2013 ADOPT Project Report

Demonstration of Forage Corn Varieties

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December 2013

1. **Project Title:** Demonstration of Forage Corn Varieties

2. **Project Numbe**r: 20120417

3. **Producer Group Sponsoring the Project:** Conservation Learning Centre Inc

4. **Project Location:** Conservation Learning Centre, Prince Albert, Sask. Located on the SW 20-46-26 W2, RM 461

5. **Project Start and End Date:** May 1, 2013 to Jan 31, 2014

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7. **Project Objectives:** To provide an opportunity for producers in the Prince Albert region to observe the newest corn varieties and evaluate how they grow.

8. **Project Rationale:** Forage corn has never been a major forage crop in the Prince Albert region due mainly to the length of growing season required for corn to mature. Corn breeders are continually developing new cultivars with earlier maturity, and are beginning to promote their production on a limited scale in the area. However, growers have only limited information about risks and benefits from corn production

   Corn production costs are high, however since the corn can be winter grazed, harvest costs are low. Information on the yields of corn relative to other forage crops grown in the region is important for producers to be able to evaluate and base management decisions on.

9. **Methodology:** There were 8 different varieties chosen. These were 2 varieties from each of Pioneer Seeds and Brett Young and 4 varieties from Prairie Pacific Seeds. The companies made their own selection of varieties. Two varieties of barley, with potential for silage, were grown as a check. Fertilizer was applied based on soil test recommendations for each crop. Herbicides were selected based on weeds present and herbicide tolerance of the respective varieties.

   The crops were assessed for biomass yield, disease resistance, forage feed quality and production costs.The corn varieties used were as follows;

   Prairie Pacific Seeds 7811
   Pioneer 7443R
   Brett Young Tundra RR Hybrid
   Brett Young Venza R Elite
   Prairie Pacific Seeds Baxxos
   Pioneer Hybrid P7553R
   Prairie Pacific Seeds HLSR35 RR2
   Prairie Pacific Seeds 3382 Cruiser Maxx

The barley varieties planted were as follows;

Cowboy
Ranger

The demonstration was seeded on wheat stubble. A burn off of 1.5 L/ac of Advantage Plus was applied on May 17, 2013. The soil temperature that day was 13C.

The corn was planted on May 21 using a regular field seeder with a row spacing of 7.5". The corn was seeded at 2.5" deep with a target population of 26,000 plants/ac. The soil temperature that day was 13.5C and the maximum air temperature was 24C. Fertilizer was mid row banded ahead of planting at a rate of 92 lbs/ac N and 40 lbs/ac P. Fertilizer applied with the seed was 46 lbs/ac N and 16 lbs/ac P.

The corn was sprayed with Maverick 111 at 1 L/ac on June 24, 2013. The air temperature that morning at spraying time was 14C. The crop should have been sprayed for weeds again in mid-July however wet weather prevented this and consequently the corn got too tall to spray with field equipment. The corn was beginning to tassel and cob around July 27, 2013.

No fungicides were used on any of the corn as there was no visual evidence of disease on any of the corn varieties.

The barley was seeded on June 4, 2013. The surface soil condition was very dry and lumpy. The seeding depth was 2" at a rate of 1.5 bushels/ac and the soil temperature was 19C that day. The fertilizer used was 40 lbs/ac N and 30 lbs/ac P applied with the seed.

The barley was sprayed with 0.40 L/ac of MCPA Amine 500 on June 27, 2013. The weed kill was rated as fair on July 2, 2013. The crop was beginning to head on July 27, 2013 and was fully headed on August 6, 2013.

No fungicide was use on either of the barley varieties as there was no visual evidence of disease on either of the varieties.

Forage yield was determined by taking square meter samples when forage moisture content had declined to 70% for both barley and corn. This occurred August 15 with both barley varieties; September 6 for Tundra, Baxxos and P7443R corn; and September 23 for the remaining corn varieties.

Corn yield was determined by counting total numbers of cobs per row for each variety and then harvesting 10 representative cobs from each plot. The cobs were air dried in the shed and combined November 7.

Representative forage samples were taken on November 5 and submitted to Central Testing Lab Ltd in Winnipeg, Manitoba for assessment of feed quality. The samples were made up of biomass from two complete corn stalks, including cobs, from each variety.

Economic analyses were determined for each corn and barley cultivar by estimating marginal costs of seed fertilizer and pesticides based on costs in Table 1. Other costs that did not differ significantly between barley and corn were not included.

Table 1. Marginal input costs ($/ac) for seed, fertilizer and pesticides for barley and corn grown at the CLC in 2013

Input	Barley	Corn
Seed	13	85
Fertilizer	51	81
Pesticides	11	8
TOTAL	75	174

10. Results: A visual assessment of the quality of the barley on August 1, 2013 was rated as very good.

Corn plant densities tended to be highest for the cultivar PPS3382, and tended to be much lower for P7533R and P7443R (Table 2). We expected that the densities would be quite similar between cultivars, but differences were actually quite large. This may reflect that the crop was sown using a small grain seeder rather than a spaced plant corn seeder, resulting in more inter-plant competition and plant losses with some cultivars.

