

Other two-rowed

barley varieties released by the N.D. Agricultural Experiment Station:

Rawson – (2005) Slightly higher yielding than Conlon. Very large seeded, but the loose hulls make it unacceptable for malting.

Conlon – (1996) Good yield and test weight with heat tolerance which helps to maintain kernel plumpness.

Logan – (1995) Similar to Bowman in heading date and plant height and similar to Morex for foliar diseases. Better yield, test weight, lodging score and lower protein than Bowman.

Bowman – (1984) Jointly released by NDSU and USDA. Good test weight and straw strength. Resistant to wheat stem rust but susceptible to loose smut and barley yellow dwarf virus.

For information on the availability of Foundation seed contact:

NDSU Research/Extension Centers

Agronomy Seed Farm, Casselton.....347-4743
Carrington Research Extension Center.....652-2951
Hettinger Research Extension Center567-4323
Langdon Research Extension Center.....256-2582
North Central Research Ext. Center.....857-7679
Williston Research Extension Center774-4315

Or

NDSU Foundation Seedstocks Project
P.O. Box 5051
Fargo, ND 58105-5051

701-231-8140

www.ag.ndsu.nodak.edu/aginfo/seedstock/fss/

Plant Quality Certified Seed

Certified seed is field inspected and lab analyzed to help ensure variety identity, germination, and purity. Contact your local seed producer or dealer for quality certified seed.

Seed producers or dealers can be found in the North Dakota Field Inspected Seeds Directory. The directory is available from the North Dakota State Seed Department (NDSSD), North Dakota Crop Improvement & Seed Association, your local county agent, or under the field seeds program of the NDSSD website. www.ndseed.com

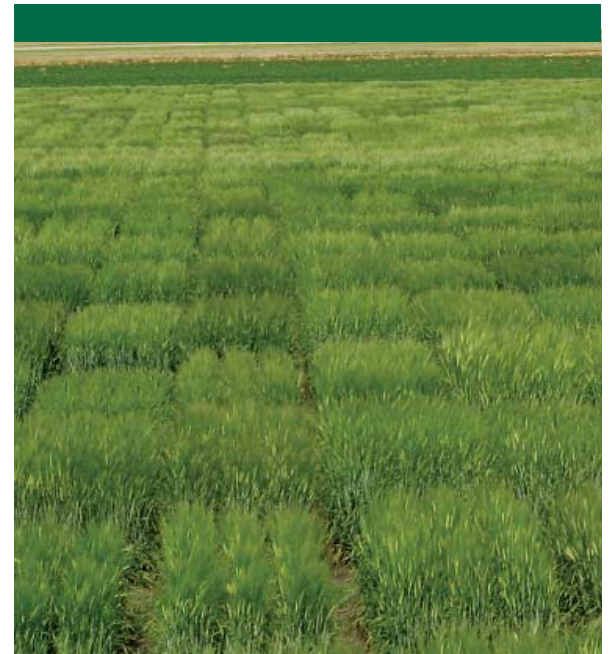


Varieties protected under PVPA with Title V option can only be sold as a certified class of seed. **It is the responsibility of the buyer and/or seller to confirm the PVP status of a specific crop variety prior to buying or selling the variety.** PVP status information can be obtained from the ND State Seed Department.

NDSU[®]

AGRICULTURE

Pinnacle Two-Rowed Barley



www.ndcropimprovement.org

Pinnacle Two-Rowed Barley

Pinnacle was developed by the NDSU Barley Breeding Program and released by the North Dakota Agricultural Experiment Station in 2006. Pinnacle has a parentage of mostly experimental lines, but includes Logan and Foster in its early ancestry. The original cross was made in 1999 by Jerry Franckowiak, former NDSU two-rowed barley breeder who retired in 2006.

Pinnacle has a white hull, smooth awns and long rachilla hair. Pinnacle has greater resistance to spot blotch than Conlon, and approaches that of Lacey and Drummond

Based on more than four years of trials in North Dakota, Pinnacle has a 15 percent yield advantage over Conlon. Pinnacle heads out about three days later than Conlon, but has greater straw strength than Conlon and approaches that of the strongest six-rowed varieties.

Pinnacle has excellent quality characteristics. Compared with Conlon, Pinnacle has lower protein and a higher percentage of plump kernels. The remainder of its malting characteristics is similar to Conlon, which is accepted by the malting and brewing industry. Pinnacle is currently in the last year of testing to determine if it will be added to the AMBA list of approved varieties for malting.

