

Seed Variety Selection in Organic Production: Wheat, Oats, Soybeans

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ORGANIC WHEAT VARIETY SELECTION

Wheat is an important crop in an organic rotation. It is often grown after a green manure or forage year to maximize available nitrogen uptake and profitability.

The following data are sourced from the Natural System's Agriculture Lab at the University of Manitoba from checks used within organic trials. Refer to your province's seed guide for reliable disease and maturity ratings.

Performance data from organic trials (i.e. from provincial seed guides) provides you with the best source of information; however, variety performance under conventional management (using chemical weed control, and synthetic fertilizers) is not representative of organic growing conditions.

Things to consider:

Quality: Protein and bushel weight

Bushel weight (or test weight) is an indicator of grain density. For example, grades 1 to 3 for Canada Western Red Spring (CWRS) wheat require a minimum test weight of 69-75 kg/hL, respectively. Generally, milling quality wheat requires a minimum of 10% protein for No.1 grade, and a protein level of 13.5% or higher may receive a premium¹.

Height

Modern wheat varieties incorporate semi-dwarf genes to keep the plant shorter while maintaining yield potential. For example, AAC Brandon contains semi-dwarf genes. Taller plants may be advantageous for weed



Photo credit: Michelle Carkner, University of Manitoba

competition under organic management. However, many taller varieties are very prone to lodging, especially if the crop is grown in a high fertility year.

Yield

The following yield data are sourced from organic trials in Manitoba and Alberta. The stars representing the location of sites are shown in *Figure 1*. Although only a few sites are represented, they span multiple years (2017-2022).

Yield data have been organized into 'low-yielding' and 'high-yielding' sites. This has been done to ensure a true representation of genetic potential in optimal years versus tough years.

