

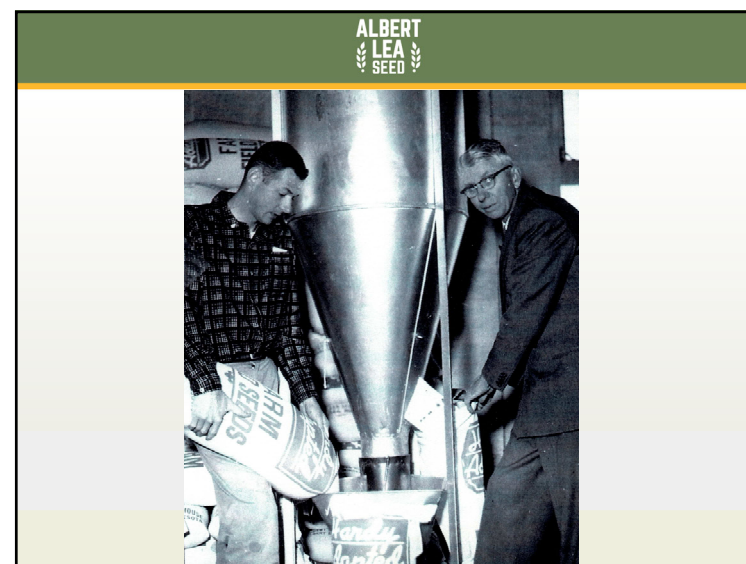


## CHOOSING THE RIGHT VARIETAL TRAITS FOR ORGANIC GRAINS

**2019 Organic Grain Winter Conference**  
Mac Ehrhardt, Albert Lea Seed

[www.alseed.com](http://www.alseed.com)

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### What We'll Cover Today

- Selecting Seed for Organic Systems**
  - Practical things to think about
  - General breeding & selection
- Breeding/Testing Methods & Changes**
- Species-by-Species Selection Considerations**

***Please Ask Questions!***

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### Selecting Seed for Organic Systems

#### Practical Considerations

- Does it make sense to grow this in your area?
  - Cotton in WI?
  - Winter Barley in WI?
  - Hard Red Spring Wheat in WI?
  - Spring field peas on heavy, wet, poorly drained soils?
- Has there been enough breeding work done to make this species a viable choice? (Lupin beans)

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### Practical Considerations, *continued*

#### Who is your intended customer? (And what do they want?)

- Specific variety?
  - Food-grade
  - Specialty marketing? (heirloom)
  - Malting barley
- Specific characteristics?
  - Milling quality (make sure you know)
  - Test weight (corn, wheat, oats)
  - Protein (wheat, hay)
- Things they hate? Deal killers?
  - GMO (corn & beans) (what level?)
  - Ergot (rye)
  - Light test weight (oats)

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## Selecting Seed for Organic Systems

### General Breeding & Selection

#### Major Crops (corn, soy, alfalfa, wheat, oats, barley)

- Majority of breeding by large companies or Universities with little/no interest in organic
- Large-scale breeding programs do all breeding, screening, & evaluation in conventional randomized, replicated systems

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			Yield Deviations													
id	Entry	Pedigree	E	W	All	Locs	Yld Rnk	Yld bu/A	Yld %Min	% Met	Yld	Pop 000s	% SL	% RL	Twt	
3	29	TR5285RPGJZ*TRex3822	-20.1	-25.5	-22.0	17	37	199.7	90	17.6	11.6	33.5	3.5	0.0	57.6	
3	12	TR7289*TRex3807	6.8	1.1	4.8	17	14	226.5	102	17.7	13.0	34.1	14.7	0.7	56.0	
3	28	TR5285RPGJZ*TRex3720	-7.6	-14.2	-9.9	17	33	211.8	96	17.7	12.1	34.0	8.2	0.1	57.5	
3	3	TR4242*TR4651	-13.0	-10.1	-11.9	17	35	209.7	95	17.9	11.9	34.3	15.0	0.0	57.3	
3	7	TR6254*TR4344	-0.6	6.6	1.9	17	20	223.6	101	17.9	12.8	34.1	21.6	0.2	56.6	
3	14	TR5272RPGJZ*TRex3807	-7.1	14.2	0.4	17	21	222.1	100	18.0	12.6	34.0	11.3	0.2	55.8	
3	5	TR6254*TRex3893	-13.2	-4.1	-10.0	17	34	211.7	95	18.1	12.0	33.0	13.3	0.1	55.0	
3	8	TR7289*TR4344	-7.1	-0.1	-4.6	17	29	217.1	98	18.1	12.3	33.9	14.7	0.1	56.2	
3	19	TR5272RPGJZ*TRex3720	10.0	10.5	10.1	17	9	231.8	105	18.1	13.0	33.9	11.9	0.0	57.0	
3	4	Dekalb DKC51-38	-1.8	3.6	0.1	17	22	221.8	100	18.2	12.4	34.2	8.8	0.2	57.0	
3	9	TRex3887*TR4344	-27.0	-31.4	-28.6	17	39	193.1	87	18.2	10.8	32.2	17.4	0.2	56.6	
3	20	TR5272RPGJZ*TRex3822	-4.5	1.0	-2.6	17	25	219.1	99	18.2	12.3	34.0	9.2	0.2	56.8	
3	16	TR5272RPGJZ*TR4344	-7.9	2.3	-4.3	17	27	217.4	98	18.4	12.0	34.1	16.1	0.1	56.6	
3	13	Pioneer P0157AM	-7.3	-1.7	-5.3	17	30	216.3	98	18.5	11.9	34.0	12.6	0.9	57.1	
3	25	TR6254HAW*TR4310	-1.1	-8.6	-3.0	17	26	218.7	99	18.5	12.1	34.9	13.8	2.1	55.9	
3	30	TR5285RPGJZ*TRex3882	7.9	-5.5	3.1	17	16	224.8	101	18.5	12.4	34.1	9.7	0.8	57.7	
3	34	TR6254*TRex3720	7.1	-5.8	2.5	17	17	224.2	101	18.6	12.4	33.9	14.8	0.0	56.5	
3	1	Pioneer P9998AM	4.4	-2.4	2.0	17	19	223.7	101	18.7	12.2	34.1	10.2	0.2	57.3	
3	31	Dekalb DKC53-56	-8.7	-7.6	-8.3	17	32	213.4	96	18.7	11.7	34.3	8.4	0.3	57.0	
3	17	TR5272RPGJZ*TR4310	-6.1	-4.1	-5.4	17	31	216.3	98	18.9	11.6	33.9	5.8	1.3	56.0	
3	22	TR5272RPGJZ*TR6946	14.7	8.5	12.5	17	8	234.2	106	19.0	12.6	33.9	9.8	0.2	56.2	
3	32	TR5272*TR6946	27.1	19.9	24.5	17	2	248.2	111	19.0	13.3	34.1	2.2	0.0	56.6	
3	11	TR7289HAR*TR3365	0.1	-3.6	-1.2	17	23	220.5	99	19.1	11.7	34.1	11.0	2.0	56.2	
3	21	TR5272RPGJZ*TRex3882	0.1	6.1	2.2	17	18	223.9	101	19.1	11.9	32.8	7.0	0.2	56.1	
3	2	TRex3390*TRex3643	16.7	9.3	14.1	17	5	235.8	106	19.2	12.5	33.9	15.4	2.5	56.7	
3	26	TR7289HAW*TR4310	-13.5	-22.4	-16.6	17	36	205.1	93	19.2	10.9	34.2	13.6	3.6	55.5	
3	10	TRex3887*TR3365	-32.0	-29.1	-31.0	17	40	190.7	86	19.3	10.2	33.4	27.3	0.1	56.7	
3	15	TR5272RPGJZ*TRex3809	-7.4	0.6	-4.5	17	28	217.2	98	19.3	11.5	33.9	15.4	0.3	56.2	

