



# 2020 South Dakota Organic Oat Variety Results

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## 2020 Organic Oat Variety Trial – Beresford

Cooperator: SDSU Southeast Research Farm, Peter Sexton, Manager

Location: 43.042841, -96.897525

Soil Type: Egan-Clarno-Tetonka complex, 0 to 2 percent slopes

Previous crop: Forage mix (7 lb/ac cowpea; 15 lb/ac pearl millet; and 4lb/ac sorghum sudan)

Row spacing: 7"

Seeding Rate: 1.6 million PLS/acre

Under seeding: Medium red clover

Date seeded: 4/09/2020

Date Harvested: 7/15/2020

## 2020 Organic Oat Variety Trial – Madison

Cooperator: Charlie Johnson

Location: 43.874792, -97.130592

Soil Type: Egan-Wentworth complex, 2 to 6 percent slopes

Previous crop: Soybeans

Row spacing: 7"

Seeding Rate: 1.6 million PLS/acre

Under seeding: Alfalfa

Date seeded: 4/21/2020

Date Harvested: 7/30/2020

## Description

A list of oat experimental lines and released varieties evaluated under organic management in South Dakota, along with agronomic characteristics, are reported in Table 1. Average test weights and grain yields at Beresford and Madison are reported in Table 2 and 3, respectively. Grain characteristics and milling quality (average over both locations) are reported in Table 3. On average, over the three environments (Beresford 2019, Beresford 2020, and Madison 2020), varieties in the top yielding group included MN Pearl, Betagene, Warrior, Sumo, Deon, Saddle, and Reins. Among this group, Sumo had significantly higher test weight than the other varieties. Betagene is not recommended for this area because of poor test weight.

In addition, the effect of four seeding rates (1.2, 1.6, 1.9, and 2.3 million seeds/acre) was evaluated on three early-maturing varieties (Sumo, Saddle, and Reins). The effect of seeding rate on grain yield was not significant for any of the three varieties (Figure 1). However, both test weight (Figure 2) and ground cover (Figure 3) were increased at higher seeding rates for Sumo and Reins. The effect of seeding rate was not significant on test weight and ground cover for Saddle. These preliminary results suggest that it may be beneficial to consider higher seeding rates for oat grown under organic management to increase test weight and help with weed management.

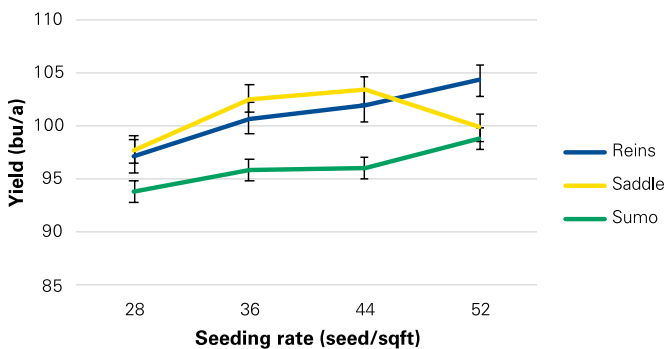


Figure 1. Effect of seeding rate (not significant) on oat grain yield for 3 oat cultivars evaluated under organic management practices at Madison, SD.

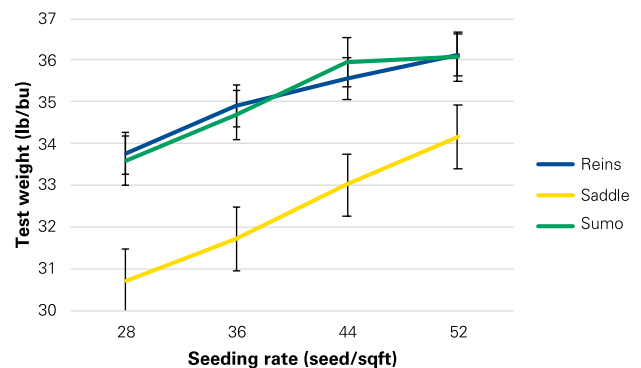


Figure 2. Effect of seeding rate (significant for Reins and Sumo) on oat test weight for 3 oat cultivars evaluated under organic management practices at Madison, SD.