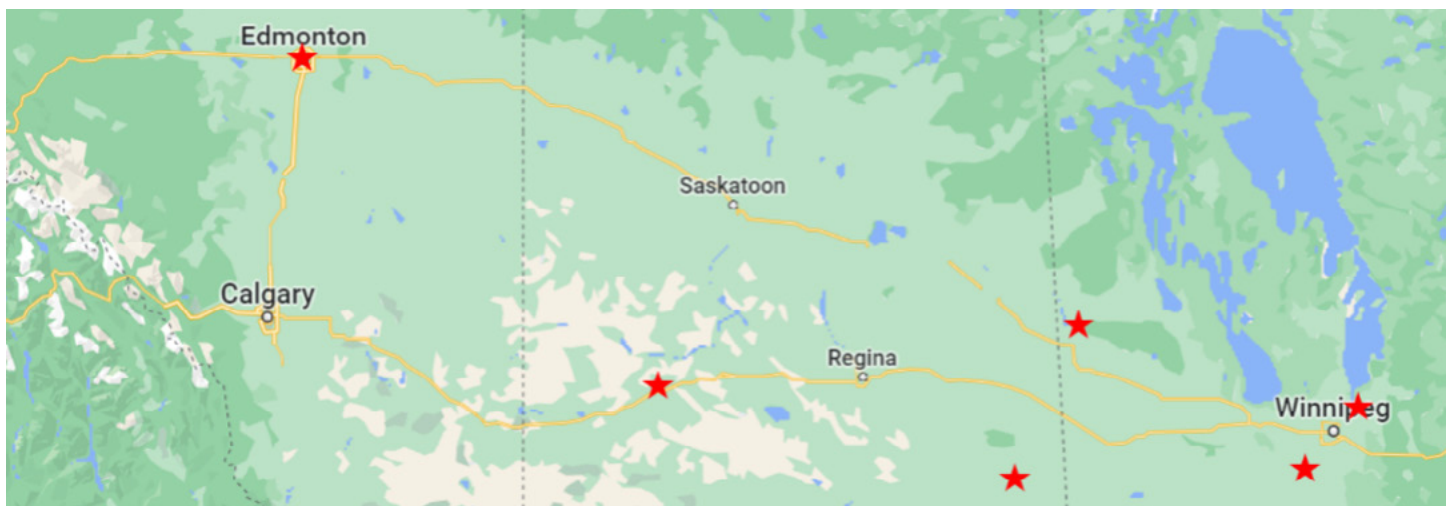


Figure 1. Locations of organic wheat trials, 2017-2022

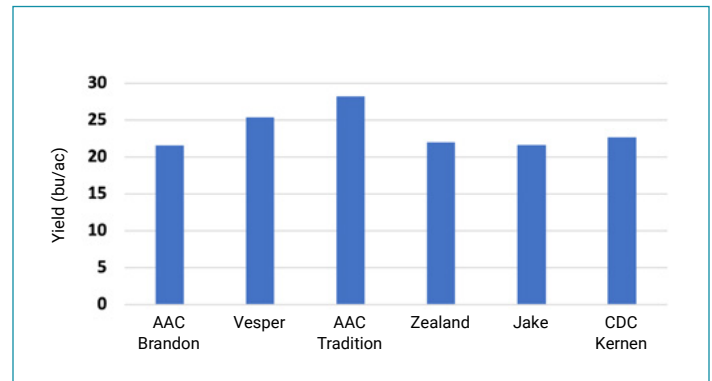
Low-Yielding Sites:

Carman 2021, Roblin 2020, 2021, Libau 2020, 2021, Oxbow 2020, 2021 (7 site years). Low yield was due to drought or very low phosphorus levels.

Cultivar information from 7 site years of lower-yielding sites from 2020-2022

Cultivar	Yield Range	Height	Protein	Bushel Weight
	bu/ac	cm	%	lbs/bu
AAC Brandon	11-37	60	13	62
Vesper	10-46	65	13	62
AAC Tradition	10-45	65	13	64
Zealand	4-33	69	13	62
Jake	14-32	71	14	62
CDC Kernen	11-33	71	14	62

Average Yield of Low-Yielding Sites



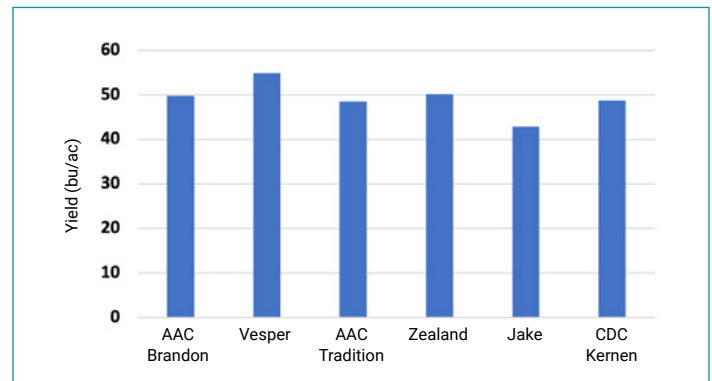
High-Yielding sites:

Carman 2020, 2022, Edmonton 2020, 2021, 2022, Libau 2022, Roblin 2022 (7 site years)

Cultivar information from 7 site years of higher-yielding sites from 2020-2022

Cultivar	Yield Range	Height	Protein	Bushel Weight
	bu/ac	cm	%	lbs/bu
AAC Brandon	36-80	74	13	64
Vesper	42-73	82	13	65
AAC Tradition	37-81	75	13	67
Zealand	37-77	88	13	65
Jake	37-67	82	15	64
CDC Kernen	32-73	83	14	64

Average Yield of High-Yielding Sites



Other yield data:

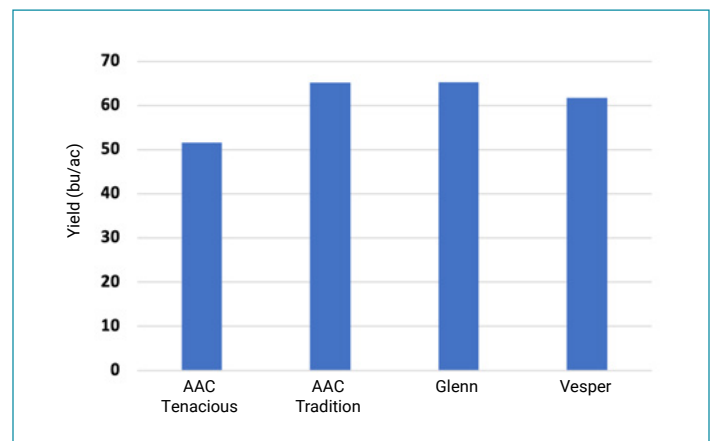
Other varieties that have been tested but not consistently across the site years mentioned above. Data provided from sites: Carman 2019, Swift Current 2019, Edmonton 2019 (3 site years)

Cultivar information from 3 site years in 2019

Cultivar	Yield Range	Height	Bushel Weight
	bu/ac	cm	lbs/bu
AAC Tenacious*	30-70	97	47
AAC Tradition	49-101	86	48
Glenn	32-113	87	46
Vesper	41-94	91	47

*AAC Tenacious is FHB resistant.

Average Yield from 3 Site Years



ORGANIC OAT VARIETY SELECTION

Oats are a great option to include in an organic crop rotation. They are very competitive against weeds and yield well under organic conditions.

The following data are sourced from the Natural System’s Agriculture Lab at the University of Manitoba from variety checks used in organic trials. Refer to your province’s seed guide for reliable disease and maturity ratings.

Performance data from organic trials (i.e. from provincial seed guides) provides the best source of information – however, variety performance under conventional management (using chemical weed control, and synthetic fertilizers) is not representative of organic growing conditions.

Things to consider:

Quality: Grain buyer considerations

When it comes to selling your oats, quality is just as important as yield. Varieties recommended or that are acceptable or under review by Canada’s largest buyer of organic oats, Grain Millers¹, are shown in for different Prairie production zones (Figure 2) in Table 1.

Quality: Bushel Weight and Percentage Plumps

Bushel weight (or test weight) is an indicator of grain density. Grain density is dependent on growing conditions in combination with genetics. Percentage plumps is an indicator of the proportion of grain with plump kernels versus thin kernels; this can also be an indicator of overall seed size.



Oat starting to head out. Photo credit: Michelle Carkner

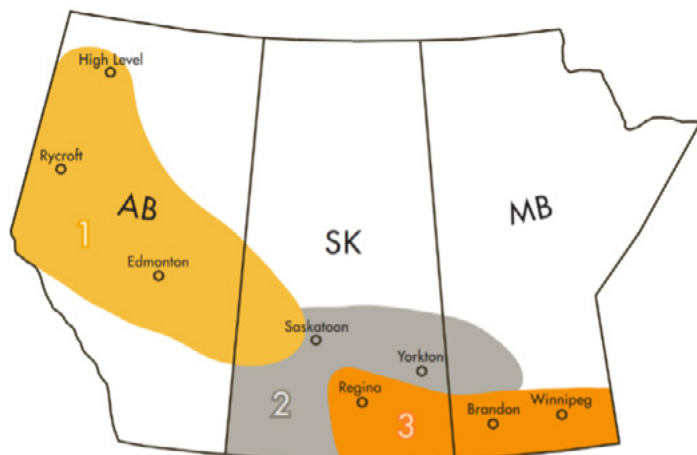


Figure 2. Zones identified by Grain Millers. These are not intended as a rule, but rather as a guide for variety selection.

Table 1. Grain Millers recommended, acceptable, under review, and prohibited milling oat varieties in 2022.

Recommended		
Zone 1	Zone 2	Zone 3
CDC Arborg ¹	CDC Arborg ¹	CDC Arborg ¹
CD Camden ¹	CD Camden ¹	CD Camden ¹
CDC Ruffian	CDC Ruffian	CDC Ruffian
CDC Seabiscuit	AAC Summit	AAC Summit
	Ore 3542M	Ore 3542M

If a variety is listed as recommended in any zone, it is considered acceptable across all zones. ¹Rust susceptible varieties.

