

## **Evaluation of Conventional and Roundup Ready Alfalfa Varieties in Central Oregon, 2014**

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### **Abstract**

An alfalfa variety trial was established in August, 2011 at the Central Oregon Agricultural Research Center, Madras, Oregon. 2014 was the third production year of a four year project to generate yield and quality 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. During 2014 total yield for conventional varieties ranged from 8.5 to 11.8 tons/acre and total yield for Roundup Ready® varieties ranged from 9.7 to 11.7 tons/acre. Average relative feed value (RFV) ratings provide the best indication of overall quality, with all varieties rated Good (126-150) or better for each of the four cuttings. As expected, fourth cutting RFV ratings were significantly higher than the three previous cuttings. Comparison of average quality scores across conventional and Roundup Ready® varieties show a similar performance with RFV ratings ranging from 144 to 160 for conventional varieties and 145 to 155 for Roundup Ready®.

### **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 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 yield and quality data for pre-release and recently released alfalfa varieties under central Oregon and 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.

During the 2014 season the trials were irrigated using solid-set sprinklers (9/64-inch Rainbird nozzles) on a 30-ft by 40-ft spacing. Based on a soil sample during the fall of 2013, fertilizer was applied to the plot area on March 24, 2014 at the rate of 100 lbs of 11-52 for N and P and 150 lbs potash for K, 300 lbs gypsum, 0.5 lb boron and 0.5 lb zinc. The conventional trial was sprayed on February 26 with Velpar® Alfamax™ at 1.75 lbs/ac, Firestorm® at 1.25 pts/ac, Hellfire® at 10 oz/ac, and included a non-ionic surfactant at 2 pts/100gal. The Roundup Ready® trial was sprayed on April 7 with Roundup PowerMAX® at 44oz/acre plus Quest® at 2 pts/100gal 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-sample weight change due to drying. Dried samples were ground using a Wiley mill, and sub-samples from all four replications combined for analysis by Dairy One Forage Testing Laboratory 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, baled and hay removed to expedite irrigation and regrowth. Harvest dates were June 3, July 8, August 12, and October 10, 2014. These dates are similar to harvest timings during the two previous seasons.

## Results and Discussion

*Yield Data:* Third year total yields for 2014 across four cuttings for conventional varieties ranged from 10.7 to 11.8 tons/acre, with all paid entries outperforming the industry standards, Plumas at 10.6 tons/acre and Vernal at 8.5 tons/acre (Table 1). Season total yields for Roundup Ready® varieties ranged from 9.7 to 11.7 tons/acre (Table 2). As expected, average yields across all varieties were highest for the first cutting and decreased with each subsequent cutting through the growing season.

*Quality Data:* RFV for all varieties was rated Good (126-150) or better for each of the four cuttings. Varieties were mostly rated Good with some Premium (151-180) for the first through third cuttings, while the fourth cutting was split between varieties rated Premium and Supreme (181+).

Average quality data across the four cuttings provides an overall comparison of varietal performance throughout the growing season (Table 3). Varietal average RFV ratings across the four-cut season ranged from 144 to 160. However, these high average RFV scores are influenced by strong ratings from the fourth cutting that pushed average scores significantly higher than ratings from the first three cuttings. These average quality ratings are most useful as a general comparison of varietal performance throughout the third year of production, rather than focusing on individual average rating for a specific variety.

First-cut conventional variety ratings for RFV ranged from 140 to 155, while Roundup Ready® varieties ranged from 141 to 148 (Table 4). Second-cut quality remained largely within the Good rating, with conventional varieties ranging from 135 to 162, while Roundup Ready® varieties ranging from 127 to 150 (Table 5). Third-cut RFV results for conventional varieties ranged from 131 to 156 and Roundup Ready® varieties were between 128 and 141 (Table 6). As customary, fourth-cut RFV ratings were significantly higher than the three previous cuttings. Conventional varieties ranged from 169 to 189 and Roundup Ready® varieties were rated 174 to 191. At fourth-cut, four varieties from both groupings received a Supreme quality rating.

*Conventional vs. Roundup Ready® Varieties:* Comparison of average yield data and quality scores across conventional and Roundup Ready® varieties show a similar performance for yield and all five quality characteristics, including RFV. Performance of specific varieties within these two groups varies within a similar range, with all conventional entries having greater yields than the two industry standards, Vernal and Plumas.

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, 2014.

