

CORN SILAGE POTENTIAL IN CENTRAL OREGON

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Abstract

Corn silage yields average approximately 23 tons per acre for six varieties tested at the Central Oregon Agricultural Research Center (COARC) and the on-farm trial at the Ed Hemenway farm. Yields at the COARC averaged 22.6 tons per acre and 23.2 tons per acre at the on-farm site. Yield and quality were comparable, though the quality was better at the on-farm site. Yields and quality were comparable to results obtained last year, thus supporting the potential for corn silage production in the area.

Introduction

Corn is a tropical grass, native to Central and South America. Central Oregon presents a relatively cool environment for growing this crop, and there was some doubt about how well it would perform in the area. Results from the 1999 trial determined that 90-day corn would provide adequate growth for silage. With the help of several companies, a number of different of corn varieties were grown to determine yield potentials for the area. The objective of this study was to further determine if corn varieties could be profitably grown for silage.

Materials and Methods

Six varieties ranging in maturity from 89 to 104 days were planted in 6-row strip plots at the COARC, Madras, Oregon on May 18, and on May 26 at Ed Hemenway's farm south of Gateway (north of Madras) near Mud Creek. The elevation at the Madras site is 2200 feet, while the on-farm site is slightly lower in elevation and is a "warmer" site.

The varieties tested were:

<u>Variety</u>	<u>Company*</u>
Croplan 298	Cenex/Land O'Lakes/Croplan Genetics
Croplan 345	Cenex/Land O'Lakes/Croplan Genetics
Geertson GS998	Geertson Seed Farms
Geertson GS1049	Geertson Seed Farms
Geertson GSX1000ND	Geertson Seed Farms
UAP DG5345RR	UAP Northwest

*We acknowledge and thank these companies for their participation and their partial funding of the trial.

Corn varieties were planted at both locations using a John Deere 7000 planter. Plots consisted of six rows, with 30-inch row spacing, and were planted at 30,000 seeds/ per acre. On-station plot size was fifteen feet in width and 230 feet in length. A solid set sprinkler system was used at Madras for irrigation and a center pivot irrigation system was used at Gateway.

Initial soil tests at the Madras station indicated 61 pounds per acre of NO₃ present in the soil profile (0-24 inches) (see table 1). Pre plant fertilizer at Madras was broadcast at a rate of 225 lb/acre 21-0-0-24, 200 lbs/ acre of 16-20-0-15 was side dressed at planting, 160 lbs/ acre of urea (46-0-0) on June 30. Total fertilizer applied to the crop included 153 lb/a of N, 40 lb/a P₂₀₅, and 84 lb/a S. Total available N the crop at Madras was 214 lb/a.

Table 1. Soil test results for the COARC corn field, Madras, Oregon taken March 8, 2000.

Depth (in.)	pH	NO ₃ (lb/a)	NH ₄ (lb/a)	P (ppm)	K (ppm)	S (ppm)
0-12	6.9	22	30	32	460	10.1
12-24	7.9	39	23	15	290	16.1
0-24 Total		61	53			

The soil test taken at the Gateway site revealed a lot of nitrogen left over from the previous crop (table 2). Wheat was planted and grown for pasture by cattle, prior to tilling and planting the field to corn. It is not known how much nitrogen was left in the soil profile at planting time. The fertilizer applied included 380 lb/ac of 46-0-0 and 135 lb/ac of 0-45-0 broadcast prior to planting, and 200 lb/ac of 16-20-0-15 banded on May 26. Total pounds of nutrients applied: 207 lb/ac N, 61 lb/ac P₂₀₅, and 30 lb/ac of S.

Table 2. Soil test results (sample taken on January 13, 2000) for the corn field at the Ed Hemenway Farm, Gateway, Oregon.