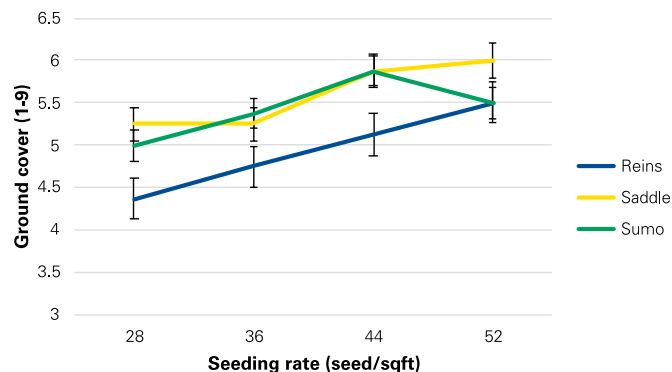


Figure 3. Effect of seeding rate (significant for Reins and Sumo) on ground cover (visual rating) for 3 oat cultivars evaluated under organic management practices at Madison, SD.

## Key information

- **Choosing a variety for organic oat grain production is an important management decision for successful organic oat production.**

No chemicals can be used to control diseases, therefore inherent disease resistance is very important when choosing a variety.

- **Resistance to crown rust is necessary for areas where the fungus is prevalent such as in the eastern part of South Dakota.**

Crown rust is the most damaging disease of oats in South Dakota. When conditions are favorable to the development of the crown rust pathogen, severe infections can develop quickly in susceptible cultivars and can result in significant yield loss, severe lodging, and grain with low test weight and poor quality. Because evolving races of crown rust can overcome the resistance of older varieties, it is important to look at recent data when selecting a variety with good level of resistance to crown rust.

- **When marketing organic grain to the milling industry, choosing varieties with high test weight and plump kernels is necessary to ensure that the grain produced meet the specification of the industry.**

Oat varieties differ significantly for test weight and kernel plumpness. For example, over two years of testing in Beresford, there was a difference in test weight of up to 9 lb/bu between varieties. In a year like 2020, where test weight was low in several areas of the state due to heat and/or drought stress, planting a variety with high test weight can be very important to meet the specifications of the milling industry.

- **Multiple years of yield data near your area should be considered when choosing a variety.**

Test weight and grain quality characteristics for oat varieties are often similar from year to year. However, grain yields for different varieties can vary widely. A variety ranking first for yield in one year may not be the highest yielding variety in average over multiple years. For example, some years may favor early-maturing varieties. To identify a variety with stable performance it is necessary to look at grain yield data over multiple years.

- **Once you have identified a variety, adjust the seeding rate based on the thousand kernel weight.**

Varieties can range widely for thousand kernel weight. For example, if we were using the samples from our variety trials (thousand kernel weight listed in Table 4), a seeding rate of 1.6 million PLS per acre) corresponds to 3.5 bu/a for Sumo but only 2.7 bu/a for Antigo due to the difference in seed size between the two varieties.

## Acknowledgement

This research is supported by **General Mills Foundation**. The overall goal of the project is to identify and develop varieties that will increase profits for farmers while improving soil health by incorporating small grains into crop rotations. We also wish to thank Charlie Johnson for providing access to his organic certified land.



Figure 4. Plots of Sumo left (36 seed/sqft) and right (52 seed/sqft) on June 4th 2020 in Madison, SD.



Figure 5. Oat variety trial under organic management at the Johnson's farm in Madison (picture taken on June 25th 2020).

Table 1. List of varieties and experimental lines evaluated under organic management practices in 2020.

Entry	Origin†	Year of release‡	Relative Heading‡ (days)	Relative Height‡ (inches)	Lodging§ (%)	Crown rust severity¶ (%)
Antigo	UW	2017	0	6	33	30
Badger	UW	2010	0	2	62	57
Betagene	UW	2014	2	5	30	13
Deon	MN	2013	5	9	5	18
Esker2020	UW	2019	1	6	75	23
Excel	IN	2006	2	5	89	43
Goliath	SD	2012	6	10	96	60
Hayden	SD	2014	4	4	96	60
Jerry	ND	1994	2	7	99	60
Leggett	CAN	2005	4	7	0	12
MN Pearl	MN	2018	4	8	22	13
Natty	SD	2014	1	8	97	60
Newburg	ND	2011	4	10	98	40
Reins	IL	2015	0	0	0	43
Rockford	ND	2009	6	9	93	55
Rushmore	SD	2019	2	5	45	20
SD140741	SD	Exp	3	7	10	17
SD150012	SD	Exp	1	8	2	13
SD150270	SD	Exp	5	8	88	48
SD160067	SD	Exp	1	5	13	22
SD160070	SD	Exp	1	8	17	8
SD160071	SD	Exp	3	6	43	15
SD160240	SD	Exp	3	7	77	20
SD170463	SD	Exp	4	10	45	27
Saber	IL	2010	0	4	25	57
Saddle	SD	2017	0	3	0	18
Shelby 427	SD	2009	1	7	95	57
Souris	ND	2006	4	5	99	63
Sumo	SD	2016	0	6	5	13
Warrior	SD	2018	1	5	2	18

† CAN - Canada, IL - Illinois; IN - Indiana; MN - Minnesota, ND - North Dakota, SD - South Dakota, WI - Wisconsin

‡ Exp: experimental line still in the process of evaluation.

