Evaluation of Conventional and Roundup Ready Alfalfa Varieties in Central Oregon, 2013

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Abstract

An alfalfa variety trial was established in August, 2011 at the Central Oregon Agricultural Research Center (COARC), located in Madras, Oregon. It is a four-year project that generates yield, protein and relative feed value (RFV) that includes ADF and NDF data under 4-cut management. Ten conventional varieties (including 2 industry standards) and seven Roundup Ready® alfalfa varieties are being evaluated in side by side replicated plots. Total yield for conventional varieties ranged from 7.2 to 9.3 tons/acre and total yield for Roundup Ready® varieties ranged from 9.1 to 9.6 tons/acre. Total yield trended higher for the Roundup Ready® varieties across harvest dates compared to conventional varieties. Overall quality for conventional and Roundup Ready® varieties were good with relative feed values increasing through the season, and highest for the fourth cutting. Relative feed value trended consistently higher across Roundup Ready® varieties compared to conventional varieties

Introduction

Alfalfa is an important crop for central Oregon, with alfalfa hay produced in the three counties used for feed on local ranches and marketed to livestock producers, dairies, marketed through feed stores in Oregon, the Pacific Northwest and Canada, and exported to Pacific Rim countries. Alfalfa is important as a rotational crop to break disease and insect cycles, with the added benefit of being able to fix nitrogen for its own use and subsequent crops.

Yield, protein and relative feed value data were analyzed to provide a thorough varietal performance evaluation under central Oregon conditions. Neutral Detergent Fiber (NDF) is used to predict intake because it is slowly digested and is part of the diet that fills the rumen and forces the animal to quit feeding. Acid Detergent Fiber (ADF) predicts digestibility, as it represents the very slowly digested fiber that is tolerant to strong acids. Total Digestible Nutrients (TDN) is calculated using ADF and represents feed energy. Relative Feed Value (RFV) provides a single value to describe forage quality, and has become a common tool for determining overall hay quality (intake and energy value). Forage grade alfalfa hay can be categorized into 5 major grades: supreme, premium, good, fair, and poor. Addendum 1 provides quality standards for RFV, with the higher the RFV the more digestible and palatable the feed.

The objective of this study is to generate quality and yield data for pre-release and recently released alfalfa varieties under central Oregon conditions. Two industry standard varieties, Vernal and Plumas, are included with the conventional varieties for comparison. This timely information is expected to provide alfalfa seed companies, field consultants, hay growers and the agricultural community-at-large with data important to decision-making in central Oregon and throughout eastern Oregon.

Materials & Methods

Ten conventional and seven Roundup Ready® alfalfa cultivars were planted August 31, 2011. Conventional and Roundup Ready® cultivars were placed in separate side-by side trials, with a 60-ft border between. The entries were planted in 5 ft by 20 ft plots in a randomized block design, replicated 4 times. Planting rate was 25 lbs/acre of pure live seed, with an Oyjord plot drill on 8-inch row spacing.

The trials were irrigated using solid-set sprinklers (9/64-inch Rainbird nozzles) on a 30-ft by 40-ft spacing. The conventional trial was sprayed with Velpar® Alfamax™ at 1.75 lbs/acre, Firestorm® at 1.25 pts/acre, Hellfire® at 10 oz/acre, and non-ionic surfactant at 2 pts/100gal on February 18, 2013 The Roundup Ready® trial was sprayed with Roundup PowerMAX® at 44oz/acre plus Quest® at 2 pts/100galon April 3, 2013 per label recommendation.

Seventeen foot plots, after 3 ft alleyways were cut, were harvested using a small-plot, forage harvester. Total fresh weight was taken in the field, with subsamples placed into a paper bag, weighed, and dried at 145°F until no further change in weight occurred. Fresh weight yields were adjusted to represent oven-dry weights based on sub-samples weight change due to drying. Dried samples were ground using a Wiley mill, and sub-samples from all four replications combined and sent to Dairy One Forage Testing Laboratory located in Ithaca, New York to determine crude protein, Acid Detergent fiber (ADF), Nutrient Detergent Fiber (NDF), Total Digestible Nutrients (TDN) and Relative Feed Value (RFV).

After each of the four harvests, the trial area was swathed, dried for 4 days, and hay removed to expedite irrigation and regrowth. Harvest dates were June 4, July 10, August 15, and October 8, 2012. The fourth cutting was harvested 6 days after the first frost and may have contributed to a slight decrease in yield for both conventional and Roundup Ready varieties.