Acceptable	Under Review	Prohibited			
AAC Leggett	AAC Douglas	Bourdais	Gwen	Lu	Whitestone
CDC Minstrel	CDC Endure	Bullion	Jasper	Murphy	Feed Varieties
AAC Morgan	AAC Kongsore	Grizzly	Jordan	Mustang	Hulless Varieties
Souris	CDC Skye	Cascade	Juniper	Ronald	Forage Varieties
Triactor ¹					

Height

Height can be an advantageous trait for weed competitiveness, shading out the competition earlier in the season. However, taller plants are prone to lodging under fertile, high moisture conditions. Most modern oat varieties are screened for lodging resistance, but choosing a taller variety increases the risk of lodging.

Yield

The following yield data are sourced from organic trials in Manitoba and Alberta. Site locations are shown in *Figure 3*. Although only a few sites are represented, the trials span multiple years (2017-2021).

Data have been organized into 'low-yielding' and 'high-yielding' sites. This was done to ensure a true representation of genetic potential in years with optimal growing conditions versus tough years.



Figure 3. Locations of organic oat trials, 2017-2022

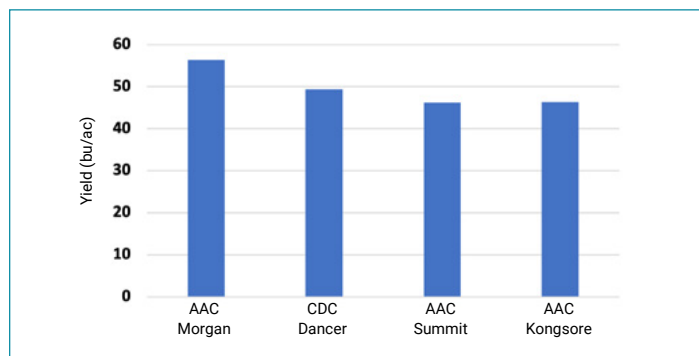
Low-Yielding Sites:

Carman 2020, 2021, Glenlea 2021, Robin 2021, Libau 2019, Somerset 2017 (6 site years). Low yield was due to drought or very low phosphorus levels.

Cultivar information from 6 site years of lower-yielding sites from 2017-2022

Cultivar	Yield Range	Height	Plumps	Bushel Weight
	bu/ac	cm	%	lbs/bu
AAC Morgan	8-88	87	94	62
AAC Dancer	11-74	82	91	62
AAC Summit	20-72	80	88	64
AAC Kongsore	4-92	87	92	62

Average Yield of Low-Yielding Sites



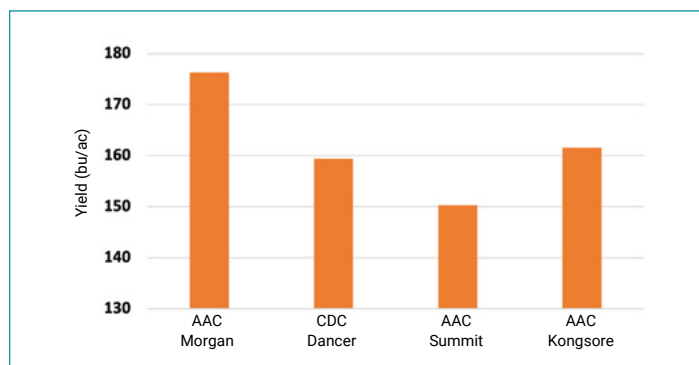
High-Yielding Sites:

Carman 2017, 2019, 2020, Roblin 2020, Lacombe 2019 (5 site years).

