



# Western Beef Development Centre

Division of PAMI

## Swath Grazing CDC SO-1 Oat and Red Proso Millet with Beef Cows

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### Introduction

Swath grazing is a management practice that can extend the grazing season and reduce feed, labor, and manure handling costs for cattle producers. By grazing beef cows on forage left in windrows after swathing rather than baling, moving, and feeding as forage, a livestock producer reduce production costs. In swath grazing, cereal crops are cut and left in windrows in the field for winter grazing. Seeding and swathing dates have the greatest impact on swath grazing quality, with earlier seeding dates having improved yields and later seeding dates producing higher quality forages (McCartney et al. 2008). Because seeding for swath grazing is delayed until June compared to the traditional seeding date of April and early May for grain production, warm-season annuals, such as millet and corn, may be advantageous due to their heat and moisture tolerance (Lardner and Froehlich 2006). A further advantage of swath grazing is the potential for regrowth after swathing, which can increase overall forage quality in the field (Volesky et al. 2002).

Millet is an annual warm-season grass. Three types grown in Western Canada are red (proso), Siberian (foxtail), and German (foxtail). Foxtail millets are taller, later maturing, and well suited to forage production; proso millet (*Panicum miliaceum* L.) is usually grown for grain and capable of producing seeds in short growing seasons of 60 to 100 days. Proso can also be used as a forage crop (McCartney et al. 2009). Both millets have been successfully grown in Saskatchewan, preferring fields that are well drained with southern exposures. Millet's metabolism and early maturity allow it to tolerate drought. Red proso millet is a warm-season annual crop that produces most of its biomass after July, during the hottest months of the summer. Foxtail millet is later maturing, continuing to grow into early September provided there is some rain in July and August. Very little grazing information is available on millet, and what is available is highly variable (McCartney et al. 2009).

Nutritional and caloric values of oat (*Avena sativa*) can be improved by increasing the oil and reducing the lignin content (indigestible part). This was the goal of the oat breeding project at the Crop Development Centre (CDC) at the University of Saskatchewan, which recently developed and released a new variety of oat licensed as CDC SO-1 (SuperOat) with two unique characteristics: low acid-detergent lignin hulls, and high oil groat (McKinnon et al 2010). CDC SO-1 oat was developed for the ruminant feed market (Yu et al 2008), however, no evaluation of swath grazing capacity of CDC SO-1 with beef cows has been investigated in terms of nutritive value and grazing days. CDC SO-1 oat and red proso millet were grown at Western Beef Development Centre's Termuende Research Ranch near Lanigan, SK to evaluate potential as swath-grazed annuals for dry, pregnant beef cattle.

### Crop Management

A 36-acre field study site was sub-divided into two 18-acre paddocks. Each 18-acre paddock of oat (CDC SO-1) and pearl millet (red proso) was seeded 3 June 2009 along with 50 lb actual nitrogen per acre. The red proso millet was seeded at a rate of 15 lb/acre and the SO-1 oat was seeded at 2 bu/acre. Crop areas were sprayed prior to emergence with 1 L/acre glyphosate on 5 June 2009. Crops were also sprayed at four-leaf stage on 3 July 2009 with a tank mix of Attain A/Refine/AgSurf for broad-leaf weed control. Late summer weed infestation

was estimated at less than 2% of the crop. Late-August dry matter yield (DMY) was estimated by clipping replicate (n=15) 0.25-m<sup>2</sup> quadrat samples, which were oven dried and weighed to determine yield per acre. The CDC SO-1 oats were swathed at mid-milk stage on 26 August 2009, and the red proso millet was swathed at 30% heading 3 September 2009 to facilitate a balance between yield and quality and grazing management.

### Crop Yield and Quality

Throughout the 2009 growing season (June to October), there were 2330 Corn Heat Units accumulated at Lanigan, which created favourable growing conditions for the warm-season (millet) and cool-season (oat) crops. Dry matter yield (DMY) of cool- and warm-season crops are presented in Table 1.

	Kg/ha	Lb/acre	Ton/acre
<b>Red proso millet</b>	6948	6191	3.1
<b>CDC SO-1 oat</b>	8088	7208	3.6

Both the oat and millet crops yielded very well at 3.6 and 3.1 tons per acre respectively, even though millet DMY was 13% less than the oat crop. In addition to estimated DMY, quality samples were obtained on this date and sent for further analysis (Table 2). Whole plant and plant structures (stems, leaves, grain) were separated and analyzed for crude protein (CP), total digestible nutrients (TDN), neutral detergent fibre (NDF) and acid detergent fibre (ADF), lignin, calcium (Ca), and phosphorous (P). Quality of whole plant red proso millet was slightly higher compared to whole plant oat. Energy and protein levels of millet were 61% TDN and nearly 13% CP, even though the samples were taken well into the fall.

	CP <sup>1</sup> , %	TDN, %	NDF, %	ADF, %	Lignin, %	Ca, %	P, %
<b>Red proso millet</b>							
Whole plant	11.0	60.9	60.4	34.6	-	0.3	0.3
Stems/leaves	9.4	60.3	63.5	35.8	3.7	0.3	0.1
Grain	14.8	61.3	57.6	33.8	5.7	0.2	0.3
<b>CDC SO-1 oat</b>							
Whole plant	10.0	57.6	66.8	41.1	-	0.3	0.3
Stems/leaves	8.2	55.5	71.9	45.4	5.8	0.2	0.2
Grain	11.5	66.0	48.1	24.3	1.3	0.2	0.4

<sup>1</sup>CP=crude protein; TDN=total digestible nutrients; NDF=neutral detergent fibre; ADF=acid detergent fibre; Ca=calcium; P=phosphorus.