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## Randomized, Replicated Testing Goals

- **Reduce variability**
- **Identify & characterize genetics**
  - Yield
  - Moisture
  - Stalk & Root Lodging
  - Test Weight
  - Disease Susceptibility
  - Other Characteristics

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## The Result of Randomized, Replicated Testing

Identifies the best hybrids & varieties for performance in randomized, replicated plots under high fertilization and pesticide management.

***Does that sound like organic farming?***

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## How Organic Seed Companies Select from Conventional Data

### Proxy characteristics from conventional data

- Corn: Emergence, Height & Canopy, Ear Flex
- Soybeans: Height, Canopy width
- Wheat: T.W. & protein, disease resistance

### Customer feedback (takes years)

- “...worked great”
- “Poor emergence”
- “Short, poor weed shading”

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## Organic Breeding Under Organic Conditions

**Not much on-organic-farm breeding work has been done** (for major grain crops)

...but this is starting to change.

- Some Universities (such as U. WI Madison, ISU, and others) have begun to breed for organic systems)
- Programs & Grants for breeding under organic systems
  - USDA-OREI
  - U of IL \$2 Million Grant in 2018 for Org. Corn Research
  - \$17 Million in latest farm bill (Org. Research)
  - OFRF

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## Evaluation/Testing under Organic Conditions

- Mostly on commercial/released hybrids & varieties
- Universities (such as U. WI, U. MN, VT, and others)
- Some other public-facing organizations (e.g. Organic Valley)
- Evaluating & Screening hybrids/varieties for organic production:
- A.L. Seed/Viking Organic Product Screening Trials

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## Organic Research & Trials

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## Viking Organic Research Trials, 2018

- 4 rows, harvest middle 2
- Replicated 4 times at each location
- Data from 1 location here
- 3 other locations (lost one, weeds)


2018 Location	Variety	Ave Yield (BU)	Ave Harvest Moisture (%)	Ave Test Weight (LB/BU)
Prairie Sky Farm	E1993	64.96	10.4%	55.52
Prairie Sky Farm	O.2188AT12N	64.37	11.6%	55.80
Prairie Sky Farm	O.1544AT	63.73	11.0%	55.50
Prairie Sky Farm	2322	61.91	11.1%	56.18
Prairie Sky Farm	19AR1	61.38	10.6%	55.34
Prairie Sky Farm	O.1955AT	61.11	11.1%	56.10
Prairie Sky Farm	2018N	60.95	10.9%	54.98
Prairie Sky Farm	1518N	59.15	10.4%	55.50
Prairie Sky Farm	V.2518	58.07	11.1%	55.53
Prairie Sky Farm	P.92M10	57.85	10.8%	55.43
Prairie Sky Farm	O.1A1029	57.79	10.9%	56.18
Prairie Sky Farm	N1958	57.51	11.0%	55.34
Prairie Sky Farm	O.2113RA12	57.48	11.0%	55.42
Prairie Sky Farm	O.1706N	57.44	10.6%	55.73
Prairie Sky Farm	P.21A20	57.04	11.1%	57.03
Prairie Sky Farm	V.2265	56.66	10.6%	55.92
Prairie Sky Farm	N2358	56.49	10.8%	56.28
Prairie Sky Farm	1722N	55.60	10.6%	55.12
Prairie Sky Farm	2023	55.26	10.5%	56.04
Prairie Sky Farm	O.1A2104	52.39	11.1%	55.44

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RNG	Plot	Comments	Lodging		RM	Yield	Avg Moisture (%)
			Score	Hybrid			
2	1	standing well - high ear ht	7	Exp. 2018-3	110	124.39	23.00
3	1	tops broken; rest is standing ok	6	38G54	96	163.99	16.00
4	1	a few stalks lodged	7	Exp. 2018-2	106	129.23	20.25
5	1	some stalks lodging	4	Exp. 2018-6	104	145.05	22.20
6	1	a few broken tops, standing ok	5	0.82-95	95	154.88	18.00
7	1	standing well	7	0.74-10G5	110	112.86	29.50
8	1	short, low ear ht, standing well	7	38G54	96	95.89	17.10
9	1	short, standing well, husk open	7	GH 47N2	97	145.63	17.80
10	1	50% lodged, later than 95d	3	Exp. 2018-5	95	135.11	21.80
11	1	short, 80% of tops broken standing fine	6	0.84-95UP	95	127.25	16.70
12	1	medium ht, tops good, stands fine	6	0.86-03	103	152.85	17.80
13	1	30% of tops breaking	6	Exp. 2018-2	106	126.33	20.60
3	2	solid stand, 10% of broken tops	6	0.51-04	104	163.89	20.05
4	2	solid stand	6	0.74-10G5	110	129.10	25.70
5	2	50% lodged, 20% broken tops	2	MC4630		143.82	18.60
6	2	tall, 30% lodged, 10% broken tops	3	Exp. 2018-1	106	157.96	22.20
7	2	10% lodged, 30% tops broken	3	0.79-00UP	101	135.78	17.45
8	2	50% lodged, tops ok	6	69-99 Unt.	101	120.23	19.50
9	2	70% tops broken, 10% lodging	3	Exp. 2018-4	105	134.09	19.90
10	2	50% tops broken, 50% lodged	3	0.79-00UP	101	130.93	17.20
11	2	10% stalks lodged, tall	6	Exp. 2018-1	106	138.48	22.05
12	2	20% tops broken, standing ok	6	0.86-03	103	133.68	17.50
13	2	30% stalks lodged, 50% tops broken	3	Exp. 2018-6	104	104.99	21.20
2	3	50% broken tops, standing ok	5	0.82-95	95	156.70	17.25
3	3	tall, 10% broken tops	7	0.51-04	104	176.78	19.15
4	3	standing fine, tops ok, open husks	6	GH 47N2	97	155.96	17.00
5	3	all lodged, a mess	2	MC4630		165.18	18.45
6	3	tall, high ear ht	3	0.68-06	106	186.72	22.40
7	3	30% broken tops, standing ok	7	69-99 Unt.	101	171.41	17.75

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## Considerations for Variety Selection by Species: Corn

### General Considerations for Hybrid Seed Corn

- End-use? (food-grade, animal feed, silage)
- What are the requirements of your potential buyer?
  - Required hybrid?
    - *Organic seed available? (If not, Certifier approval?)*
  - Quality specifications? (test weight, thins, starch density)
  - GMO threshold?