Cultivar information from 5 site years of higher-yielding sites from 2019-2020

Cultivar	Yield Range	Height	Plumps	Bushel Weight
	bu/ac	cm	%	lbs/bu
AAC Morgan	100-327	60	13	62
AAC Dancer	97-285	65	13	62
AAC Summit	77-305	65	13	64
AAC Kongsore	83-323	69	13	62

Average Yield of High-Yielding Sites



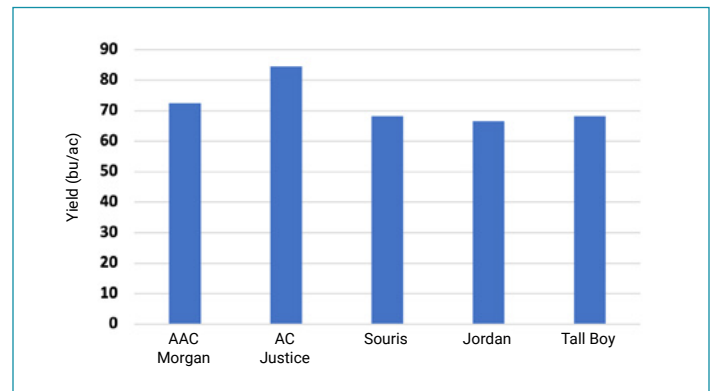
Other Yield Data:

Other varieties that have been tested but not consistently across the site years mentioned above. Data provided from sites: Carman 2015, 2017, 2017 (late seeded), Somerset 2017 (4 site years).

Cultivar information from 5 site years from 2015-2017

Cultivar	Yield Range	Height	Plumps	Bushel Weight
	bu/ac	cm	%	lbs/bu
AAC Oravena	48-122	104	87	47
AAC Justice	59-150	95	80	48
Souris	42-100	96	76	46
Jordan	42-113	102	72	47
Tall Boy	34-119	107	62	45

Average Yield of Low Yielding Sites



SOYBEAN VARIETY FOR ORGANIC PRODUCTION SYSTEMS

Soybean is a warm season crop, but new varieties have allowed Manitoba growers to produce high yielding short season varieties. However, special considerations are required given our colder growing conditions.

Soybeans should be placed near the lower fertility 'end' of a rotation. Lower soil nitrogen gives the N-fixing qualities of soybean a competitive advantage over weeds. But don't forget to inoculate with rhizobium!



Organic soybeans in Carman, MB. Photo credit: Michelle Carkner

Things to consider:

Soybean maturity

The most critical part of choosing the right variety is choosing the right maturity rating for your area. Usually, the longer the soybean takes to mature, the higher the yield potential. However, if the crop undergoes frost damage prior to seed fill and maturity, seed fill stops, and yield is severely affected.

To grow a successful soybean crop, you should be aware and understand the maturity zone system.

Manitoba Maturity Zones

Manitoba Agriculture has organized soybean growing zones into four categories: very early-, early-, mid-, and long-season (*Figure 4*). The categories were created based on long-term heat units and frost-free periods. Each zone indicates the longest season varieties that can be grown in that region.

Variety Maturity Group

Varieties fit into each soybean growing zone based on their relative days to maturity. The soybeans best suited to Manitoba are in the 000-00 maturity group. The number after the "." indicates an extra day to maturity.

Varietal Characteristics

Soybeans are not competitive with weeds, especially early in the growing season. Soybeans are a warm-season crop, and often cooler season weeds such as mustard and lamb's quarters that are more accustomed to our cool growing conditions, outcompete them early in the season, severely affecting yield.

Early Vigour

Soybeans that can put on high growth early in the season are valuable for weed competitiveness. While some research has indicated that earlier maturing soybeans put on greater growth earlier in the season than later maturing varieties, organic soybean variety trials in Manitoba did not show that height or biomass early in the season resulted in higher yields³. Variety guides often don't report early vigour. It would be more important to select a variety with high yield potential, in combination with your proper maturity group and market goals.