Results and Discussion

Yields during 2013 for each of the four cuttings and season total yields for conventional varieties ranged from 7.2 (Vernal) to 9.3 tons/acre, with no significant difference between the top 7 yielding varieties (Table 1). Individual cutting and season total yields for Roundup Ready® varieties ranged from 9.1 to 9.6 tons/acre, with no significant differences between varieties (Table 2).

First cutting conventional variety quality analysis determined using RFV ranged from 128 to 152 (Plumas), while Roundup Ready® varieties ranged from 128 to 142 (Table 3). Based on the RFV grading system provided in Addendum 1, both conventional and Roundup Ready® varieties largely performed within the Good rating. Quality data cannot be statistically analyzed due to subsamples from the four replications being combined into one sample to reduce cost.

Second cutting RFV quality was largely within the Good rating, with conventional varieties ranging from 129 to 148 and Roundup Ready® varieties ranging from 135 to 151 (Table 4).

Third cutting RFV results for conventional varieties ranged from 141 to 166 (Vernal) and Roundup Ready® varieties were between 145 and 161 (Table 5). Three conventional varieties and four Roundup Ready® varieties were rated Premium.

RFV ratings continued to increase through the fourth cutting across varieties, with conventional varieties between 153 and 185 (Vernal) and Roundup Ready® varieties between 167 and 191(Table 6). One conventional and three Roundup Ready® varieties were rated Supreme.

Overall, total yields for Roundup Ready® varieties were higher (9.1 to 9.6 tons/acre) than conventional varieties (7.2 to 9.3 tons/acre), and more tightly grouped within the upper range. Relative feed value trended consistently higher across Roundup Ready® varieties compared to conventional varieties. Evaluation of individual varietal performance is important in making management decisions about which variety is best suited for a specific production situation.

Alfalfa varietal yield and quality data provided by this research project conducted at the Central Oregon Agricultural Research Center in Madras provides valuable information to assist, seed companies, fieldmen and growers in making decisions related to optimizing alfalfa production and enhancing the economic benefit throughout the region. Our thanks to alfalfa seed companies and industry representatives directly involved in this project.

Information related to fall dormancy, winter survival index, pest resistance, and other agronomic ratings for conventional and Roundup Ready® alfalfa varieties included in this performance evaluation is provided in Addendums 2 and 3.

Table 1. Conventional alfalfa variety yields for each of four cuttings and the season total at COARC, Madras, OR, 2013.

Variety	1st Cutting Yield	2nd Cutting Yield	3rd Cutting Yield	4th Cutting Yield	Total Yield
	- - - - - - - - - - - - - - - - - - (tons/acre) - - - - - - - - - - - - - - - - - -				
Pioneer 54V09	3.8 a	2.0 a	2.1	1.4 a	9.3 a
445NT	3.2 b	2.0 a	2.1	1.5 a	8.8 ab
6422Q	3.2 b	2.1 a	2.1	1.4 a	8.8 ab
WL 354HQ	3.3 b	2.1 a	1.9	1.5 a	8.8 ab
Mountaineer 2.0	3.4 ab	2.0 a	1.8	1.5 a	8.7 ab
Pioneer 54Q25	3.3 b	2.1 a	1.9	1.4 a	8.7 ab
WL 363HQ	3.2 b	2.0 a	1.9	1.4 a	8.5 ab
Plumas	3.0 b	1.9 a	2.0	1.5 a	8.4 b
FGI 48W202	3.0 b	1.9 a	2.0	1.4 a	8.3 b
Vernal	3.0 b	1.5 b	1.6	1.1 b	7.2 c
Average	*3.2*	*2.0*	*2.0*	*1.4*	*8.6*
LSD	*0.5*	*0.4*	*NS*	*0.2*	*0.9*

Table 2. Roundup Ready®alfalfa variety yields for each of four cuttings and the season total at COARC, Madras, OR, 2013.

Variety	1st Cutting Yield	2nd Cutting Yield	3rd Cutting Yield	4th Cutting Yield	Total Yield
	- - - - - - - - - - - - - - - - - - (tons/acre) - - - - - - - - - - - - - - - - - -				
FGI R48W224	3.7	2.5	1.9	1.5	9.6
Pioneer 54R014	3.6	2.4	2.0	1.5	9.5
433TRR	3.5	2.7	1.9	1.3	9.4
DKA 43-22RR	3.4	2.6	1.7	1.6	9.3
R470K215	3.7	2.6	1.7	1.3	9.3
FGI R58HG236	3.4	2.5	1.8	1.5	9.2
4R200	3.5	2.5	1.7	1.4	9.1
Average	*3.5*	*2.5*	*1.8*	*1.5*	*9.4*
LSD	*NS*	*NS*	*NS*	*NS*	*NS*

Table 3. First cutting alfalfa variety quality evaluation June 4, 2013 at COARC, Madras, OR.