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## Considerations for Variety Selection by Species: Corn

### Adventitious Presence (A.P.) GMO

### National Organic Program Rule

The use of GMOs is prohibited in organic production and handling. The NOP regulations prohibit the use of GMOs as “excluded methods” under 7 CFR § 205.105, ‘Allowed and prohibited substances, methods, and ingredients in organic production and handling

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## Considerations for Variety Selection by Species: Corn, *continued*

- NOP Standard is a process-based standard.
- There has never been a “threshold” or “tolerance level” for A.P. GMO in the NOP Organic Rule.
- New Approach?
  - The Materials Subcommittee of the N.O.S.B. proposal (Oct. 24-26, 2018, St. Paul, MN) “*Protecting the Genetic Integrity of Seed Grown on Organic Land*”
  - Proposal would require transparency on A.P. of GMO in Hybrid Seed Corn only. (Both Organic & Unt. Conv.)


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### What GMO levels are allowed by buyers of Organic Grain?

Table 3. Action Thresholds

Category	Action Threshold
Seed and other propagation materials	0.25% *
Inputs to human food, ingredients, supplements, personal care products, and other products that are either ingested or applied directly to skin, and pet food	0.9%
Livestock feed and supplements, including those used for animal-derived inputs to human food products	5% <sup>b</sup>
Inputs to packaging, cleaning products, textiles and other products that are not ingested or applied directly to skin	1.5%



**Cashton Farm Supply**

Org. Feed Corn: 5%

Org. Feed Soy: 5%

**Large Grain Aggregator X**

Org. Feed Corn: 2% (traceability emph.)

Org. Food-grade Corn: "Neg. Strip Test"

Org. Feed Soy: 2% (traceability emph.)

Org. Food Soy: "Neg. Strip Test" (0.25% RR, 0.50% LL, 0.25% R2X)

**SunOpta**

Org. Feed Corn: 1.5% - 5% (buyer-driven)

Org. Food-grade Corn: 0.9%

Org. Feed Soy: 1.5% - 5%

Org. Food Soy: 0.1 - 0.9%


**Scoular Grain**


Org. Feed Corn: 3% - 5% (buyer-driven)

Org. Feed Soy: 0.9% - 5%


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**ALBERT LEA SEED**







### HOW WE DEVELOP & MAINTAIN NON-GMO PURITY



**GEOGRAPHIC ISOLATION**



**DEDICATED EQUIPMENT & TRANSPORTATION**



**STRINGENT TESTING**

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**ALBERT LEA SEED**

### What are Seed Companies doing about GMOs in seed?



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**SGS**

### REPORT OF SEED ANALYSIS

SGS 1405 32nd Ave. Brookings, SD 57006

Date Received: 3/28/2017  
Date Completed: 4/5/2017  
Date of Report: 4/5/2017

Albert Lea Seed House  
PO Box 127 1414 W Main  
Albert Lea, MN 56007 USA

To: Brian White      Fax:      Kind of Seed: CORN  
Sample Number: 53250      Customer ID: 0.84-95UP / MR / 21813  
Account Number: 482 CL  
Client ID:  
SampleTrack  
OrderID:  
Customer Remarks: P-35S,GA21,MIR162,MIR604

Number of Seeds: 10000

Sample Remarks:

TEST: Real Time PCR	Analysis	Result (%)	Method	Remarks
Quan PCR	P-35S	Not Detected	RealTime PCR	LOD: 0.01 %; LOQ: 0.1 %
Quan PCR	GA21	Not Detected	RealTime PCR	LOD: 0.01 %; LOQ: 0.1 %
Quan PCR	MIR162	Not Detected	RealTime PCR	LOD: 0.01 %; LOQ: 0.1 %
Quan PCR	MIR604	Not Detected	RealTime PCR	LOD: 0.01 %; LOQ: 0.1 %

SGS Brookings is an accredited Laboratory (USML06) of the International Seed Testing Association (ISTA).

All sizes pass pure

\$425

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LEA  
SEED**

## Start Pure, Stay Pure.

Viking offers the industry's first non-GMO purity guarantee.

ORGANIC



**VIKING  
PURE**

**99 %**

NON-GMO

ORGANIC



**VIKING  
ULTRAPURE**

**99.9 %**

NON-GMO

### NON-GMO PURITY GUARANTEED

- It can be cross-pollinated by neighboring fields
- It can be contaminated through co-mingling

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SEED**

## What are Seed Companies Doing About GMOs in Organic Seed Corn?



PuraMaize is a natural gene blocking system that impedes fertilization from "foreign" pollen.

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SEED**

## What are Seed Companies Doing About GMOs in Organic Seed Corn, *continued?*

PuraMaize gene system prevents pollination from GMO corn and blue corn by strongly preferring its own pollen.



On the left a PuraMaize hybrid, on the right a regular hybrid.  
Both pollinated with Hopi Blue Corn pollen and their own pollen.

