

2012 Central Oregon Alfalfa Variety Trial

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Abstract

An alfalfa variety trial was established in August, 2011 at the Central Oregon Agricultural Research Center, Madras, Oregon. It is a four year project that will generate yield, protein and relative feed value (ADF, NDF) data under 4-cut management. Ten conventional (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 7.6 to 9.0 ton/acre and total yield for Roundup Ready[®] varieties ranged from 8.0 to 8.5 ton/ac⁴³. 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 higher for the Roundup Ready[®] varieties across harvest dates compared to conventional varieties.

Introduction

Alfalfa is an important crop for central Oregon, with hay produced in the three counties used for fed 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's slowly digested and 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 6 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 concerning pre-release and recently released alfalfa varieties under central Oregon conditions compared to industry standard varieties. This timely information is expected to provide alfalfa seed companies, fieldmen, hay growers and the agricultural community-at-large with data important to decision-making in central Oregon and throughout eastern Oregon.

Materials & Methods

This alfalfa variety evaluation was established at Central Oregon Agricultural Research Center (COARC) near Madras, Oregon. Recent crop history for the plot area was fallow during 2010, oats grown for hay in 2009, and alfalfa production from the fall of 2003 to the summer of 2008. Soil samples were taken and analyzed by Agri-Check Laboratory at Umatilla, Oregon. For soil testing purposes the plot area was treated as one field. Based on these samples, lime was applied at 1 ton/acre on August 23 and tilled following application. Fertilizer was applied at 150 lbs/ac of Mesz (or hydropyl) 12-40-0-10, 1% zinc on August 25, 2011.

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. All seed was inoculated with Nitragin AB[®] prior to planting. No fungicides treatments were added to seed; however some varieties were coated by the provider, as indicated in Table 1.

The trials were irrigated using solid-set sprinklers (9/64-inch Rainbird nozzles) on a 30-ft by 40-ft spacing. The first irrigation was August 31 following planting and rolling of the plot area. Plant emergence occurred on approximately September 5, with percent stand estimated visually as percent green in the rows on September 15. Stand uniformity was evaluated September 21 by determining percent of plants within a one-foot square area that had one, two, and three trifoliolate leaves.

Due to light weed pressure following planting, no herbicides were applied to the conventional trial. The Roundup Ready[®] trial was sprayed with Roundup PowerMAX[®] at 44oz/acre plus non-ionic surfactant at 4 pts/100gal on October 12 per label recommendation.

Seventeen foot plots, after 3 ft alleyways were cut, were harvested using a small-plot, forage harvester with a 42 inch sickle bar. 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 in Ithica, 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 remainder of the plot area was swathed and hay removed to expedite irrigated and regrowth. Harvest dates were June 11, July 11, August 15, and October 2, 2012. The fourth cutting was timed prior to a forecast for sub-freezing temperatures, and may have contributed to a slight decrease in yield for both conventional and Roundup Ready varieties.

Results and Discussion

There was excellent germination and stand establishment for all varieties. Varietal performance in both conventional and Roundup Ready® varieties ranged from 86 to 100 percent (Table 1). The conventional varieties showed some variation in stand (% in-row cover) 15 days after planting, while performance of Roundup Ready® varieties was statistically similar.

Uniformity of plant development for conventional and Roundup Ready® varieties was estimated by determining plants with first, second or third trifoliolate leaves 21 days after planting (Table 2). This information is helpful for fall application of herbicides during establishment, as most herbicide applications are based on number of trifoliolate leaves on the developing alfalfa plants. Application of these herbicides and their proper timing is critical to overall stand vigor by eliminating weed competition.

Yields during 2012 for each of the four cuttings and season total yields for conventional varieties are provided in Table 3. Total yield across the four cuttings ranged from 7.6 to 9.0 tons/acre, with no significant difference between the top 5 yielding varieties. Individual cutting and season total yields for Roundup Ready® varieties are provided in Table 4. Season total yields for Roundup Ready® varieties ranged from 8.0 to 8.5 tons/acre, with varieties statistically similar.