Crude protein content of whole plant millet forage was 10% higher than oat, and CP of millet grain 29% higher than oat grain. Energy content of oat stem, leaf or whole plant was lower relative to millet stem, leaf or whole plant (Table 2), however, oat grain energy TDN level was 6% higher than millet grain energy level. This observation is consistent with levels reported by Zalinko et al (2009) who reported that energy level of a similar oat prototype line was superior to barley grain. In contrast, fibre content of whole plant CDC SO-1 oat, estimated by content of NDF and ADF, was 11 and 19% higher respectively, relative to millet fibre levels (Table 2).

Lignin content of SO-1 oat and red proso millet grain was 1.3 and 5.7% respectively, suggesting improved digestibility of the low lignin oat kernel. Finally, given that NRC (1996) requirements for a pregnant beef cow in second trimester of pregnancy are 52% TDN and 8% crude protein, quality of both crops was more than adequate.

### Animal Management

The SO-1 oat and proso millet were swathed 26 August 2009 and 3 September 2009, respectively. One hun-



dred and two dry pregnant beef cows were allocated evenly between the two crop types (51 each). Grazing began on 4 December 2009. Table 3 shows cow performance while grazing either red proso millet or SO-1 oat windrow swaths.

Average cow weight was 1365 lbs prior to grazing, and during the study all the cows maintained an average body condition score of 3.0. Coming off the study, average cow weights were 1379 lbs and 1349 lbs for cows grazing oat or millet respectively (Table 3). To manage feed wastage, cows were restricted to the amount of swath they accessed by using portable electric fencing. Approximately 2.0 acres were allocated for each grazing period. Based on these results, cows were able to utilize swathed crops and maintain performance during the winter period.

**Table 3. Performance of beef cow grazing annual crops**

Item	Crop type	
	SO-1 oat	Red proso millet
<i>Body weight<sup>1</sup>, lb</i>		
Initial	1376	1349
Final	1379	1349
Change	3	0
<i>Cow grazing days</i>	140	135

<sup>1</sup>Cow body weight was average of two consecutive-day weights

## Economics

Cost estimates for each of the swath-grazed crops were determined by using actual agronomic records, yield data, and grazing days. Crop production costs were \$99.12/acre for SO-1 oats and \$91.12/acre for red proso millet. The difference in production costs is due to the difference in seed prices; SO-1 oats cost \$7/bu (seeded at 2 bu/ac) and red proso millet costs \$0.40/lb (seeded at 15 lb/ac). Using grazing days per acre, the cost per cow per day is calculated; \$0.59/day for SO-1 oat and \$0.55/day for red proso millet (Table 4).

**Table 4. Economic Analysis of SO-1 oat and Red proso millet, 2009/10**

Expense <sup>†</sup>	Crop type	
	SO-1 oat (\$/acre)	Red proso millet (\$/acre)
Harrowing (x2 passes)	\$4.80	\$4.80
Herbicide and application	\$19.75	\$19.75
Seed	\$14.00	\$6.00
Seeding	\$15.00	\$15.00
Fertilizer	\$30.57	\$30.57
Swathing	\$15.00	\$15.00
<b>Total Crop Production Expenses</b>	<b>\$99.12</b>	<b>\$91.12</b>
	(\$/cow/day)	(\$/cow/day)
Swath graze forage	\$0.71	\$0.68
Labour	\$0.04	\$0.04
Fencing Supplies & Repair	\$0.01	\$0.01
<b>Total Grazing Costs</b>	<b>\$0.76</b>	<b>\$0.73</b>

<sup>†</sup>Field equipment costs are from SMA's Farm Machinery Custom and Rental Rate Guide 2010/11. Per-day forage costs are based on 140 grazing days/acre for SO-1 oat and 135 grazing days/acre for red proso millet. Herbicide and fertilizer prices are actual prices paid for product in 2009. Seed prices are based on 2011 price quotes from the 2009 suppliers. Labour is an estimate of total hours for project setup, and moving cows and fences.



While the SO-1 oat does cost more to seed and thereby \$/cow/day to swath graze is higher, this study found the yield was higher, which resulted in increased grazing days (140 vs. 135 d) and the cows swath grazing oats gaining similarly to those grazing the millet.

## Summary

At Lanigan, Saskatchewan, the 2009 growing season proved to be one well suited for both oat and millet production. Temperatures allowed for very good crop yield and quality, with the high quality resulting in adequate performance of the grazing cows. The red proso millet retained its forage quality slightly better than the oat, even though crops lay in swath nearly 60 days prior to being grazed. The cows found the crops very palatable and, in addition to this, the cross fencing allowed for maximum utilization of the swaths. Differences observed in crop production expenses and grazing costs were due to seed cost and grazing days. Finally, based on these results, either SO-1 oat or red proso millet can work well as swath grazed crops for beef cows to extend the grazing season in Saskatchewan. However, millet and SO-1 oat performance will vary from year to year, being entirely dependent on growing conditions.

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