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LEA  
SEED**

## What are Seed Companies Doing About GMOs in Organic Seed Corn, *continued?*

### Limitations of PuraMaize

- Capital-intensive & time-consuming to develop
- Only 5 Pura-Maize hybrids have been released (so far)
- Grain & food companies have, so far, not been keen to pay a premium for grain produced from PuraMaize hybrids

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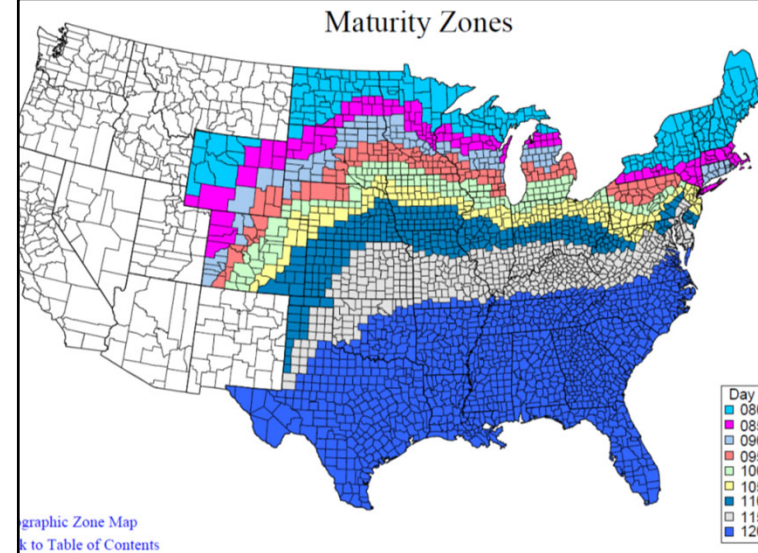


## Considerations for Variety Selection by Species: Corn

- A. Maturity (map)
- B. Emergence and Early Season Growth (Seed Coatings may help)
- C. Height and leaf-angle (weed shading)
- D. Ear Flex (population tolerance)
- E. Yield and Yield Stability (Broad adaptability)
- F. Root Strength
- G. Stalk Strength
- H. Drought tolerance
- I. Wet ground tolerance
- J. Health
- K. Quality (Test Weight)

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## Maturity Zones



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## Additional considerations for seed companies: Corn, *continued*

### Hybrid Selection Criteria

#### Organic Corn Selection Criteria

<b>Emergence/Vigor</b>	Very important as it needs to get out of the ground and canopy quickly to shade the ground to prevent weed growth.
<b>Adaptability</b>	Hybrids need to be able to perform on a wide range of environments.
<b>Yield</b>	Hybrids (current & new) need to be able to compete with industry standards/checks. Looking for top-of-the-line yield performance.
<b>Producibility</b>	Is it available? Need to be sure that the hybrid can be produced organically. Need untreated inbred seed with low GMO levels. Ideally, the female would be a modified or a sister-line.
<b>Agronomics</b>	This is a broad topic that can be broken down, it includes root structure and strength, stalk strength, standability, plant and ear height, etc.
<b>Ear Flex</b>	Fits with agronomics, but even more important in organics as plant populations are typically less dense than in conventional farming.
<b>Drydown</b>	An off-shoot to agronomics, but still important to many farmers. The faster corn can go from black-layer to 20%, the better for grain farmers. Later planting dates in organic expresses more need for faster drydown.
<b>Disease Resistance</b>	Many early seedling disease are not as harsh in organics with the later planting dates, but without fungicide possibilities, resistance to many stalk and leaf diseases is important.
<b>Maturity</b>	Important to have a good spread of maturities to fit farmers' needs. Also important to fill "empty slots" in the lineup and not stack too-many hybrids of the same maturity into the lineup on top of each other.

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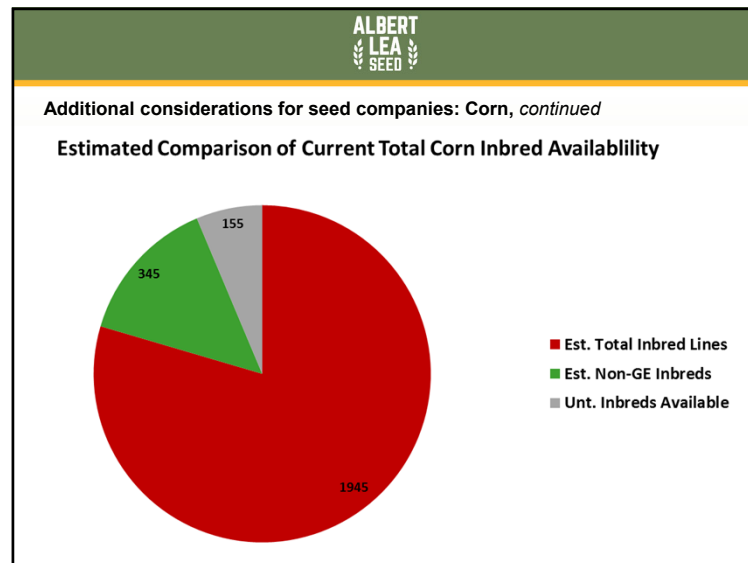


## Additional considerations for seed companies: Corn, *continued*

- **Availability of untreated inbred parent seed** (male & female)
- **Producibility in a seed field** (often a guaranteed contract)
  - Parent seed vigor and height
  - Parent seed potential yield and pollen shed
- **GMO content of parent seed**

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Considerations for Variety Selection by Species: Soybeans

**What is my intended market?**

- If food-grade, then grow what the buyer wants (if it fits your farm)
- If animal feed, then just grow the highest yielding, best adapted variety you can find

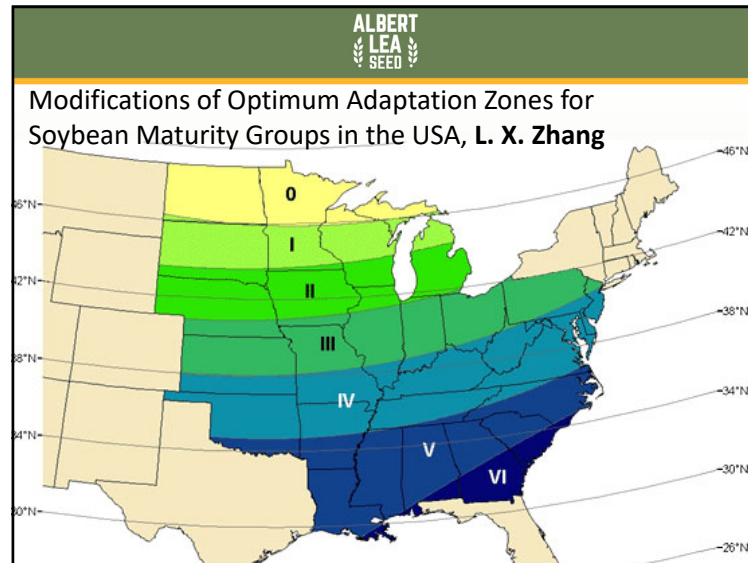
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ALBERT LEA SEED

Considerations for Variety Selection by Species: Soybeans

- **Geographical Adaptation**
  - Maturity Zones in Soybeans (e.g. Group 1.5)
  - Photoperiod sensitive (map)
- **Environmental Adaptation**
  - East to West
- **Disease pressure** (White Mold, PRR, BSR, SDS, IDC)
- **Insect Pressure** (Cyst Nematode, Aphids)
  - Aphid-tolerant soybeans
  - Rag 1, Rag2
  - Stacked (breeding effort in 2<sup>nd</sup> year)
- **Wet soil Tolerance** (PRR)

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**ALBERT LEA SEED**

### Considerations for Variety Selection by Species: Soybeans

- **Organic adaptability**
  - Same problems described previously for corn
    - Mostly conventional breeding & screening
    - Selection by proxy
- **Cultural adaptation**
  - Row width (Bushy)
  - Maturity & Planting date (Until June 15, plant full-season)
  - Are some varieties better for roller-crimper rye?
- **Practical adaptation**
  - What is available in organic seed?
  - Is there a much better conventional untreated option?
- **A.P. of GMO?**

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**ALBERT LEA SEED**

### What are Seed Companies doing about GMOs in organic soybean seed?

Starting with GMO-free soybean seedstock  
"seems achievable".