Depth (in.)	pH	NO ₃ (lb/a)	NH ₄ (lb/a)	P (ppm)	K (ppm)	S (ppm)	B (ppm)	Zn (ppm)	OM (ppm)	Soluble Salts (mmhos/cm)
0-12	5.9	138	13	20	269	12	0.6	0.4	2.4	1.3

Two sub samples for each variety were harvested by hand (using a machete) in Gateway on September 22. For each sub sample harvested, 21.5 ft of row was cut at 6-inch height. The fresh weight was determined and a two-stalk sub sample was ground through a landscape chipper. The chopped material was mixed well, and a sub sample was removed and immediately weighed with an electronic scale (Scout SC6010, Ohaus Corp, Florham Park, NJ), and placed in a paper bag for drying. This percent moisture was used to convert fresh weight yields to a dry-matter basis.

Madras silage plots were harvested on September 26 using a two-row New Holland chopper with a cutting height of 4 inches. Ends and sides of the field were trimmed prior to chopping to ensure a constant area. Plots were chopped into a truck and weighed on a commercial truck scale (Cenex, Inc., Madras, OR). A 300 to 500 g sub sample of each plot was taken, placed into a sealed plastic bag, and weighed.

All of the sub samples were dried at 145 degrees Fahrenheit until dry (constant weight) and then ground through a Thomas-Wiley Mill (Arthur H. Thomas Co., Philadelphia, PA) with 10 mm screen to analyze for quality using wet chemistry by a commercial lab (Agri-King, Inc. Fulton, IL). Digestible yields, nutrient uptake or yield was calculated.

Results and Discussion

Initial plant stand at both sites was very good and plants grew rapidly throughout July and August. Harvest population and percent dent, harvest yields and agronomic information, quality analysis, and nutrient uptakes for the corn silage trials are summarized in tables 3, 4, 5, and 6.

Harvest population at Gateway averaged 26,879 plants/acre (30,000 seeds per acre were planted) and only one variety had a dent percentage that was different from the rest at both sites. Croplan 345 was more mature at harvest based on dent. (See Table 3)

Yields (at 65% moisture) averaged 23.2 ton/acre (7.9 ton/acre dry matter) at Gateway and 22.6 ton/acre (8.1 ton/acre dry matter) in Madras. Bird damage was significant at the Madras site. It is difficult to say there were real differences in yield between the varieties, because there were no true replications, but GS 998 was the top yielder at both locations. The dry matter yield differential was a plus 0.7 t/a and 1.2 t/a at Madras and Gateway, compared to the second highest yielding variety. The other five varieties were separated by 0.3 t/a and 1.0 t/a at Madras and Gateway. There was a killing frost just before the plots were harvested at Madras and there was some leaf drop.

On Average, Madras receives about 1,870 growing degree-days for corn between May 1 and September 30. This corresponds to about a 75-day corn for full maturity. Because corn grown for silage is harvested before maturity, a variety that takes longer to mature is appropriate for corn silage where it wouldn't be for grain. Actual growing degree-days for Madras in 2000 were 1,550 and 1,461 for Gateway. Growing degree-days were calculated from date of emergence to harvest. On average, date of emergence was 12 days after planting.

Crude protein, at Gateway, averaged 8.9 percent, which was higher than the 7.0 percent average at Madras. Acid detergent fiber was lower at 28.3 percent at Gateway compared to 30.4 at Madras. The range of ADF was 30.4 to 31.1 percent at Madras and 23.5 to 31.9 at Gateway. NDF averaged 46.7 percent at Gateway and 49.7 at Madras while the range of NDF at Madras was 48.4 to 50.5 percent and 40.0 to 51.1 at Gateway. IVDMD averaged 68.0 percent and 69.3 percent at Madras and Gateway (table 3). The range in ADF, NDF, and IVDMD was much greater at the Gateway site. The Gateway site also had the highest average quality.

The nutrient analyses are presented in table 5. IVDMD in tons per acre and nutrient uptake are presented in table 6. Total nutrient uptake, at both sites, was approximately the same for Calcium, Phosphorus, Magnesium, Potassium, as well as lignin and ash produced by the crop. Though the potassium level, in the two fields, was different, there was not a large difference in the plant percent potassium, or the total amount of potassium taken up by the crop at the two sites. Oil, Chlorine and Nitrogen uptake was much greater at Gateway than at Madras. Sodium uptake was greater at Madras. There was a 54 lb/ac average difference in nitrogen uptake between the sites.