‡ Days to heading compared to Sumo (57 days) and height in inches compared to Reins (23 inches).

§ Lodging severity in Madison. 0%: no lodging – 100%: entire plot flat.

¶ Crown rust severity: field ratings from Madison, 0%: no crown rust pustules – 100%: flag leaves completely covered with pustules.

Table 2. 2020 organic oat variety trial results and average performance. Entries are sorted by overall yield.

Entry	Beresford						Madison		Overall	
	2020		2019		2-year		2020		2019-2020	
	Test Wt (lb/bu)	Yield (bu/a)	Test Wt (lb/bu)	Yield (bu/a)	Test Wt (lb/bu)	Yield (bu/a)	Test Wt (lb/bu)	Yield (bu/a)	Test Wt (lb/bu)	Yield (bu/a)
SD160067	37.4	<b>80.2</b>	35.6	<b>101.7</b>	36.5	<b>90.9</b>	34.0	<b>105.5</b>	35.6	<b>95.8</b>
SD140741	35.4	64.7	<b>36.6</b>	<b>100.6</b>	36.0	<b>82.9</b>	33.7	<b>98.0</b>	35.2	<b>87.9</b>
MN Pearl	36.8	<b>74.2</b>	35.5	<b>88.7</b>	36.1	<b>81.4</b>	34.4	91.7	35.6	84.9
SD150012	36.7	67.1	<b>37.6</b>	83.2	37.1	75.1	34.2	<b>99.6</b>	36.1	83.0
SD160240	38.5	<b>71.4</b>	35.8	75.8	37.2	73.6	35.9	<b>99.0</b>	36.7	82.0
Betagene	34.6	68.2	32.8	70.0	33.7	69.1	31.2	<b>101.1</b>	32.9	79.8
Warrior	35.4	<b>70.1</b>	<b>36.1</b>	71.4	35.8	70.8	32.5	<b>96.7</b>	34.7	79.4
Sumo	38.5	69.1	<b>37.8</b>	<b>85.7</b>	<b>38.2</b>	77.4	36.5	77.5	<b>37.6</b>	77.5
Deon	35.8	<b>72.6</b>	35.1	71.6	35.4	72.1	34.5	87.2	35.1	77.1
Saddle	36.8	63.4	<b>36.7</b>	72.8	36.8	68.1	34.2	<b>94.7</b>	35.9	76.7
Reins	38.1	65.7	34.6	70.6	36.4	68.1	35.3	93.5	36.0	76.6
Rushmore	<b>38.8</b>	66.1	34.9	71.9	36.9	69.0	<b>36.1</b>	85.0	36.6	74.3
Badger	36.2	<b>74.7</b>	35.3	63.5	35.8	69.1	32.4	84.1	34.7	74.1
Antigo	<b>39.7</b>	68.6	<b>39.0</b>	69.4	<b>39.4</b>	69.0	<b>37.0</b>	81.4	38.6	73.1
Natty	38.0	<b>70.3</b>	35.9	57.2	37.0	63.7	35.2	90.6	36.4	72.7
Goliath	36.8	<b>69.6</b>	32.8	63.9	34.8	66.8	35.3	79.7	35.0	71.1
SD150270	37.7	68.2	<b>36.7</b>	57.8	37.2	63.0	35.6	85.5	36.7	70.5
Excel	36.7	<b>71.7</b>	26.6	44.8	31.7	58.3	33.1	91.8	32.1	69.4
Leggett	34.6	50.6	35.2	70.3	34.9	60.5	33.6	84.5	34.5	68.5
Newburg	34.4	71.5	30.4	39.9	32.4	55.7	33.1	78.1	32.6	63.2
Hayden	35.8	60.3	30.1	47.5	33.0	53.9	33.0	79.7	33.0	62.5
Saber	36.7	55.9	<b>36.9</b>	35.6	36.8	46.1	34.2	90.9	35.9	61.0
Shelby 427	36.2	57.3	33.3	46.8	34.8	52.0	34.6	75.5	34.7	59.9
Jerry	35.5	61.2	29.3	31.1	32.4	46.2	34.5	79.5	33.1	57.3
Souris	34.4	67.6	31.3	25.5	32.9	46.6	29.8	69.4	31.8	54.2
Rockford	33.9	52.1	26.4	26.4	30.1	39.4	33.0	66.1	31.0	48.3
Esker2020	33.7	67.4	--	--	--	--	31.2	<b>100.0</b>	--	--
SD170463	38.5	66.1	--	--	--	--	<b>37.1</b>	<b>99.5</b>	--	--
SD160071	37.1	68.5	--	--	--	--	34.9	92.5	--	--
SD160070	36.5	59.2	--	--	--	--	34.3	<b>95.1</b>	--	--
<b>Trial average</b>	36.5	66.5	34.5	64.4	35.3	64.9	34.2	87.9	34.9	71.4
<b>C.V.%</b>	1.5	9.7	5.5	15.49	5.0	14.4	1.9	8.0	4.3	13.5
<b>LSD(0.05)</b>	0.9	10.9	2.9	16.3	2.1	10.9	1.1	11.7	1.4	9.2