**eurofins** | BioDiagnostics

Eurofins BioDiagnostics, Inc.  
307 Highland Drive, River Falls, WI 54022  
Phone: 715-425-0246 Fax: 715-425-0231

#### GMO Contamination Report

Customer Name: Albert Lea Seed House Address: 1414 West Main St PO Box 127 Albert Lea, MN 56007 Phone: 507-375-3141 Email: <a href="mailto:info@albertlea.com">info@albertlea.com</a> <a href="mailto:mac@albertlea.com">mac@albertlea.com</a>				Kind of Seed: Soybean Seed Genes/Species: Glycine max Date Received: May 4, 2017 May 5, 2017 Date Completed: May 11, 2017 Date Reported: May 12, 2017 Test Protocol Used: PCR for the indicated targets									
EBCN Sample No.	Variety	Lot	# Seeds Tested	Probs Tested	Probs per Pool	Number of Positive Probs for Each Target			% Seed Contamination Statistical Evaluation				
						40-3-2	Mon 90738	Pat	Number of Negative Probs	Number of Positive Probs	Estimated Contamination Level	Probable Contamination Range	Confidence Level
1571893	T2346	16TA2346-1	1500	6	250	0	0	0	6	0	None Detected	<0.05%	99%
1572861	MC 2381W	580000009-P	1500	6	250	0	2	0	4	2	0.10%	<0.05%	99%
1572862	E2162	16TQ2162-7	1500	6	250	1	0	0	0	1	0.07%	<0.05%	99%

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Albert Lea Seed	
Viking Organic Soybean Criteria	
1 Plant Type	Varieties with a more bushy plant type rather than narrow are more desirable. Need to be able to fill wide rows easily.
2 Plant Height	More important in organic farming with the need to shade the row and help prevent weeds. Does come with standability risks.
3 Aphid Tolerance	Very important in organic without the possibility of using foliar insecticides. But right now its either there, or it's not.
4 Yield	Varieties need to yield better or with current varieties. Also needs to compete well with Conventional, non-GMO varieties.
5 Broad Adaptation	Need to be able to take each variety to a wide range of environments, east to west, and sometimes north to south.
6 Defense	Soybean varieties need to be able to handle a wide range of stresses, i.e. Wet soils, drought, etc..
7 Disease Tolerance	Related to defense, but specific to needs: In order: PRR, SWM, BSR, IDC, CN, SDS, Frog-eye.
8 Standability	Good lodging scores are desirable.
9 Maturity	Find maturities that fit the needs of customers, but not stacked on top of each other.
10 Food Grade	Food grade markets are more prevalent in organic production. Soybeans with clear/yellow hila are more marketable, and higher protein can bring higher premiums. Work with end-users.

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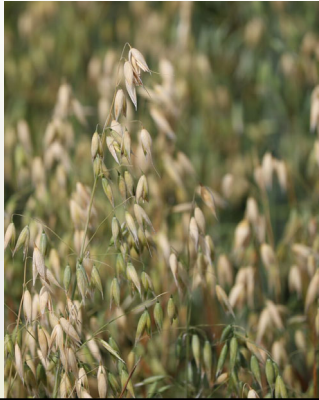
Albert Lea Seed

### Considerations for Variety Selection by Species:

#### Oats

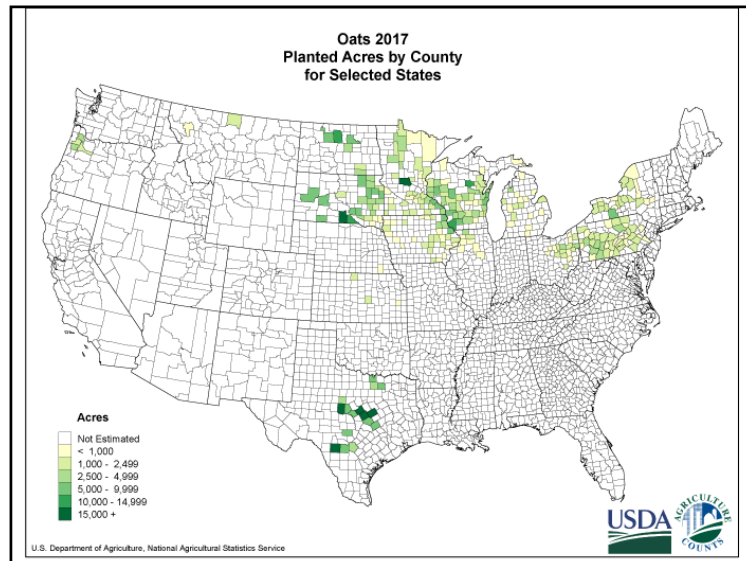
##### Standard Oat Selection Criteria

- Yield
- Test Weight
- Lodging Resistance/Height
- Maturity
- Disease Resistance
  - Crown Rust
  - BYDV



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### Considerations for Variety Selection by Species: Oats

**Grain for a Miller?** (check with them on preferred varieties)

**Are you underseeding them with alfalfa?**

If **Yes**, then most important factors are:

- Very Good lodging resistance
- Early Maturity
- Short

**Reins**  
**Saber**  
**Sumo**  
**Saddle**  
**Antigo**

If **No**, then the most important factors are:

- Test Weight (if it is for a Miller)
- Yield
- Crown Rust Resistance
- Lodging Resistance

**Antigo**  
**Goliath**  
**Natty**  
**Shelby 427 (?)**

**Deon**  
**Hayden**  
**Reins**  
**Sumo**

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### Food Buyers Specifications---Oats

Quality Standards	Foreign Material	Damage	Pest/Pesticide/Odor/FM restrictions
Test Wt. 38 lb. (Min 36)	FM 2%	Frost	NO insect damaged kernels
Moisture 13.5% (10-14%)	wheat, barley, wild oat	Sprouted	NO preharvest glyphosate
Thins 12% (Max 20%)	Ergot 0.02 %	Green	NO detectable levels of pest.
Dehulled 8% (Max 12%)	Buckwheat	Vomitoxin 0.1 ppm	NO objectionable odors