First cutting conventional variety quality analysis determined using RFV ranged from 108 to 146, while Roundup Ready® varieties ranged from 131 to 152 (Table 5). Based on the RFV grading system provided in Addendum 1, conventional variety performed in the Fair to Good range, while Roundup Ready® varieties were in the Good to Premium categories. Quality data cannot be statistically analyzed due to subsamples from the four replications being combined into one sample to reduce cost.

Second cutting quality for conventional varieties ranged from 127 to 145, placing all varieties within the Good rating. Roundup Ready® varieties ranged from 141 to 157 (Table 7) with varietal performance across Good and Premium ratings.

Third cutting results for conventional varieties ranged from 147 to 163, across the Good and Premium ratings. Roundup Ready® varieties were between 154 and 170 (Table 8), placing all varieties within the Premium rating.

Relative feed value continued to increase through the fourth cutting across both conventional and Roundup Ready® varieties, with conventional varieties ranging between 175 and 191, and Roundup Ready® ranging between 180 and 203 (Table 9). Conventional varieties ranged from Premium to Supreme, while all but one Roundup Ready® variety were in the Supreme rating.

Overall, total yields for Roundup Ready® varieties were similar to conventional varieties, but within a tighter range (8.0 to 8.5 tons/acre) than the conventional (7.6 to 9.0 tons/acre). Relative feed value trended consistently higher across Roundup Ready® varieties compared to conventional varieties; however 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 will provide 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 for conventional and Roundup Ready[®] alfalfa varieties in this evaluation related to fall dormancy, winter survival index, pest resistance, and other agronomic ratings is provided in Addendums 2 and 3.

Table 1. Percent stand based on in-row green 15 days after planting August 31, 2011, COARC, Madras, OR.

Conventional		Roundup Ready [®]	
Variety	Stand (% In-Row Green)	Variety	Stand (% In-Row Green)
6422Q	89 cd ¹	R470K215	89
WL 363HQ	93 cd	433TRR	93
WL 354HQ	95 ab	FGI R58HG236	95
445NT	92 bcd	FGI R48W224	92
FGI 48W202	86 d	DKA 43-22R*	86
Mountaineer 2.0	89 cd	Pioneer 54R014*	89
Pioneer 54V09*	100 a	4R200*	100
Pioneer 54Q25*	100 a		
Vernal	90 bcd		
Plumas*	100 a		NS

*Seed provided with coating

¹Mean separation with Least Significant Difference (LSD) at P≤0.05

Table 2. Percentage of plants with 1, 2 or 3 trifoliate leaves 21 days after planting August 31, 2011, COARC, Madras, OR.

Conventional Varieties				Roundup Ready [®] Varieties			
Variety	1 st Trifol.	2 nd Trifol.	3 rd Trifol.	Variety	1 st Trifol.	2 nd Trifol.	3 rd Trifol.
	(%)	(%)	(%)		(%)	(%)	(%)
6422Q	1	41	58	R470K215	0	39	61
WL 363HQ	3	61	36	433TRR	0	36	64
WL 354HQ	0	60	40	FGI R58HG236	4	61	35
Ameristand 445NT	7	79	14	FGI R48W224	3	41	56
FGI 48W202	10	49	41	DKA 43-22RR	1	50	49
Mountaineer 2.0	1	58	41	Pioneer 54R014	2	65	33
Pioneer 54V09	0	27	73	4R200	2	45	53
Pioneer 54Q25	1	35	64				
Vernal	5	54	41				
Plumas	0	35	65				

Table 3. Conventional alfalfa variety evaluation yields for each of four cuttings and season total, 2012, COARC, Madras, OR.