For more information about Pinnacle and other two-rowed barley varieties visit www.ag.ndsu.nodak.edu/aginfo/variety/index.htm or contact the NDSU BARLEY breeder or small grains agronomist at 701-231-7973.

To help ensure genetic purity, Pinnacle barley will be protected under PVPA Title V and must be sold as a class of certified seed. A research fee will apply to all Registered and Certified Seed sales. This fee will be collected from the labeler by the North Dakota State Seed Department.

Pinnacle General Characteristics

- High yield
- Low protein
- Long rachilla hairs
- Smooth awns
- White aleurone
- Medium-late maturity
- Medium height
- Strong straw strength

Disease reaction¹ of Pinnacle and other two-rowed barley varieties. Ratings based on several years of data collected in various trials and disease nurseries.

Variety	Stem Rust	Loose Smut	Spot Blotch	Net Blotch
Pinnacle	S	S	MR	MS
Conlon	S	S	MS	MR
Bowman	S	S	MS-S	S-MS
AC Metcalfe	S	NA	MS	MS

¹R = Resistant, MR = Moderately resistant, MS = Moderately susceptible, S = Susceptible



Agronomic traits of Pinnacle two-rowed barley in eastern North Dakota NDSU variety trials (Carrington, Fargo and Langdon, 2008).

Variety	Grain Yield (bu/acre)	Protein (%)	Test Weight (lbs/bu)	Plump Kernels (%)
Pinnacle	108	11.3	49.7	90
Conlon	90	12.8	51.7	95
Bowman	95	13.4	50.7	91
Ac Metcalfe	92	13.3	48.4	81

Agronomic traits of Pinnacle two-rowed barley in western North Dakota NDSU variety trials (Minot, Williston, Dickinson and Hettinger, 2008).

Variety	Grain Yield (bu/acre)	Protein (%)	Test Weight (lbs/bu)	Plump Kernels (%)
Pinnacle	87	13.2	47.7	86
Conlon	81	14.2	49.2	93
Bowman	80	14.5	48.9	87
AC Metcalfe	75	15.2	45.6	70

INFORMATION ON PINNACLE TWO-ROWED BARLEY

Selection No: 2ND21863

Parentage: ND18172/ND19130

Project Leaders: J.D. Franckowiak, R.D. Horsley, P.B. Schwarz, S.M. Neate

Description:

Growth habit:	Spring	Glume hairs:	A band with long hairs
Spike type:	Two-rowed, semi-lax	Hull wrinkling:	Finely wrinkled
Awn type:	Smooth	Lateral vein barbs:	Present
Rachilla hairs:	Long	Kernel shape:	Broad compared to length
Aleurone color:	White	Crease shape:	Shallow, flared toward end
Basal mark:	Depression		

History:

Pinnacle is an F₃-derived selection from the cross ND18172/ND19130. ND18172 (ND15147//F103-105/ND14636) is a late line having some resistance to Fusarium head blight (FHB). The lines ND15147 (Logan sib/TR231) and ND14636 (ND11883/Logan sib) were selected based on agronomic performance and low grain protein. F103-105 (Foster/Zhedar 2//ND9712) is a two-rowed line selected as having some FHB resistance. ND19130 is a low-protein line from the cross ND15468/ND15368//ND16461. ND16461 (ND13296/ND14760) has low protein and high yield, ND15468 (ND13154/ND13897) is a late, high yielding line with some net and spot blotch resistance, and ND15368 (ND13083/ND13100) is an early line with good malt quality and some resistance to Septoria speckled leaf spot. The F₁ generation of cross C2-00-133 was grown in the 2001 spring greenhouse nursery, the F₂ generation was grown at Fargo in 2001, and F₃ headrows were grown at Casselton in 2002. Row C2-00-133-20 was harvested and selected for continuation based on low grain protein. Row C2-00-133-20-3 in the 2003 Yuma, AZ nursery was harvested and tested as 2ND21863 in 2003 preliminary yield trials grown at Fargo and Langdon. Pinnacle was planted in advanced yield trials in 2004 and in variety trials in 2005.

Agronomic Characteristics:

Based on five years of trials in North Dakota by the barley breeding programs, Pinnacle has over a 15% yield advantage over Conlon (Table 1). It also has a 9% yield advantage over the six-rowed cultivar Lacey, which was used as a check in all NDSU Two-rowed Barley Breeding Program yield trials. Pinnacle heads about 4 d later than Conlon and 1 d later than Lacey. Plant height of Pinnacle is about 1 in taller than Conlon, but Pinnacle has stronger straw than Conlon. Lodging resistance of Pinnacle is intermediate to that of Conlon and Lacey.

