



2019-2020 South Dakota Forage Oat Variety Trial Results

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Oats are a dual-purpose crop which can be harvested for grain or used for annual forage production. Oat forage can not only be harvested for oat hay and oatlage but can also be grazed. Oat varieties differ in both forage yield potential and the quality of forage produced. When selecting an oat variety for forage production, it is important to consider disease resistance as well as forage production characteristics. Crown rust and barley yellow dwarf virus (BYDV) are two of the most common pathogens that can severely affect oat health and, correspondingly, forage yield. Although the presence of crown rust pustules on plants do not affect cattle health (<https://extension.sdstate.edu/does-crown-rust-oats-cause-problems-livestock>), crown rust infection can result in reduced forage yield and quality. It is recommended to choose a variety that is resistant to crown rust and tolerant to BYDV.

The growth stage at harvest is also critical for both forage yield and quality. Generally, harvesting at late-milk to early-dough stages maximizes forage production with relatively good quality (compared to other small grains). However, an earlier harvest (boot stage) provides significantly higher nutrition value, which may be important in dairy rations.

In 2019 and 2020, a set of oat varieties and breeding lines were evaluated in forage trials conducted at multiple locations in South Dakota (Table 1). Lines with SD experimental numbers are in evaluation and are not available to producers. The lines were harvested at late milk/early dough stage. Agronomic characteristics for the varieties tested are summarized in Table 2. Forage yields and nutritional quality characteristics are summarized in Tables 3.

Table 1. List of testing sites for each year.

Year	Location	Planting date	Harvesting date	Crown rust pressure
2019	South Shore	05/07	07/19	Moderate
	Volga	05/14	07/16	Heavy
	Beresford	04/26	07/12	Severe
	Pierre	04/09	07/02	None
2020	South Shore	04/27	07/07	Moderate
	Volga	04/22	07/02	Heavy
	Beresford	04/01	07/02	Moderate
	Pierre	03/31	07/01	None

The average dry matter yield for the trial was 4.5 T/ac. Forage production varied widely depending on the location and the year, ranging from 3.3 T/ac at Volga in 2020 to 6.3 T/ac at South Shore in 2019. The cool and wet growing condition in 2019 at South Shore favored biomass production.

In Volga, Rushmore and Warrior produced the highest forage yield among the released varieties evaluated in the trial with an average of 4.1 and 3.9 T/ac, respectively. In Beresford, Rushmore and MN Pearl produced the highest dry matter yield in 2019 (5.7 and 5.4 T/ac respectively). Severe crown rust infections were observed at both locations. The top-yielding varieties (Warrior, Rushmore, and MN Pearl) are either resistant or moderately resistant to crown rust suggesting that for these areas, it is best to select a variety with some level of resistance to crown rust.

At South Shore, Rushmore, Hayden, Rockford, Goliath, and MN Pearl were among the varieties in the high yielding group with an average dry matter yield ranging from 5.1 to 5.6 T/ac. Although Hayden, Rockford, and Goliath are susceptible to crown rust, pustules developed only later in the season and did not seem to considerably impact forage yield.

In Pierre, Rockford and Hayden were among the released varieties with the highest forage yield. No crown rust was observed. In the central and western parts of the state, where crown rust infections are rare, it is not as important to consider crown rust resistance when choosing a variety for forage production. Tall and leafy varieties will likely produce the highest forage yield.

Overall, Warrior, Natty, and MN Pearl produced forage with the highest quality. The ADF and NDF values were lower and the relative feed values (RFV) were higher for these three varieties (Table 3). ADF refers to the cellulose and lignin levels and is important to take note of since lignin is considered indigestible by animals. The NDF refers to the total cell wall that is comprised of the ADF fraction and hemicellulose. The TDN estimates the energy content of the feed or roughage, and in general, the greater the value, the more energy-dense the feedstuff is considered. Higher quality forage has a TDN in the range of 50% to 60%.

Acknowledgement

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References:

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Forage harvest at the Dakota Lakes research farm on July 1st, 2020.

