, and superior seed quality. It was row number 11107 and thus assigned the experimental designation 01Ab11107.

For all nonreplicated and replicated yield trials, the seeding rate was 105.3 and 79.0 kg ha⁻¹ for irrigated and dryland conditions, respectively. Lenetah was evaluated in a nonreplicated yield trial in 2002 under irrigation at Aberdeen. A single plot 4.1 by 1.3 m with row spacing 17.8 cm was evaluated for yield, test weight, and percentage plump kernels. Yield analyses of all plots consisted of the total grain weight, adjusted to 110 g kg⁻¹ moisture. Percentage plump kernels were determined on a 100-g sample of seed, which was screened on a sieve with 0.24- by 1.9-cm slotted openings (American Society of Brewing Chemists, 1992). Kernels retained were considered plump. From this point forward, all trials consisted of three replicated plots 4.3 by 1.3 m with row spacing of 17.8 cm. Lenetah entered preliminary yield trials in 2003 and was evaluated under irrigation at Aberdeen and Filer, ID, and under dryland conditions at Soda Springs, ID. A 400-g subsample of a composite of 1 kg from each of two replicates was evaluated for malt quality by the USDA-ARS Cereal Crop Research Unit in Madison, WI. On the basis of low values of malt extract and diastatic power at multiple locations compared to 'Harrington' (Harvey and Rossnagel, 1984), the two-rowed industry standard, it was removed from consideration for further malt evaluation and assigned to the feed barley program. In 2004 it was tested under irrigation at Aberdeen and under dryland conditions across Idaho at Craigmont, Soda Springs, Tammany, and Tetonia. It entered the elite feed trial in 2005 and was evaluated under irrigated conditions at Aberdeen and Filer and under dryland conditions at Potlatch, Soda Springs, Tammany, and Tetonia. In 2006 it was again evaluated in the elite feed trials under irrigation at Aberdeen and Filer, although yield was not evaluated at Filer. It was evaluated under dryland conditions at Fenn, Potlatch, Soda Springs, and Tetonia. In 2007 it was again evaluated in the elite feed trial under irrigation at Aberdeen and Filer, as well as dryland trials at Fenn, Potlatch, and Tetonia, in addition to Uniontown, WA. Plots at Soda Springs were abandoned due to severe drought stress exacerbated by nonuniform plot conditions. In 2007 Lenetah was entered into both the irrigated Western Regional Spring Barley Nursery (WRSBN) and dryland Western Regional Dryland Barley Nursery (WRDSBN) trials across Idaho, Washington, Oregon, Montana, Utah, Wyoming, North Dakota, and Saskatoon, SK, Canada.

Seed Purification and Increase

Seed of Lenetah from the original F_{5.6} progeny row was increased in 2006 as a two-row plot (4.9 by 1.2 m) and examined for segregating types before bulk harvest of F_{5.7} seed. F_{5.7} seed was planted in 2007 as a 4.6- by 6-m plot, examined for segregating types, and F_{5.8} seed harvested in bulk. Before harvest, 300 individual spikes were harvested, and 25 were

examined to determine morphological characteristics. There was no variability for any of the descriptive traits (described in the characteristics section) among the 25 spikes. The remaining 275 spikes were threshed and grown as progeny rows in isolation in Yuma, AZ. Approximately 40 kg of F_{5.8} Breeder seed is available for Foundation seed production. In addition, selected rows from Yuma will be evaluated and uniform rows harvested for production of F_{5.9} Breeder seed.

Statistical Analyses

All statistical analyses were performed using Agrobases Generation II software (Agronomix Software, 2004). Analysis of variance for yield, test weight, plump kernels, heading date, height, and lodging from ARS trials was performed across locations within years, and a combined analysis was performed across location-years using only entries common to all trials from 2005 to 2007. Within-year evaluations had location and genotypes as fixed factors and replications as a random factor. Analyses across years had location-years and genotypes as fixed factors and replications as random factors.

Characteristics

Agronomic and Botanical Description

Lenetah and 'Spaulding' are slightly taller than both 'Baronesse' and Tetonia. Lenetah is similar to Baronesse for straw strength. Lenetah, Baronesse, and Spaulding head on average 1 d earlier than Tetonia (Table 1). Lenetah has a moderately lax spike that nods at maturity. The spike has smooth awns, long rachilla hairs, glume hairs that are banded, and glume awns equal in length to the glume. Laterals are sterile with a barbed apex. The kernel has white aleurone, veins with few barbs, and a crease that is open to slightly flaring. The hull is adhering, slightly wrinkled, tending to smooth. The rachis is glabrous to very few hairs. Lenetah is easily distinguished from Baronesse, Tetonia, and Spaulding as only Lenetah has smooth awns.