Variety	1st Cutting Yield	2nd Cutting Yield	3rd Cutting Yield	4th Cutting Yield	Total Yield
----- (ton/acre) -----					
WL 354HQ	3.2 ab	1.9	2.0 a	1.9	9.0 a
Pioneer 54V09	3.4 a	1.8	1.8 b	1.9	8.9 ab
Ameristand 445NT	3.1 ab	1.8	1.8 b	2.1	8.8 ab
Mountaineer 2.0	3.3 a	1.7	1.7 b	2.0	8.8 ab
WL 363HQ	3.0 ab	1.8	1.8 b	2.0	8.6 abc
6422Q	2.8 b	1.8	1.8 b	1.9	8.4 bcd
Plumas	3.0 ab	1.8	1.7 bc	2.0	8.4 bcd
Pioneer 54Q25	3.0 ab	1.7	1.7 bc	1.7	8.1 cde
FGI 48W202	2.8 b	1.8	1.5 cd	1.8	7.9 de
Vernal	3.3 a	1.5	1.5 cd	1.4	7.6 e
<i>Average</i>	<i>3.1</i>	<i>1.8</i>	<i>1.7</i>	<i>1.7</i>	<i>8.5</i>
<i>LSD</i>	<i>NS</i>	<i>NS</i>	<i>0.2</i>	<i>NS</i>	<i>0.6</i>

Table 4. Roundup Ready® alfalfa variety evaluation yields for each of four cuttings and season total, 2012, COARC, Madras, OR.

Variety	1st Cutting Yield	2nd Cutting Yield	3rd Cutting Yield	4th Cutting Yield	Total Yield
----- (ton/acre) -----					
R470K215	3.2	1.9	1.7	1.7	8.5
FGI R48W224	3.1	1.8	1.7	2.0	8.5
433TRR	3.4	1.8	1.5	1.8	8.4
4R200	3.2	1.8	1.7	1.7	8.4
Pioneer 54R014	3.1	1.8	1.7	1.7	8.4
DKA 43-22RR	3.2	1.8	1.6	1.7	8.3
FGI R58HG236	2.8	1.8	1.6	1.9	8.0
<i>Average</i>	<i>3.1</i>	<i>1.8</i>	<i>1.7</i>	<i>1.8</i>	<i>8.4</i>
<i>LSD</i>	<i>NS</i>	<i>NS</i>	<i>NS</i>	<i>NS</i>	<i>NS</i>

Table 5. First cutting alfalfa variety quality evaluation June 11, 2012, COARC, Madras, OR.

Variety	Crude Protein	ADF	NDF	TDN	RFV	Blooming plants/plot
<i>Conventional</i>						
----- (% dry matter) -----						
Pioneer 54V09	19.3	35.5	46.5	53	123	2.3
Mountaineer 2.0	19.7	34.4	44.5	54	130	8.0
Vernal	20.0	40.0	49.5	53	108	4.5
WL 354HQ	20.6	33.0	42.7	54	138	2.8
Ameristand 445NT	20.4	32.5	41.8	54	141	7.3
WL 363HQ	21.3	32.3	40.9	53	145	3.3
Pioneer 54Q25	21.1	33.9	43.1	55	135	3.0
Plumas	20.7	33.1	43.0	54	137	3.5
6422Q	21.8	31.8	41.0	55	146	4.8
FGI 48W202	21.4	32.1	40.7	55	146	9.0
<i>Roundup Ready®</i>						
433TRR	20.0	33.3	43.3	55	135	3.3
R470K215	18.1	35.2	43.7	54	131	4.0
DKA 43-22RR	20.1	34.5	43.7	56	132	4.5
4R200	19.3	32.9	42.9	55	137	4.3
FGI R48W224	20.0	32.2	39.2	56	152	2.8
Pioneer 54R014	19.7	33.6	43.3	55	135	4.0
FGI R58HG236	18.0	32.1	39.6	55	150	5.5

Table 6. Second cutting alfalfa variety quality evaluation July 11, 2012, COARC, Madras, OR.

Variety	Crude Protein	ADF	NDF	TDN	RFV
<i>Conventional</i>					
----- (% dry matter) -----					
6422Q	23.8	35.0	39.6	56	145
WL363HQ	24.0	35.8	40.1	57	142
Pioneer 54V09	24.3	34.7	41.0	56	140
Plumas	25.7	34.3	41.9	58	138
WL354HQ	24.8	35.3	41.8	59	137
445NT	24.3	36.7	41.6	58	135
Vernal	23.9	36.9	41.6	56	134
FGI 48W202	23.6	36.8	42.6	58	132
Mountaineer 2.0	24.9	36.1	44.3	59	128
Pioneer 54Q25	24.1	36.1	44.5	58	127
<i>Roundup Ready®</i>					
4R200	24.0	32.1	37.8	56	157
FGI R48W224	24.1	33.5	38.2	57	153
433TRR	24.7	32.4	39.1	55	152
FGI R58HG236	23.8	32.9	38.7	54	152
DKA 43-22RR	24.4	33.9	38.6	56	151
Pioneer 54R014	23.9	34.0	39.8	56	146
R470K215	23.3	36.3	39.9	56	141