The field performance of the corn crop at both locations this year and last year indicates good potential for growing more corn silage in the Jefferson county area.

Table 3. Plant population at harvest at Gateway, and percent dent at Madras and Gateway.

Variety	Maturity Rating	Plant Population at Harvest (Gateway)	Dent (at Madras)	Dent (at Gateway)
	(Days)	(Plants/acre)	(%)	(%)
Croplan 345	95	27,149	5	45
Croplan 298	89	26,339	10	10
Geertson GS1049	104	28,365	5	5
UAP DG5345RR	97	25,528	5	5
Geertson GS 998	99	28,365	0	1
Geertson GSX1000ND	100	25,528	0	10
Average		26,879	4	13

*All varieties were at growth stage R3 at both ocat ons at time of harvest.

Table 4. Performance of corn silage varieties planted in a commercial field near Gateway on May 26 and at COARC, Madras, OR on May 18

Variety	Maturity Rating	Yield at 65% Moisture	Dry Matter Yield	Field Moisture	Bird Damage	Seed Moisture	Height	Leaf Number at Harvest	Crude Protein	Soluble Protein	Acid Detergent Fiber	Neutral Detergent Fiber	Net Energy Lactation
	(Days)	(tons/acre)	(tons/acre)	(%)	(%)	(%)	(in)		(%)	(%)	(%)	(%)	(Mcal/lb)
Madras, OR													
Geertson 998	99	25.7	9.0	68.8	3	74.5	109	13	7.33	37.5	30.4	50.5	0.66
Croplan 345	95	22.3	7.8	62.9	25	64.4	118	14	6.94	30.4	30.7	49.8	0.66
Croplan 298	89	22.3	7.8	73.2	3	70.2	118	14	5.69	33.3	30.8	50.5	0.66
UAP DG5345RR	97	22.3	7.8	65.0	15	64.0	104	14	6.89	36.6	29.8	50.3	0.67
Geertson GSX1000ND	100	21.7	7.6	65.8	10	57.2	108	12	7.45	31.7	29.5	49.0	0.67
Geertson 1049	104	21.4	7.5	70.4	12	61.3	101	16	7.66	38.1	31.1	48.4	0.65
Mean		22.6	7.9	57.2	11	65.3	110	13.8	7.00	34.6	30.4	49.7	0.66
Gateway, OR													
Geertson GS 998	99	26.3	9.2	78.1					8.12	36.2	29.2	51.1	0.68
Geertson GS 1049	104	24.3	8.5	78.5					9.65	33.3	23.5	40.0	0.75
Geertson GSX1000ND	100	23.4	8.2	78.0					9.14	42.9	27.4	44.3	0.70
Croplan 345	95	22.3	7.8	76.0					8.93	36.2	28.0	44.8	0.69
Croplan 298	89	21.7	7.6	74.2					8.74	40.4	31.9	50.9	0.64
UAP DG5345RR	97	21.4	7.5	75.8					8.76	37.9	30.0	49.1	0.67
Mean		23.2	8.1	76.8					8.90	37.8	28.3	46.7	0.69

yields corrected for bird damage assume a 50% harvest index.

Table 5. IVMDM, oil, calcium, phosphorus, magnesium, potassium, sodium, chlorine, lignin, ash percent contents, and net energy for maintenance, and net energy for gain for corn silage varieties planted in a commercial field near Gateway on May 26 and at COARC, Madras, OR on May 18.