Disease Resistance

Lenetah was tested for reaction to barley stripe rust (causal agent *Puccinia striiformis* Westend. f. sp. *hordei* Ericks. & Henn.) by Dr. Xianming Chen at the USDA-ARS Wheat Genetic, Quality, Physiology, and Disease Research Unit in Pullman, WA. Ten seedlings of Lenetah were grown in the greenhouse along with a

Table 1. Agronomic summary for 'Lenetah' spring barley and two-rowed cultivars in ARS performance trials from 2005 to 2007.

Cultivar	Heading date	Height	Lodging score [†]
	Julian days	cm	1-9
Lenetah	176.0	74.2	2.0
Baronesse	176.1	69.7	2.3
Tetonia	177.4	71.1	-
Spaulding	176.0	74.5	-
LSD _{0.05}	1.02	2.3	1.0
Observations	13	13	11

[†]1 = none, 9 = completely flat. Irrigated trials only.

qualitative (Bison 7H), quantitative (Bison 4H), and susceptible check, 'Step toe' (Muir and Nilan, 1973).

Seedlings were inoculated with *P. striiformis* f. sp. *hordei* races PSH-14 and PSH-31 (field races collected in Washington). After 13 d, seedling leaves were scored according to the 0 to 9 scale described by Line et al. (1974). PSH-14 is virulent on the barley stripe rust differentials 1, 2, 3, 4, 5, 6, 7, 8, and 9, while PSH-31 is virulent on the same differentials as PSH-14 and the differential line 10 (Chen and Line, 2002). All 10 seedlings of Lenetah were susceptible with scores ranging from 7 to 9, while the qualitative and quantitative checks were resistant with scores of 1 and 3, respectively. All 10 seedlings of the susceptible check, Step toe, were rated as 9. On the basis of this data, it appears that Lenetah is susceptible to field races of *P. striiformis*. The incidence of barley stripe rust in Idaho is rare, and when present, losses have been insignificant.

Field Performance

Lenetah was evaluated across 43 location-years from 2004 to 2007. Of these, 21 were conducted by the ARS–Aberdeen breeding program. The remainder of the trials consisted of the WRSBN (10), WRDSBN (7), and University of Idaho Extension trials (5). Across all location-years, Lenetah yielded 103% of Baronesse. In dryland trials, Lenetah yielded 108.1% of Baronesse (Table 2) and 108.5% of Baronesse in trials conducted in northern Idaho and eastern Washington (Table 3). Under irrigation the performance of Lenetah has been equal to Baronesse, Tetonia, and Spaulding for yield, test weight, and plump kernels. In the 2007 WRDSBN and WRSBN trials, Lenetah ranked second and eighth, respectively. For within-year analyses, Lenetah was in the top statistical grouping in both the irrigated and dryland trials, while Baronesse was in the top statistical group only in the irrigated trials. Lenetah was in the top statistical grouping at all locations in the dryland test except at Hettinger, ND. In the irrigated trial, Lenetah and Baronesse were not in the top statistical group at Aberdeen, Langdon, ND, and Williston, ND. In addition, Lenetah was not in the top group at Powell, WY, and Saskatoon, SA. Baronesse was not in the top group at Idaho Falls, ID and Pullman, WA.

Availability

Breeder and Foundation seed of Lenetah will be maintained by the Idaho AES Foundation Seed Program.

Table 2. Grain yield, grain volume, and plump kernels for barley cultivars Lenetah and Baronesse in dryland trials from 2005 to 2007.

Cultivar	Grain yield	Test weight	Plump kernels
	kg ha ⁻¹	g L ⁻¹	%
Lenetah	4092**	652*	71.1**
Baronesse	3786	635	62.6
Locations	24	15	15

*Significant at the 0.05 probability level.

**Significant at the 0.01 probability level.

Table 3. Grain yield, grain volume, and plump kernels for barley cultivar Lenetah and selected two-rowed barley cultivars in trials across northern Idaho and eastern Washington from 2005 to 2007.

Cultivar	Grain yield	Test weight	Plump kernels
	kg ha ⁻¹	g L ⁻¹	%
Lenetah	4426	650	74 ₋
Baronesse	4034	631	70
Tetonia	4081	639	70
Spaulding	4054	661	73
LSD _{0.05}	276	10.6	6.1
Locations	10	6	6

Requests for seed should be directed to the Coordinator, Foundation Seed Program, College of Agriculture, Kimberly Research and Extension Center, 3793 N 3600 E, Kimberly, ID 83341. Small quantities of seed may be obtained from the corresponding author for up to 5 yr. It is requested that appropriate recognition of source be given when this cultivar contributes to development of new germplasm or cultivars.

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