Variety	Crude Protein	ADF	NDF	TDN	RFV
Conventional	- - - - - - - - - - - - - - - - (% dry matter) - - - - - - - - - - - - - - - -				
Plumas	21.1	33.7	38.4	62	152
WL 363HQ	19.4	34.4	40.5	61	143
FGI 48W202	20.9	35.3	40.1	61	142
Mountaineer 2.0	19.6	35.6	41.3	60	138
Pioneer 54Q25	19.8	35.5	41.4	60	137
Vernal	20.0	35.5	41.6	61	137
WL 354HQ	20.3	36.2	42.0	60	134
445NT	19.2	36.1	42.6	59	133
6422Q	20.8	35.9	43.0	62	132
Pioneer 54V09	18.8	36.9	43.7	61	128
Roundup Ready®					
4R200	18.5	34.2	40.8	61	142
433TRR	20.8	34.5	41.0	63	141
R470K215	20.2	34.4	41.4	63	140
FGI R58HG236	19.9	35.0	42.9	62	134
FGI R48W224	19.6	35.6	43.1	62	132
DKA 43-22RR	19.9	36.4	43.1	60	131
Pioneer 54R014	18.1	36.4	44.1	59	128

Table 4. Second cutting alfalfa variety quality evaluation July 10, 2013 at COARC, Madras, OR.

Variety	Crude Protein	ADF	NDF	TDN	RFV
Conventional	- - - - - - - - - - - - - - - - (% dry matter) - - - - - - - - - - - - - - - -				
445NT	22.9	34.9	38.7	58	148
WL 354HQ	22.2	35.0	39.1	59	147
WL 363HQ	23.2	34.6	39.1	60	147
FGI 48W202	20.7	36.2	39.1	56	144
Mountaineer 2.0	20.9	36.9	40.0	57	140
Pioneer 54Q25	22.1	36.5	40.2	58	140
Plumas	24.7	36.6	41.2	60	136
6422Q	21.5	37.5	41.4	58	134
Vernal	20.2	37.5	41.6	57	133
Pioneer 54V09	20.9	39.1	42.2	55	129
Roundup Ready®					
Pioneer 54R014	23.4	35.2	37.9	60	151
DKA 43-22RR	22.9	35.6	38.3	60	148
FGI R58HG236	21.4	35.3	38.6	57	148
FGI R48W224	22.6	35.5	39.4	59	145
433TRR	20.7	36.7	40.7	58	138
4R200	20.9	37.1	40.8	57	137
R470K215	21.2	36.1	41.8	58	135

Table 5. Third cutting alfalfa variety quality evaluation August 15, 2013, COARC, Madras, OR.

Variety	Crude Protein	ADF	NDF	TDN	RFV
Conventional	- - - - - - - - - - - - - - - (% dry matter) - - - - - - - - - - - - - - -				
Vernal	24.1	29.6	36.9	64	166
FGI 48W202	24.4	33.2	37.7	59	156
Pioneer 54Q25	23.9	34.6	37.7	61	153
Plumas	23.9	34.7	38.5	59	150
6422Q	23.9	34.0	39.0	61	149
Pioneer 54V09	23.9	35.4	39.0	61	146
WL 354HQ	23.0	35.1	39.5	58	145
445NT	22.6	36.5	39.6	58	142
Mountaineer 2.0	22.8	36.4	39.8	60	142
WL 363HQ	21.7	36.1	40.1	57	141
Roundup Ready®					
433TRR	24.8	33.0	36.5	61	161
FGI R48W224	22.6	31.3	37.2	57	161
FGI R58HG236	23.2	32.7	37.5	58	157
DKA 43-22RR	23.7	34.0	38.3	58	152
R470K215	22.3	35.3	38.8	57	147
Pioneer 54R014	23.2	34.6	39.6	58	146
4R200	23.1	35.3	39.4	57	145

Table 6. Fourth cutting alfalfa variety quality evaluation October 8, 2013, COARC, Madras, OR.