Height

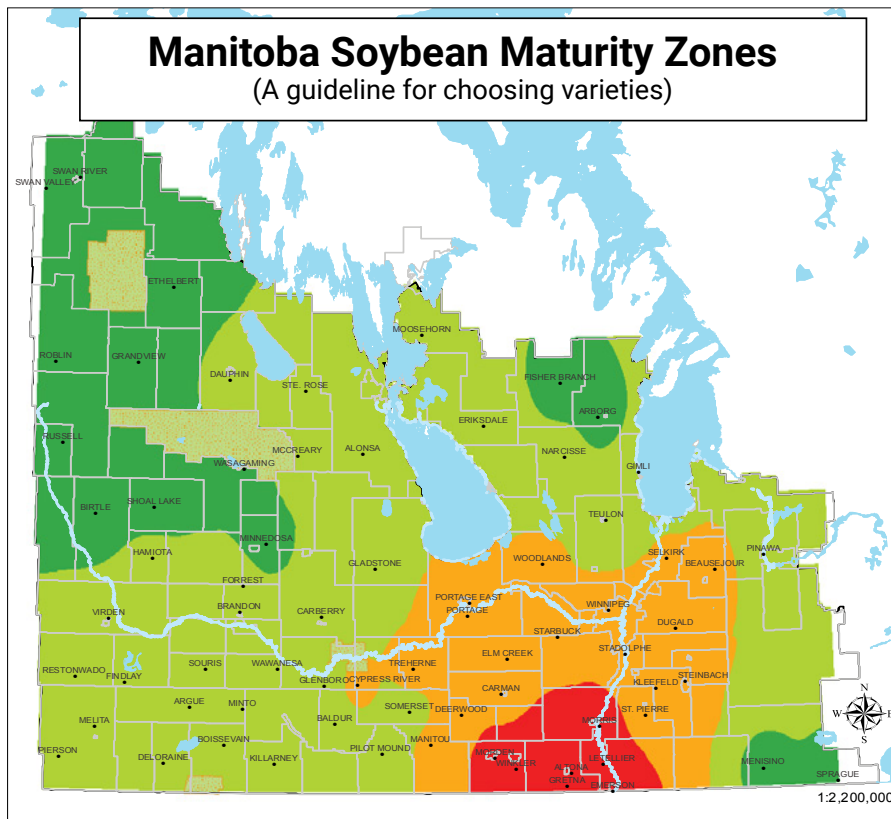
Height is advantageous for weed competition⁴. Yield and soybean height were significantly correlated in organic soybean variety trials in Manitoba³, thus selecting a taller variety may be useful in organic soybean production.

Height to Lowest Pod

The length from the ground to the first pod affects harvestability. Pods higher off the ground are more likely to be harvested and less likely to be stained - a factor that can downgrade soybean quality.

Hilum Colour

The hilum is the point on the seed where it connects to the pod. Hilum colours can be eight different colours: black, imperfect black, gray, dark brown, medium brown, imperfect yellow, and yellow. Hilum colour may cause the milk and meal of the soybean to have gray shades, therefore yellow, imperfect yellow, and clear are usually preferred for food-grade soybeans and export markets.



Map Elements

- Water Bodies
- Rural Municipalities
- Prov./Nat. Parks

Maturity Zones

- Very Early
- Early
- Mid
- Long

Maturity Zone	CHU	FFP (days)	Maturity Group
v. Early	<2250	<110	<00.2
Early	2250-2400	110-118	00.2-00.3
Mid	2401-2500	119-125	00.4-00.6
Long	>2550	>125	>00.6

This map is based on 1981-2010 Climate Normal Data for cumulative Corn Heat Units (CHU May 15-Sept 20) and average frost-free period (FFP, days Tmin >0°C).

The map outlines the longest maturity suggested for each production area, but earlier varieties can also perform well. Use in conjunction with the Pulse and Soybeans Variety Guide, which outlines varieties according to maturity zones.