Variety	IVDM	Oil	Calcium	Phosphorus	Magnesium	Potassium	Sodium	Chlorine	Lignin	Ash	Net Energy Maintenance	Net Energy Gain
	(%)										Mcal/lb	Mcal/lb
Madras, OR												
Croplan 345	66.0	1.10	0.14	0.18	0.19	1.50	0.06	0.13	3.06	5.56	0.69	0.43
Geertson GSX1000ND	68.3	1.03	0.19	0.20	0.17	1.77	0.03	0.11	2.91	6.91	0.69	0.42
Croplan 298	66.1	0.70	0.22	0.15	0.14	2.09	0.03	0.10	3.58	6.55	0.69	0.42
Geertson 998	69.8	0.92	0.16	0.17	0.16	1.82	0.03	0.08	2.64	6.37	0.70	0.43
Geertson 1049	68.6	1.16	0.17	0.27	0.16	1.82	0.06	0.10	2.90	5.95	0.70	0.44
UAP DG5345RR	69.4	0.82	0.20	0.22	0.19	1.49	0.04	0.08	2.77	7.59	0.69	0.42
Mean	68.0	0.96	0.18	0.20	0.17	1.75	0.04	0.10	2.98	6.49	0.70	0.43
Gateway, OR												
Croplan 345	67.6	1.30	0.19	0.19	0.23	1.41	0.02	0.19	2.97	6.21	0.71	0.44
Croplan 298	74.1	1.77	0.15	0.22	0.19	1.62	0.03	0.20	2.25	5.99	0.76	0.49
Geertson GS 1049	70.8	1.30	0.17	0.21	0.17	1.76	0.03	0.14	2.83	5.88	0.72	0.45
UAP DG5345RR	68.8	1.23	0.18	0.22	0.21	1.43	0.04	0.15	3.03	6.97	0.72	0.45
Geertson GS 998	66.1	1.02	0.18	0.19	0.18	2.05	0.03	0.21	3.33	7.00	0.68	0.41
Geertson GSX1000ND	68.2	1.24	0.17	0.24	0.17	1.82	0.03	0.18	3.03	6.30	0.70	0.43
Mean	69.3	1.31	0.17	0.21	0.20	1.68	0.03	0.18	2.91	6.39	0.72	0.45

Table 6. Total IVDMD yield, oil yield, and calcium, phosphorus, magnesium, potassium, sodium, chlorine uptake, and lignin and ash yield, and total nitrogen uptake for the corn silage varieties planted in a commercial field near Gateway on May 26 and at COARC, Madras, OR on May 18.

Variety	IVDMD	Oil	Calcium	Phosphorus	Magnesium	Potassium	Sodium	Chlorine	Lignin	Ash	Nitrogen Uptake
	(tons/acre)					lb/a					
Madras, OR											
Croplan 345	5.15	171.6	21.8	28.1	29.6	234.0	9.4	20.3	477.4	867.4	173.2
Geertson GSX1000ND	5.19	156.6	28.9	30.4	25.8	269.0	4.6	16.7	442.3	1050.3	181.2
Croplan 298	5.16	109.2	34.3	23.4	21.8	326.0	4.7	15.6	558.5	1021.8	142.0
Geertson 998	6.28	165.6	28.8	30.6	28.8	327.6	5.4	14.4	475.2	1146.6	211.1
Geertson 1049	5.15	174.0	25.5	40.5	24.0	273.0	9.0	15.0	435.0	892.5	183.8
UAP DG5345RR	5.41	127.9	31.2	34.3	29.6	232.4	6.2	12.5	432.1	1184.0	172.0
Mean	5.39	150.8	28.4	31.2	26.6	277.0	6.6	15.8	470.1	1027.1	177.2
Gateway, OR											
Croplan 345	5.27	202.8	29.6	29.6	35.9	221.5	3.1	29.6	463.3	968.8	222.9
Croplan 298	5.63	269.0	22.8	33.4	28.9	246.2	4.6	30.4	342.0	910.5	212.6
Geertson GS 1049	6.02	221.0	28.9	35.7	28.9	299.2	5.1	23.8	481.1	999.6	262.5
UAP DG5345RR	5.12	184.5	27.0	33.0	31.5	214.5	6.0	22.5	454.4	1045.5	210.2
Geertson GS 998	6.08	187.7	33.1	35.0	33.1	377.2	5.5	38.6	612.2	1288.0	239.1
Geertson GSX1000ND	5.59	203.4	27.9	39.4	27.9	298.5	4.9	29.5	496.9	1033.2	240.1
Mean	5.62	211.4	28.2	34.4	31.0	276.2	4.9	29.1	478.0	1049.9	231.2