Table 7. Third cutting alfalfa variety quality evaluation August 15, 2012, COARC, Madras, OR.

Variety	Crude Protein	ADF	NDF	TDN	RFV
<i>Conventional</i>					
----- (% dry matter) -----					
FGI 48W202	23.1	29.9	37.4	57	163
Vernal	22.9	30.6	37.9	59	160
Pioneer 54Q25	23.6	30.8	38.0	57	159
Plumas	23.2	31.1	38.4	58	157
WL354HQ	22.2	30.6	39.1	57	155
WL363HQ	22.4	32.0	38.5	58	155
Pioneer 54V09	23.0	32.0	39.3	57	151
6422Q	22.7	32.7	39.5	58	150
445NT	22.0	33.3	39.6	57	148
Mountaineer 2.0	22.6	33.3	39.7	58	147
<i>Roundup Ready</i> [®]					
FGI R48W224	23.9	28.7	36.4	57	170
433TRR	24.0	29.3	36.3	58	169
Pioneer 54R014	23.3	29.0	36.6	58	168
FGI R58HG236	22.8	30.9	37.5	58	161
DKA 43-22RR	23.3	30.4	38.1	58	159
R470K215	22.2	32.4	38.5	57	154
4R200	22.2	32.0	38.8	58	154

Table 8. Fourth cutting alfalfa variety quality evaluation October 2, 2012, COARC, Madras, OR.

Variety	Crude Protein	ADF	NDF	TDN	RFV
<i>Conventional</i>					
----- (% dry matter) -----					
Pioneer 54V09	24.7	27.5	32.8	62	191
Vernal	25.5	27.0	33.2	62	190
FGI 48W202	25.2	27.3	33.3	61	189
Pioneer 54Q25	25.2	27.7	33.5	62	187
6422Q	24.5	29.2	33.5	61	184
WL363HQ	24.5	29.1	33.7	62	183
WL354HQ	24.0	28.6	34.2	61	181
Plumas	24.3	28.3	34.4	61	181
Mountaineer 2.0	23.9	29.3	35.0	62	176
445NT	24.0	28.9	35.3	62	175
<i>Roundup Ready</i> [®]					
FGI R48W224	26.4	26.9	31.2	63	203
DKA 43-22RR	24.4	27.7	32.7	62	192
Pioneer 54R014	25.3	27.2	33.1	61	190
433TRR	25.1	27.1	33.5	62	188
FGI R58HG236	24.8	28.1	34.1	61	183
4R200	24.2	28.6	34.5	61	180
R470K215	23.7	29.2	34.6	60	178

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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.

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	Tech
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

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

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	Anth ¹	PRR	SAA	PA	BAA	SN	APH ¹	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 Dormancy¹, WSI = Winter Survival Index², BW = Bacterial Wilt, VW = Verticillium Wilt, FW = Fusarium Wilt, Anth¹ = Anthracnose Race 1, PRR = Phytophthora 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-Foliolate Expression
 CGT = Continuous Grazing Tolerance, SE = Standability Expression, ST = Salt Tolerance (G – germination, F – forage), Tech = Technology (C – conventional, H – Hybrid, R – Roundup Ready)

¹Fall Dormancy Rating: 1 = most dormant to 11 = least dormant

²Winter Survival Index: 1 = Superior, 2 = Very Good, 3 = Good, 4 = Moderate, 5 = Low, and 6 = Non-Winter Hardy

³Resistance Ratings: S = susceptible, LR = low resistance, MR = moderate resistance, R = resistance, HR = high resistance , MR = moderate resistance, R = resistance, HR = high resistance