Average numbers of cobs per plant were very similar for all cultivars. Weight of grain from 10 cobs varied from .6 kg to 1.14 kg. This likely reflected maturity differences between cultivars, with higher yielding ones having matured more than those that were lower yielding prior to the first killing frost. Other factors that may account for differences in grain weigh of 10 cobs include differences in average numbers of seeds per cob, or seed size.

Table 2. Corn plant densities, cobs per plant and dry weight of grain from 10 cobs at the CLC in 2013.

Corn Variety	Density Plants/m2	Average Cobs/Plant	10 cob wt (kgs)
Tundra	9	2	0.86
Venza	8	2	0.66
HL5R35RR	10	2	0.60
PPS3382	16	2	1.12
P7533R	6	2	1.12
P7443R	6	2	1.10
Baxxos	14	2	1.14
PPS7811	11	2	0.96

In general, biomass percent dry matter content reflects relative maturity of that crop/cultivar at the time of harvest. Higher percent biomass is associated with greater maturity. PPS7811 corn had the highest % dry matter, while P7443R and Tundra had low % dry matter Table 3. Dry matter % for the two barley cultivars at forage harvest was slightly higher than that of Tundra corn, and substantially lower than for PPS7811 corn. Baxxos corn had a dry matter content of 35.6% while that of the remaining corn cultivars was between 43.8 and 48.2%.

Forage dry matter (DM) yield was lowest for the 2 barley cultivars, and much higher for all corn cultivars. There were substantial differences between corn cultivars with Tundra, and P7443R providing yields of less than 2.5 t/ac, while Venza, HL5R35RR, PPS3382 and PPS7811 all produced more than 6 T/ac. The varieties P7533R and Baxxos were intermediate yielding. It is interesting to note that the 2 corn cultivars that had lowest forage yield were also the 2 with lowest % dry matter.

Corn grain yield was highest for PPS3382 and Baxxos at greater than 3 T/ac while PPS7811 yielded 2.11 T/ac and other cultivars yielded less than 2 T/ac of grain.

Table 3. Biomass dry matter content, forage biomass yield and grain yield of two cultivars of barley and eight cultivars of corn at the CLC in 2013.

Crop	Cultivar	DM (%) at silage harvest	Forage DM yield (t/ac)	Forage wet biomass yield (t/ac)	Grain yield (t/ac)
Barley	Cowboy	31.7	1.21	3.83	na
	Ranger	31.5	1.15	4.66	na
Corn	Tundra	28.7	2.28	7.95	1.55
	Venza	43.8	6.08	13.89	1.06
	HL5R35RR	47.1	6.24	13.25	1.20
	PPS3382	48.2	6.71	13.92	3.58
	P7533R	43.9	4.48	10.20	1.34
	P7443R	27.4	1.98	7.22	1.32
	Baxxos	35.6	4.03	11.33	3.19
	PPS7811	50.1	6.76	13.49	2.11

Crude protein of Cowboy barley forage was very high at over 13%, while Ranger barley was much lower at 9.15% (Table 4). All corn cultivars had lower protein % than Cowboy barley, but several had higher crude protein than Ranger barley. Both Baxxos and Tundra corn had greater than 10% crude protein while PPS3382 had only 6.66% protein. Low protein % can be associated with high yield due to yield dilution. There did not appear to be any relationship between protein % and yield for the corn cultivars, suggesting that some factor other than yield dilution was a mainly responsible.

Total digestible nutrient % was between 60 and 63.6 % for the 2 barleys while for corn it varied between 62.9 and 68.6% depending on variety with corn. This was a much narrower range than for crude protein.

Digestible energy was 2.64 – 2.80 Mcal.kg for barley, and generally higher for the corn varieties at 2.83 to 3.02 Mcal/kg. This is not surprising since corn is generally regarded as high energy forage.

Table 4. Crude protein (CP), total digestible nutrients (TDN) and digestible energy (DE) for barley and corn grown at the CLC in 2013.

Crop	Cultivar	CP (%)	TDN (%)	DE (Mcal/kg)
Barley	Cowboy	13.02	60.02	2.64
	Ranger	9.15	63.55	2.80
Corn	Tundra	10.47	66.03	2.91
	Venza	8.55	68.09	3.00
	HL5R35RR	8.05	62.93	2.77
	PPS3382	6.66	65.61	2.89
	P7533R	8.29	68.64	3.02
	P7443R	9.93	64.30	2.83
	Baxxos	10.05	67.77	2.98
	PPS7811	8.17	67.45	2.97

Total crude protein (CP) yields/ac were much higher for all corn cultivars at 432.5 to 1215.0 lb/ac compared with 231.5 to 346.6 lb/ac for barley (Table 5). However the marginal cost of crude protein with barley compared quite favorably with corn. The lowest cost for corn CP was PPS7811 at $0.143/lb and for barley CP was Cowboy at $0.216/lb. Ranger barley was at $0.324/lb CP, while corn costs per lb of CP ran as high as $0.402/lb.