Specifications for Grain Millers, Inc. Eden Prairie, MN

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### Oat Variety Selection for 2019

**Trials**

1. Check more than one (they can conflict)
  - Data can be wrong (U. of MN test weights in 2016)
2. Oats change over years (especially due to Crown Rust)
3. Ask local suppliers what has been working
4. Ask your customer
  - Millers have recommended lists
  - Horse Oat buyers have preferences (white oats)

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## 2018 Small Grain Trial Data

### Barley

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## Considerations for Variety Selection by Species: Oats

### Why planting date is important

- Heat stress at anthesis results in a greater potential yield loss than heat stress at tillering, jointing or grain filling
- Reduced number of seeds fertilized and formed
- Later season heat stress due to delayed planting dates = shorter period of grain fill = lower test weight potential

Anther (pollen)

(Frey, 1997)

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## Considerations for Variety Selection by Species: Oats

### Why is planting date important?


Date 3      Date 1      Date 2

07/07/2015

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**SEEDING  
THE FUTURE  
SINCE 1856**




**KWS**

### Small Grains – Hybrid Winter Rye


- Hybrid winter rye: yields 2X to 3X our standard rye
- Hybrid winter rye: much lower ergot potential
- Everything oats do, hybrid winter rye does better:
  - Erosion control, nutrient scavenging, breaking up pest cycles, GHG capture, pesticide use reduction, reduced fertilizer use, water quality improvements
- Finite market for distilling/milling
- Huge potential market for animal feed
  - Swine rations in the E.U. include from 10-60% cereal rye
  - 2015 Germany, Poland, and Denmark fed over 180 million bushels of rye to swine
- KWS is funding 4-year swine-feeding study at U of IL

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**KWS**

### Small Grains – Hybrid Winter Rye

#### Hybrid Winter Rye

## 153 Bu./acre

*Table 2. Relative grain yield of winter rye varieties in five Minnesota locations in single-year (2017) and multiple year comparisons (2015-2017).*

Cultivar	Lamberton		Le Center		St. Paul		Kimball <sup>2</sup>	Crookston		State	
	2017	3 Yr	2017	3 Yr	2017	3 Yr		2017	3 Yr	2017	3 Yr
Aroostook	81	78	53	70	53	77	70	78	68	73	67
Elbon	84	84	86	78	55	73	78	77	72	78	73
Hazlet	116	115	120	119	155	132	119	120	129	123	125
KWS Bono <sup>1</sup>	153	160	249	190	210	173	190	165	172	175	187
KWS Brasetto <sup>1</sup>	144	141	188	162	187	157	162	157	170	162	167
Maton II	80	77	70	73	62	75	73	68	64	72	63
Musketeer	95	95	69	89	83	81	89	100	105	92	96
ND Dylan	100	—	88	—	105	—	—	99	—	100	—
Okon	83	78	66	72	65	80	72	65	65	76	68
Prima	99	110	66	93	97	95	93	113	110	98	108
Ryman	102	105	96	108	97	103	108	114	108	103	111
Spooner	88	99	86	100	89	108	100	102	96	84	101
Wheeler	74	60	64	47	43	47	47	42	41	63	35
Mean (bu/acre)	100.2	82.3	59.9	76.7	56.2	65.6	76.7	71.1	60.3	71.7	56.1
LSD (0.1)	6	13	35	17	30	23	14	29	19	8	11

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**KWS**

### Small Grains

## HYBRID WINTER RYE


*KWS recommends 800,000 viable seeds/acre (approx. 65-80 lbs/A) depending on size and germination. Seed ½"-1" deep. Uniform seed spacing is essential.*

## KWS BONO HYBRID WINTER RYE\*\*

### CONVENTIONAL, UNTREATED


- Highest yields by U of MN in 2016 and 2017
- Excellent drought tolerance, best dryland variety
- Very large, deep-rooted system

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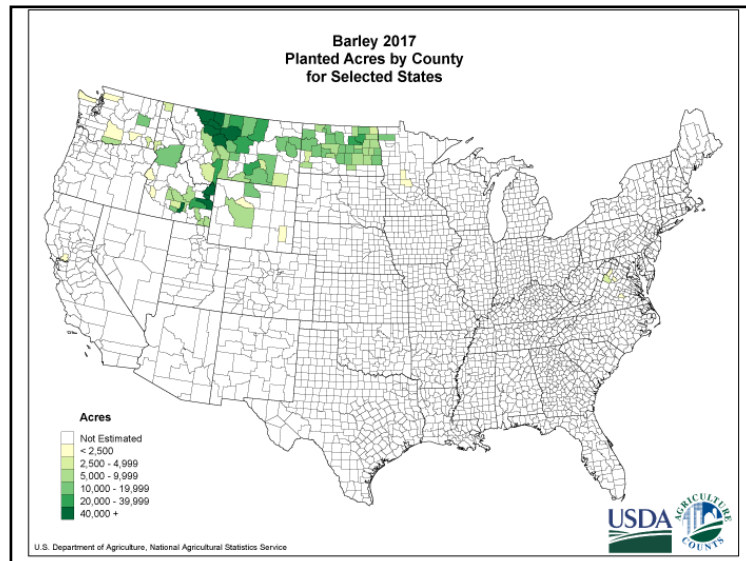
**KWS**

### Varietal Traits for Organic Grains: Barley

#### General Considerations

- I. What is your end-use for barley?
  - A. Forage
  - B. Animal Feed
  - C. Milling
  - D. Malting
- II. What are the requirements of your end-user?
  - A. What is the probability of meeting their needs?

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### Varietal Traits for Organic Grains: Barley

**Management Considerations:**

- Avoid planting barley on fields with lots of corn trash. Corn trash carries the Fusarium fungus, which can cause FHB in barley.
- Avoid fields rotating from oats or wheat
- Well-drained soils are essential for producing good quality barley. Barley grows best in cool and dry conditions.

**Optimum Planting Dates:**

- As early as you can
- Recommended planting date: early April to very early May.