Table 2. Agronomic characteristics of the oat cultivars evaluated in the oat forage trials.

Variety	Relative heading date†	Relative height (inch)‡	Crown rust	Lodging§
Deon	4	2	R/MR	3.5
Goliath	5	7	MS	4.3
Hayden	3	1	S	4.7
Jerry	2	0	S	4.5
MN Pearl	2	3	MR	3.5
Natty	0	3	S	4.0
Newburg	4	4	S	4.7
Rockford	5	4	S	-
Rushmore	1	0	R/MR	2.6
Stallion	3	5	MR	-
Warrior	1	0	R	2.2

†Days to heading compared to Natty (171 days Julian).

‡Height in inches compared to Warrior (39 inches).

§Lodging score: Rating scale 1-5 (1 = standing perfectly to 5 = completely flat).

Table 3. Forage dry matter yield (T/ac) and nutritional quality characteristics of oat varieties and breeding lines evaluated in 2019 and 2020 at four South Dakota locations.

Variety	Volga			Beresford	South Shore			Pierre			Overall†				
	2020	2019	2-year	2019	2020	2019	2-year	2020	2019	2-year	DMY	ADF	NDF	TDN	RFV
Deon	3.1	3.8	3.5	5.1	3.2	6.5	4.7	5.0	4.6	4.8	4.4	36.8	55.4	60.4	101.7
Goliath	2.9	4.0	3.5	4.6	4.0	6.4	5.2	3.9	5.0	4.5	4.4	36.8	56.4	59.8	99.6
Hayden	3.1	3.8	3.5	4.0	4.0	7.0	5.5	4.7	5.1	4.9	4.5	36.3	55.7	60.9	102.0
Jerry	3.2	4.4	3.8	4.2	3.5	5.9	4.7	4.3	5.3	4.8	4.4	34.6	54.0	60.8	107.6
MN Pearl	3.5	4.1	3.8	5.4	4.0	6.2	5.1	4.3	4.4	4.3	4.6	35.3	53.2	62.2	108.3
Natty	3.2	3.6	3.4	3.7	3.7	6.8	5.3	4.7	4.6	4.6	4.3	34.2	51.8	62.2	112.9
Newburg	3.5	3.8	3.7	3.7	3.8	5.8	4.8	4.5	4.8	4.6	4.3	36.7	56.2	60.6	100.7
Rockford	3.3	3.8	3.5	3.2	4.1	6.6	5.4	4.6	5.6	5.1	4.5	37.8	57.5	59.0	96.7
Rushmore	3.8	4.3	4.1	5.7	4.3	7.0	5.6	4.2	4.8	4.5	4.9	35.3	54.3	61.3	106.1
Stallion	3.1	4.3	3.7	4.0	3.5	5.2	4.3	4.4	4.5	4.4	4.1	37.6	56.1	59.5	99.4
Warrior	3.8	4.0	3.9	5.0	4.0	5.3	4.6	3.9	4.8	4.4	4.4	33.8	49.8	63.0	117.3
Trial Average‡	3.3	4.1	3.7	4.7	3.8	6.3	5.0	4.6	4.9	4.7	4.5	36.5	55.2	60.7	102.7
LSD (0.05)§	0.3	0.5	0.3	1.0	0.6	0.9	0.6	0.5	0.4	0.3	0.3	3.2	3.9	NS	11.6
C.V. %¶	5.1	6.0	6.7	12.4	9.8	8.5	10.5	6.0	5.2	5.9	9.4	8.3	6.7	--	10.7

† DMY: dry matter yield (T/ac); ADF: Acid Detergent Fiber (%); NDF: Neutral Detergent Fiber (%); TDN: Total Digestible Nutrients (%); RFV: Relative Feed Value.

‡ Note: summary statistics including the Trial Average, LSD, and CV are calculated including values from experimental lines not reported.

§ Value required (\geq LSD) to determine if varieties are significantly different from one another.

¶ C.V. is a measure of variability or experimental error, 15% or less is considered acceptable.