Table 3. Grain quality and milling characteristics for oat varieties and breeding lines evaluated in the 2020 organic oat variety trial (average over both locations).

Entry	Plump (%)	Mid (%)	Thin (%)	1000 Kernel Weight (g)	Groat (%)	Groat Protein (%)	Groat Beta-Glucan (%)	Groat Oil (%)
Antigo	2.8	73.1	24.0	24.6	65.7	17.2	5.0	6.3
Badger	28.6	66.7	4.6	33.2	67.0	14.8	4.6	4.6
Betagene	55.5	40.2	4.1	32.8	68.1	14.8	5.7	4.6
Deon	14.4	77.5	7.9	29.9	69.8	14.4	4.6	5.0
Esker2020	19.2	68.9	11.8	27.9	69.0	14.6	5.1	4.1
Excel	40.0	53.1	6.8	29.2	66.2	15.0	4.5	4.0
Goliath	18.7	71.9	9.5	28.6	70.1	13.7	4.8	4.7
Hayden	26.2	64.5	9.3	27.9	67.3	14.2	5.0	5.6
Jerry	22.2	68.6	9.0	29.1	68.6	15.7	4.7	4.0
Leggett	32.6	61.9	5.4	31.6	70.7	16.3	5.4	4.6
MN Pearl	48.2	45.7	5.9	30.8	72.7	12.6	4.4	5.5
Natty	24.6	69.2	6.0	30.8	69.9	14.4	4.2	3.7
Newburg	21.0	66.5	12.4	28.0	69.6	13.5	5.2	5.4
Reins	32.2	62.5	5.1	30.4	69.9	14.7	4.9	4.7
Rockford	17.2	69.6	13.1	25.8	66.4	14.5	4.8	5.5
Rushmore	30.4	63.6	5.7	29.7	69.4	15.1	4.5	4.5
SD140741	19.9	73.6	6.4	29.2	67.7	16.3	5.0	4.1
SD150012	29.6	66.3	4.0	32.8	68.9	15.1	4.7	5.4
SD150270	30.5	62.1	7.3	30.6	67.5	14.4	4.9	5.4
SD160067	19.4	74.4	5.9	31.7	69.0	13.1	5.0	4.5
SD160070	41.9	53.7	4.2	34.3	67.5	15.2	5.0	4.5
SD160071	31.4	61.3	7.2	31.6	69.9	13.5	4.8	4.9
SD160240	23.4	71.4	5.0	29.5	69.1	14.0	5.8	5.6
SD170463	42.7	50.9	6.2	29.6	68.7	15.0	4.8	4.3
Saber	23.5	65.2	11.3	29.9	71.6	16.2	4.6	3.7
Saddle	10.4	81.5	8.0	28.8	70.4	15.6	4.6	3.8
Shelby 427	19.0	71.2	9.7	26.6	69.7	15.0	4.6	5.2
Souris	7.5	70.3	22.2	25.3	66.9	13.7	4.9	4.6
Sumo	37.8	58.5	3.6	32.3	71.3	16.3	4.5	4.3
Warrior	21.0	71.8	7.1	28.9	69.2	15.4	5.0	4.7
<b>Trial average</b>	26.4	65.2	8.3	29.7	68.9	14.8	4.9	4.7
<b>C.V. %</b>	26.4	9.4	23.6	5.9	1.8	4.6	3.5	5.9
<b>LSD (0.05)</b>	9.8	8.7	2.8	2.5	1.9	1.0	0.2	0.4