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### Food Buyers Specifications---Barley

Quality Standards	Foreign Material	Damage	Pest/Pesticide/Odor-----restrictions
Test wt. 46 (44)	FM 1.5 (3%)	Frost	NO signs of insect infestation
Moisture 13.5 (10-14%)	Wheat 0% (1%)	Sprouted	NO preharvest glyphosate
Thins 4 % (6%)	Blue barley 0% (1%)	Vomitoxin 0 (3 ppm)	NO pest. odors
Plump 70%	Ergot 0% (0.04%)	Falling # 275 (min 250)	NO objectionable odors

Specifications for Grain Millers, Inc. Eden Prairie, MN

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### Varietal Traits for Organic Grains: Barley

#### General Considerations

**I. 2-Row vs. 6-Row**


- 2-Row had been preferred by malters
- 2-Row tends to have plumper kernels
- 6-Row used to yield more
- Check with your end-user

**II. How to choose a barley?**

- For Millers/Malters, check with them
- For feed: highest yield, best disease resistance
- For forage: highest tonnage/quality

Two Row      Six row

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## Varietal Traits for Organic Grains: Barley

### Agronomic Considerations

- I. Scab tolerance (FHB)
- II. Yield
- III. Lodging Resistance
- IV. Recommended Varieties for grain
  1. ND Genesis, 2-row (Good FHB tolerance, high yields)
  2. Pinnacle, 2-row
  3. Conlon, 2-row (Best FHB tolerance, low yield)
  4. Quest, 6-row (Very good FHB tolerance, good yields)

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Trial Data

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## Varietal Traits for Organic Grains: Wheat


### Agronomic Considerations

**Management Considerations:**


- Avoid planting wheat on fields that were planted to corn the previous year. Corn trash harbors the Fusarium fungus which can cause Scab (FHB).

**Optimum Planting Dates:**

- HRS Wheat: Plant as soon as you can prepare a good seedbed (last week of March is fine). After April 21 in southern MN, you give up 1% of yield for each day of delay.
- Winter Wheat: Varies by latitude, but generally Sept. 10 – Oct. 10



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## Varietal Traits for Organic Grains: Wheat

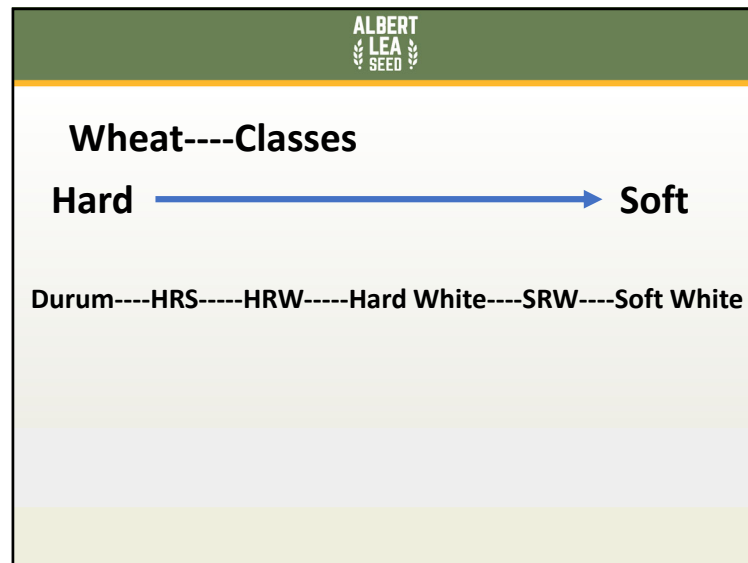
### General Considerations

- I. What does your end-user want?
  - A. Hard Red Spring
  - B. Hard Red Winter
  - C. Soft Red Winter
- II. What are the requirements of your end-user?
  - A. What is the probability of meeting their needs?

- ✓ Market available?
- ✓ Fit your climate? Soils? (agronomic fit)
- ✓ Work in your rotation?

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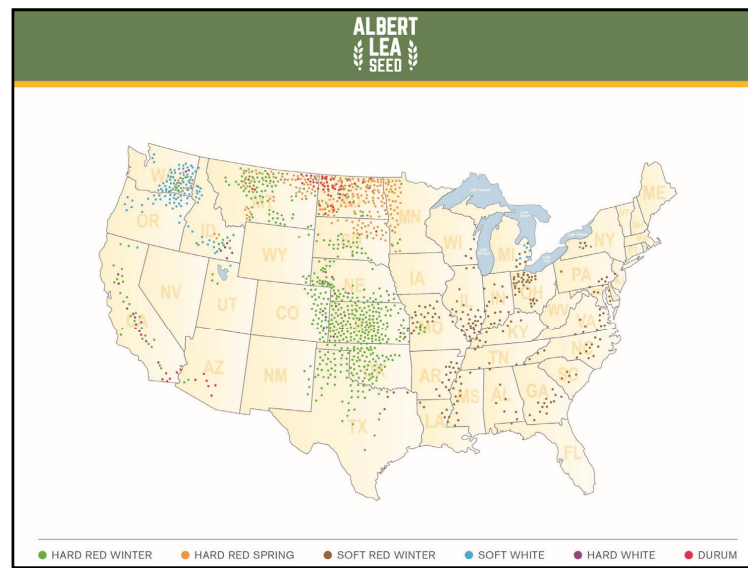




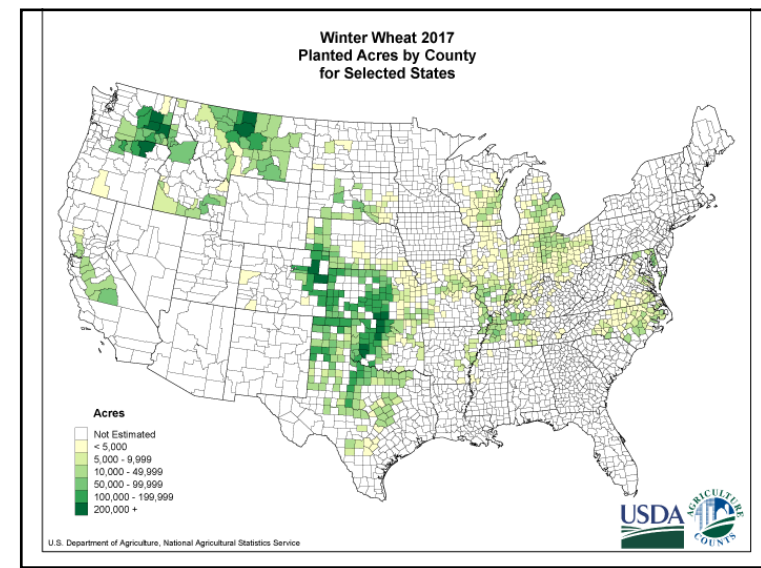
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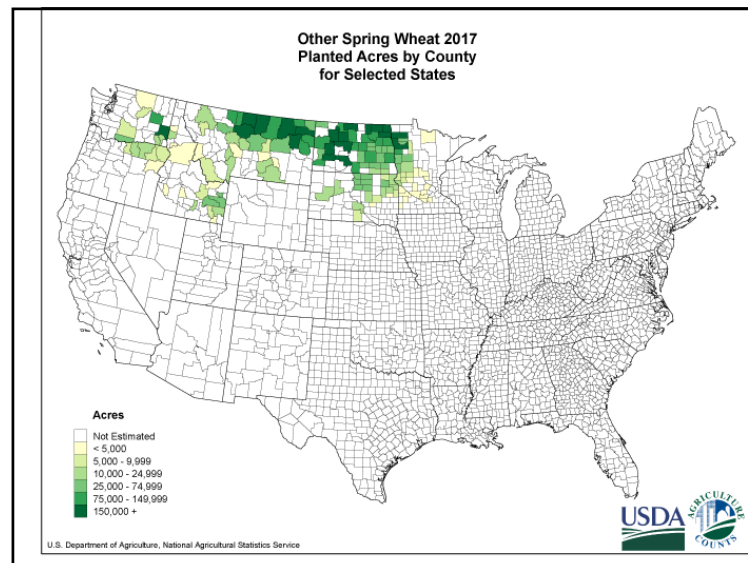
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Please respect the work of plant breeders!