Variety	Crude Protein	ADF	NDF	TDN	RFV
Conventional	- - - - - - - - - - - - - - - - (% dry matter) - - - - - - - - - - - - - - - -				
Vernal	25.1	29.1	33.3	64	185
Pioneer 54Q25	24.2	29.5	34.3	63	179
Pioneer 54V09	24.9	30.2	34.2	64	178
Mountaineer 2.0	23.4	29.7	34.7	63	177
Plumas	24.9	30.0	34.5	64	177
WL 354HQ	24.1	30.1	34.6	64	176
6422Q	23.8	31.8	34.0	60	175
445NT	23.0	30.6	36.0	63	168
WL 363HQ	22.5	32.1	36.2	62	164
FGI 48W202	22.6	33.0	38.4	62	153
Roundup Ready®					
433TRR	22.9	27.6	32.9	65	191
R470K215	21.3	28.3	33.3	63	187
FGI R58HG236	22.2	29.9	33.4	62	183
4R200	23.9	30.4	33.9	61	179
FGI R48W224	22.8	31.5	33.8	60	177
Pioneer 54R014	23.2	30.0	34.4	62	177
DKA 43-22RR	22.0	31.1	36.1	60	167

Acknowledgements

Support for this trial was sponsored by Forage Genetics Inc., America's Alfalfa, W-L Seed Co., Helena Chemical Company-Culver, Eureka Seed, Cropland Genetics, Inc., and Monsanto.

Addendum 1. Relative Feed Value (RFV) grading criteria used for determining forage quality.

Forage Grade and Description	If the ADF is:	If the NDF is:	Then the Relative Feed Value is:
1 Supreme	Under 30	Under 40	Over 180
2 Premium	31-35	41-45	151-180
3 Good	36-40	47-53	126-150
4 Fair	41-42	54-60	101-125
5 Poor	43-45	61-65	Under 100

Addendum 2. Fall dormancy, winter survival index, pest resistance, and other agronomic ratings for the conventional alfalfa varieties.
Blanks in the grid indicates that the variety is susceptible or has not been adequately tested.

Variety	FD[1]	WSI[2]	BW[3]	VW	FW	Anth 1	PRR	SAA	PA	BAA	SN	APH 1	APH2	NRKN	MF E	CGT	S E	ST	Tec h
6422Q	4	1	HR	HR	HR	HR	HR		R		R	HR			H				C
WL 363HQ	5	1	HR	HR	HR	HR	HR		HR		HR	HR		HR	H				C
WL 354HQ	4	1	HR	HR	HR	HR	HR	HR	HR		R	HR	HR		H				C
Ameristand 445NT	4		HR	R	HR	HR	HR	HR	R		HR	R		HR	M				C
FGI 48W202																			
Mountaineer 2.0	5	2	HR	R	HR	HR	HR	R	HR		HR	R		R	H				C
Pioneer 54V09	4		HR	HR	R	HR	HR	R	HR		HR	R	MR	HR					C
Pioneer 54Q25	4		HR	HR	HR	HR	HR	R	R		HR	R		HR					C
Vernal	2		R		MR									MR					C
Plumas	4	2	HR	R	HR	HR	HR	R	R		HR	HR		R	H				C

Addendum 3. Fall dormancy, winter survival index, pest resistance, and other agronomic ratings for the Roundup Ready alfalfa varieties.

Variety	FD[1]	WSI[2]	BW[3]	VW	FW	Anth1	PRR	SAA	PA	BAA	SN	APH1	APH2	NRKN	MFE	CGT	SE	ST	Tech
R470K215																			R
433TRR	3	2.5	HR	R	R	HR	HR		R			HR							R
FGI R58HG236																			R
FGI R48W224																			R
DKA 43-22RR	4	2	HR	HR	HR	HR	HR				HR	HR		R	H				R
Pioneer 54R01	4	2	HR	HR	HR	HR	HR	R	R		R	HR		R	H				R
4R200	4	2	HR	HR	HR	HR	HR	MR	R	MR	HR	HR		R	H				R

Blanks in the grid indicates that the variety is susceptible or has not been adequately tested.

FD = Fall Dormancy[1], WSI = Winter Survival Index[2], BW = Bacterial Wilt, VW = Verticillium Wilt, FW = Fusarium Wilt, Anth1 = Anthracnose Race 1, PRR = Phytopthora Root Rot, SAA = Spotted Alfalfa Aphid, PA = Pea Aphid, BAA = Blue Alfalfa Aphid, SN = Stem Nematode, APH1 = Aphanomycese Race 1, APH2 = Aphanomycese Race 2, NRKN = Northern Root Knot Nematode, MFE = Multi-Foliate Expression
CGT = Continuous Grazing Tolerance, SE = Standability Expression, ST = Salt Tolerance (G – germination, F – forage), Tech = Technology (C – conventional, H – Hyrbrid, R – Roundup Ready)
[1]Fall Dormancy Rating: 1 = most dormant to 11 = least dormant
[2]Winter Survival Index: 1 = Superior, 2 = Very Good, 3 = Good, 4 = Moderate, 5 = Low, and 6 = Non-Winter Hardy
[3]Resistance Ratings: S = susceptible, LR = low resistance, MR = moderate resistance, R = resistance, HR = high resistance , MR = moderate resistance, R = resistance, HR = high resistance