Malting Quality Characteristics:

Compared to Conlon, the only two-rowed cultivar recommended by the American Malting Barley Association (AMBA) for production of malting barley in North Dakota, Pinnacle has higher malt extract, lower grain protein, lower beta-glucan values, and similar kernel plumpness (Table 2). The lower grain protein and the associated greater kernel plumpness could make production of barley with malting quality easier in western ND. Pinnacle was grown in 2005 for the first year of the AMBA Pilot Scale Evaluation Program and was rated as satisfactory. Pinnacle was rated as unsatisfactory in its second year of Pilot Scale evaluation.

Deoxynivalenol (DON) Accumulation Characteristics:

In 2005 and 2006, DON accumulation in Pinnacle has been determined in 15 station years of trials. On average, Pinnacle accumulates nearly 40% less than DON than Robust and similar amounts as Conlon.

Adaptation and Probable Production Area:

Pinnacle is the culmination of over 30 years of breeding two-rowed malting barley cultivars suitable for western North Dakota. Pinnacle appears adapted to all parts of North Dakota and adjacent areas of Montana and South Dakota. Because of its later heading date, Pinnacle appears to respond better than Conlon to late-season rains. Yet, its large kernel and low grain protein traits may be helpful when growing malting barley in environments where moisture stress develops after heading. Pinnacle appears to have adequate straw strength for production in most US spring barley areas where barley is grown under dryland conditions.

Availability of Seed

Pinnacle was officially released by NDSU in July 2007 and will be distributed to growers for seed increase through the North Dakota Crop Improvement Association beginning late January 2008. Sufficient seed is available in 2008 for production of grain for AMBA Plant Scale Evaluation. If there is a desire to test Pinnacle in the 2008 AMBA Plant Scale Evaluation Program, Dr. Dale Williams, Director of the NDSU Foundation Seedstocks Program, needs to be notified by early January to ensure sufficient seed is reserved for seeding the Plant Scale fields.

Unique Properties of Pinnacle:

- May be suitable malting as grown in North Dakota
- High grain yields
- Large, plump kernels and some drought tolerance
- Moderate resistance to net and spot blotch
- Good lodging resistance
- Mid-early heading
- Low grain protein
- ___ Good malt extract values
- ___ Accumulates less DON than Robust and similar to that of Conlon

Table 1. Mean agronomic performance of Pinnacle, Conlon, and Lacey barley grown in NDSU Barley Breeding Project yield trials, 2003-2007.

Entry	Days to heading (days after 5/31)	Plant height (in)	Lodging (1-9)†	Foliar disease (1-9)‡	Yield (bu/ac)	Test weight (lb/bu)
Station years	64	63	30	4	81	9
Pinnacle	25.6	30.3	3.1	3.9	88.2	51.9
Conlon	21.7	29.6	3.5	5.7	76.6	51.4
Lacey	24.7	29.7	2.8	4.9	80.7	50.0

†Lodging score of 1=no lodging and 9=severe lodging.

‡Foliar disease score of 1=no disease and 9=severe disease.

Table 2. Mean malt quality of Pinnacle, Conlon, and Lacey barley grown in NDSU Barley Breeding Project yield trials, 2003-2006†.

Entry	Kernel weight (g)	Plump kernels (%)	Kernel color (Agtron)	Malt extract (%)	Wort color	Wort clarity	Barley protein (%)	Soluble protein (%)	S/T (%)	Diastatic power (°ASBC)	Alpha-amylase (20° DU)	Beta-glucan (ppm)
Station years	30	30	30	30	30	30	30	30	30	30	30	30
Pinnacle	44.7	93.7	49.0	80.7	1.9	1.0	12.1	5.17	44.4	115	66.5	230
Conlon	42.4	93.3	51.9	80.0	1.9	1.1	13.0	5.21	42.0	125	75.8	299
Lacey	34.6	83.0	51.5	79.1	2.1	1.1	13.5	5.76	44.4	178	71.4	133

†Data provided by the USDA-ARS Cereal Crops Research Unit, Madison, WI.

Table 3. Deoxynivalenol accumulation (ppm) in Pinnacle, Robust, and Conlon barley, 2005-2006.

Entry	NABSEN†		Breeders' trials		Average
	2005	2006	2005‡		
Station years	5	7	3		15
Pinnacle	10.6	2.8	0.8		5.0
Robust	14.1	5.2	4.0		7.9
Conlon	10.1	2.7	0.9		4.8

†NABSEN=North American Barley Scab Evaluation Nursery.

‡Data from 2006 are not available due to lack of FHB development.