Dr. Kevin Smith, U MN Barley Breeder

Dr. Melanie Caffe, SDSU Oat Breeder

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Starting a Cover Crop Seed Business: Intellectual Property

**Types of I.P. on seed germplasm or genetics:**

1. P.V.P. (Plant Variety Protection)
2. Patents
3. Licensed Varieties

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Plant Variety Protection Act

- Varieties can be protected by Plant Variety Protection (PVP) certificates
  - Applied for by breeder or Univ. I.P. office
  - Twenty year protection on seed
  - Farmers can use seed on own holdings—but cannot sell PVP'd varieties (without Approval & Certification)
- PVP varieties must be sold only as variety names
- PVP Title V varieties must be sold as class of Certified Seed
- Examples:
  - Reins Oats, Deon Oats, Hayden Oats, Shelby 427 Oats
  - ND Dylan Winter Rye
  - Quest Barley, Pinnacle Barley, Rasmussen Barley
  - Shelly Spring Wheat, Expedition Winter Wheat

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## Patents

- **Plant Patent (Plant Protection Act 1930)**  
Very similar to a PVP BUT only for asexually propagated non-tuberos species (not usually seed)
- **Utility Patent (Most Seed Patents)**
  - 20 year protection
  - DUS (Distinctness, Uniformity and Stability) + innovative step + disclosure
  - Products, Processes (methods)
    - Maize variety per se first patented 1985
    - Patented herbicide resistant soybeans 1996
  - Requires license from owner for any use
  - No breeder exception in the US
  - Placed in public domain at expiration
- **Examples:**
  - Most Corn inbreds (and the resulting hybrids)
  - Soybean Seed (RR & Conv.)
  - Many Private Wheat Varieties
  - Some Privately-developed Barley, Triticale, & other grains

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## Licensed Seed

**More and more seed grains are requiring a license to be signed before planting:**

- Trait-ed Corn, Soybeans, Cotton, Sugar Beets
- Conventional Soybeans (even I.S.U.)
- Winter Rye (both Hybrid rye & non-hybrid)
- Wheat
- Barley
- Cotton

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**LCS** **LCS**

**Schedule 3. Single Season Use Agreement for SUA Varieties**

**SINGLE SEASON USE AGREEMENT FOR BARLEY**

This Single Season Use Agreement ("Agreement") is entered into between you ("Grower") and Limagrain Cereal Seeds LLC ("LCS").

By signing and returning this Agreement, the grower receives a limited license to use the following LCS barley variety(s):

LCS Violetta                      and/or                      LCS Calypso

The Agreement confirms that the Grower agrees to purchase the LCS barley variety(s) under the following conditions:

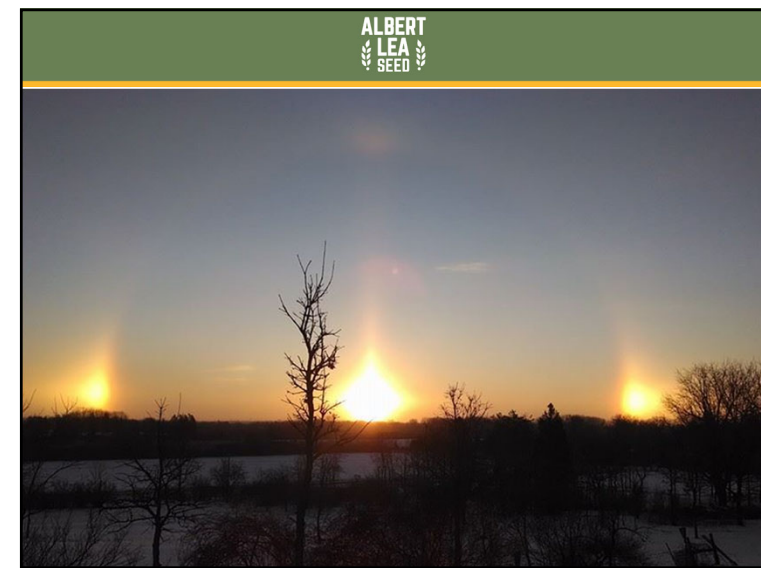
**GENERAL CONDITIONS:**

- 1) The Grower receives the right to purchase Certified seed of the LCS barley variety(s) for one (1) crop year;
- 2) Grower acknowledges that the LCS barley variety(s) and all intellectual property rights thereto are owned by LCS, notwithstanding any license or distributor relationships;
- 3) Grower will cooperate with LCS to protect the intellectual property rights of LCS on the LCS barley variety(s) and agrees to notify LCS of any infringement they are aware of, or become aware of.

**GENERAL TERMS:**

- 1) Grower acknowledges that growing crops from certified seed enhances marketability and yield and that LCS' intellectual property rights should be protected by requiring use of certified seed;
- 2) Grower agrees that the Certified seed purchased will be used solely for planting one (1) commercial crop of grain;
- 3) Grower acknowledges that this LCS barley variety(s) is sold only as a class of certified seed, and further that grain grown from this seed may only be sold through normal commercial channels as grain and not for seed;
- 4) Grower further agrees not to supply any of this seed to any other person or entity for planting, nor to save any of the grain produced from this seed for replanting and that the grain cannot be sold, reproduced or otherwise exposed for sale as seed;
- 5) Grower acknowledges an intent to plant this LCS barley variety(s) for commercial grain production and will provide, upon LCS request, evidence of final commercial disposal of the grain produced.

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“Subjects’ unwillingness to deduce the particular from the general was matched only by their willingness to infer the general from the particular.”

Daniel Kahneman quoting Nisbett and Borgida in his book Thinking, Fast and Slow