Figure 4. Manitoba Soybean Maturity Zones

Yield

The following data are sourced from organic non-GM soybean performance trials that took place across southern Manitoba in 2014 and 2015 (Table 2). All soybean variety hilums are either yellow, imperfect yellow, or clear. Soybean yield was comparable to conventional yields at certain sites. However, an early killing frost at one site reduced yield in some varieties dramatically. The killing frost exemplifies the importance of selecting the correct maturity group. Figure 5 summarizes data from all sites and years. Somerset (2014) and Swan Lake are omitted due to frost effects.

Table 2. Organic soybean variety trials in southern Manitoba: Days to Maturity, Yield Indices, Plant Height, and Pod Height Summary.

Varieties can only be compared with each within each test area. Yield index is the percentage of the average yield of all varieties grown in a test area (refer to the bottom of each site's column for that site year's average yield). Days to maturity, plant height, and pod height are averaged across all sites and years.

Variety	Days to Maturity	Average Yield Index		Carman Yield Index		Elie Yield Index	St. Pierre Jolys Yield Index	Somerset Yield Index	Woodmore Yield Index		Plant Height Avg.	Pod Height Avg.
		2014	2015	2014	2015	2014	2014	2015	2014	2015		
Tundra	102	90	96	93	97	90	81	105	131	85	53	14
SK0007	106	89	101	97	98	97	71	110	149	95	55	15
OAC Prudence	106	89	99	87	105	91	99	98	75	93	58	13
Toma	108	106	110	102	117	N/A	106	103	N/A	111	63	13
OAC Petrel	109	95	96	82	94	110	112	102	100	93	60	13
DH 863	109	99	99	93	96	107	91	93	69	106	60	13
DH 401	110	106	93	106	88	N/A	101	93	N/A	99	64	15
Jari	111	108	99	111	92	N/A	98	102	N/A	102	73	15
Savanna	112	111	111	119	120	114	102	100	104	113	60	15
Krios	116	101	96	92	97	103	115	95	99	98	65	14
Auriga	116	106	93	111	92	90	134	92	87	95	59	14
SVX14T0053	117	99	106	105	104	99	91	105	86	110	58	14
Avg. Yield	kg/ha	2130.8	2224.0	2404.4	3023.9	2292.1	1946.6	1489.5	1759.7	1848.5		
	bu/ac	31.8	31.7	36.1	45.2	34.1	29.2	22.17	26	27.7		

Average Yield Across All Locations, Years

Somerset and Swan Lake 2014 omitted due to early frost yield reduction

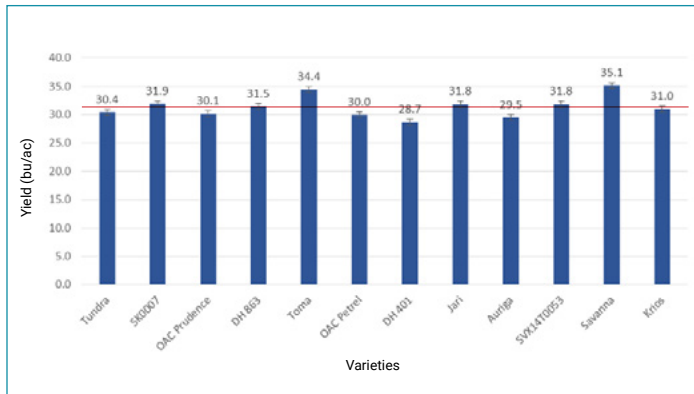


Figure 5. Average cultivar yield across all site years. The red line indicates average yield across all cultivars and site years.

SUMMARY

While choosing the right variety for your farm and market is important, it cannot substitute for good agronomy. A diverse crop rotation, adequate nutrients, and agronomic interventions such as a clean seedbed, high seeding rates, increased seed size, and good weed control (pre-emergence harrowing) is essential for crop success.

Choosing the correct variety for your farm is only part of the journey that leads to a successful crop. Proper early season weed control (clean seedbed, blind harrowing, and inter-row cultivation) is key. For more information on growing a successful organic soybean crop, check out the Natural Systems Agriculture research report [here](#).

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