Marginal cost of dry matter was lowest for PPS7811 and PPS3382 corn at $25.74 and $25.93/T respectively, and highest for P7443R and Tundra corn at $87.88 and $76.33/T respectively. Dry matter marginal cost for Cowboy barley was $61.98/T while for Ranger it was $65.22/T.

Overall four varieties of corn appeared to combine high dry matter yield and high protein yield with low cost per pound of protein and per ton of dry matter. These included Venza, HL5R35RR, P7533R and P7443R. In addition, Venza and P7533R had high total digestible nutrients along with high digestible energy. Overall corn compared very favorably with barley as a crop for use as silage, particularly if high yields are desirable such as where land for silage production is limited. Where corn is grown for winter grazing, it may compare even more favorably due to lower harvest costs, but comparisons between corn and barley for winter grazing was beyond the scope of this trial.

It should be noted that using narrow row seeding equipment where plants are randomly spaced may have placed corn at a disadvantage compared with barley for which such seeding equipment is ideally suited.

Table 5. Total crude protein (CP), and marginal cost of crude protein and marginal cost of total dry matter (DM) produced from barley or corn at the CLC in 2013.

Crop	Cultivar	Forage DM yield (T/ac)	Total CP (lb/ac)	Marginal cost of CP ($/lb)	Marginal cost of DM ($/T)
Barley	Cowboy	1.21	346.6	.216	61.98
	Ranger	1.15	231.5	.324	65.22
Corn	Tundra	2.28	525.2	.331	76.33
	Venza	6.08	1143.6	.152	28.62
	HL5R35RR	6.24	1105.1	.157	27.88
	PPS3382	6.71	983.1	.177	25.93
	P7533R	4.48	817.1	.213	38.84
	P7443R	1.98	432.5	.402	87.88
	Baxxos	4.03	891.0	.195	43.18
	PPS7811	6.76	1215.0	.143	25.74

Results: Extension and Impact

This trial was featured at the CLC summer field day on July 18 with 50 in attendance. A summary of results will be posted on the CLC website, and results will be presented at winter meetings as opportunities arise. Results will also be presented at industry workshops alone or in combination with results from other Agri-ARM sites as opportunities arise.

11. Conclusions and Recommendations:

During 2013, corn was higher yielding than barley at the CLC. In addition, corn produced substantially more crude protein and total digestible nutrients. However marginal costs for seed fertilizer and pesticides were more than twice that for barley. Despite higher costs, some corn varieties still produced dry matter and protein at much lower cost per unit than for barley. Overall PPS7811, Venza, HL5R35RR and PPS3382 corn performed better than other corn or barley cultivars. However, we would need to know more about how performance of corn and barley compares over several years to predict what production risks might be. It is recommended that such trials be repeated in future with some of the poorer performing corn cultivars dropped and replaced by newer more promising ones.

12. Acknowledgements: The Conservation Learning Centre would like to acknowledge the funding received for this project from the ADOPT Program of the Saskatchewan Ministry of Agriculture. The CLC would also like to acknowledge the technical assistance of Curtis Braaten, Russell Wall, summer students, Linda Hunt, Forage Specialist, MOA and Stu Brandt of NARF.

13. Appendices: Nil

14. Abstract/Summary:

As newer earlier maturing corn cultivars are developed, grower interest in using corn for silage, winter grazing and even grain production increases. To provide information about relative performance of corn compared with barley, two barley varieties along with 8 corn varieties at the CLC in 2013. Cowboy and Ranger barley were grown along with Prairie Pacific Seeds 7811, Pioneer 7443R, Brett Young Tundra RR Hybrid, Brett Young Venza R Elite, Prairie Pacific Seeds Baxxos, Pioneer Hybrid P7553R, Prairie Pacific Seeds HLSR35 RR2 and Prairie Pacific Seeds 3382 corn. During 2013, corn was higher yielding than barley at the CLC. In addition, corn produced substantially more crude protein and total digestible nutrients. However marginal costs for seed fertilizer and pesticides were more than twice that for barley. Despite higher costs, some corn varieties still produced dry matter and protein at much lower cost per unit than for barley. Overall PPS7811, Venza, HL5R35RR and PPS3382 corn performed better than other corn or barley cultivars. However, we would need to know more about how performance of corn and barley compares over several years to predict what production risks might be. It is recommended that such trials be repeated in future with some of the poorer performing corn cultivars dropped and replaced by newer more promising ones.