Variety	1st Cutting Yield	2nd Cutting Yield	3rd Cutting Yield	4th Cutting Yield	Total Yield
----- (tons/acre) -----					
WL 354 HQ	4.0	3.2	2.7	2.0	11.8
6422Q	3.9	3.4	2.6	1.7	11.6
Mountaineer 2.0	4.1	2.7	2.5	2.0	11.3
Pioneer 54V09	4.2	2.8	2.5	1.9	11.3
WL 363 HQ	3.8	3.0	2.4	1.9	11.1
445NT	3.5	2.9	2.5	2.1	11.0
Pioneer 54Q25	4.1	2.6	2.5	1.8	10.9
Integra 8420 (FGI 48W202)	3.5	2.9	2.5	1.8	10.7
Plumas	3.7	2.6	2.3	2.0	10.6
Vernal	3.2	2.0	1.9	1.4	8.5
<i>Average</i>	3.8	2.6	2.4	1.8	10.6

**Table 2.** Roundup Ready® alfalfa variety yields for each of four cuttings and the season total at COARC, Madras, OR, 2014.

Variety	1st Cutting Yield	2nd Cutting Yield	3rd Cutting Yield	4th Cutting Yield	Total Yield
----- (tons/acre) -----					
Ameristand 415NT-RR (R470K215)	3.7	3.3	2.6	2.0	11.7
DKA 43-22 RR	3.7	3.1	2.4	1.8	11.0
Pioneer 54R01	3.5	2.8	2.3	2.0	10.6
4R200	3.3	2.9	2.3	2.0	10.4
RR Nemastar (FGI R48W224)	3.2	2.6	2.3	1.7	9.9
Integra 8444 RR (FGI R58HG236)	3.2	2.8	2.2	1.6	9.7
433TRR	3.3	2.5	2.1	1.8	9.7
<i>Average</i>	3.4	2.8	2.3	1.8	10.3

**Table 3.** Average alfalfa variety quality across the 2014 season, COARC, Madras, OR.

Variety	Crude Protein	ADF	NDF	TDN	RFV
<i>Conventional</i>					
----- (% dry matter) -----					
445NT	22.4	31.0	37.6	63	160
WL 363HQ	22.3	32.2	38.4	62	156
6422Q	22.0	31.8	39.1	62	154
WL 354HQ	21.6	32.6	39.1	62	153
Plumas	21.8	33.0	39.3	62	151
Integra 8420 (FGI 48W202)	21.6	33.0	39.7	61	150
Vernal	21.6	32.8	39.7	62	149
Pioneer 54V09	21.8	33.8	39.9	61	148
Pioneer 54Q25	21.6	33.7	40.5	61	145
Mountaineer 2.0	21.6	33.8	40.7	60	144
<i>Average</i>	<i>21.8</i>	<i>32.8</i>	<i>39.4</i>	<i>61</i>	<i>151</i>
<i>Roundup Ready®</i>					
433TRR	22.7	33.2	38.5	62	155
4R200	22.9	33.1	38.3	61	154
Integra 8444 RR (FGI R58HG236)	21.5	32.7	39.1	61	153
Pioneer 54R014	22.4	32.5	38.8	62	152
RR Nemastar (FGI R48W224)	21.1	33.0	39.2	62	151
DKA 43-22RR	21.6	33.6	39.4	60	150
Ameristand 415NT-RR (R470K215)	21.4	33.6	40.6	61	145
<i>Average</i>	<i>21.9</i>	<i>33.1</i>	<i>39.1</i>	<i>61</i>	<i>151</i>

**Table 4.** First cutting alfalfa variety quality evaluation June 3, 2014 at COARC, Madras, OR.

Variety	Crude Protein	ADF	NDF	TDN	RFV
<i>Conventional</i>	----- (% dry matter) -----				
Integra 8420 (FGI 48W202)	19.5	32.8	38.1	60	155
445NT	20.1	32.9	38.6	60	152
Plumas	19.6	34.9	40.6	59	142
6422Q	18.8	34.3	40.9	58	141
WL 363HQ	19.5	35.4	41.1	58	139
Pioneer 54V09	19.7	35.5	41.1	58	138
WL 354HQ	18.7	35.0	41.7	57	138
Vernal	19.2	36.1	41.8	58	135
Pioneer 54Q25	19.4	36.2	42.3	58	133
Mountaineer 2.0	18.5	36.1	43.2	56	131
<i>Average</i>	<i>19.3</i>	<i>34.9</i>	<i>40.9</i>	<i>58</i>	<i>140</i>
<i>Roundup Ready®</i>					
DKA 43-22RR	19.0	34.0	39.3	58	148
Integra 8444 RR (FGI R58HG236)	19.1	34.6	39.1	57	148
Pioneer 54R014	19.1	33.9	39.6	58	147
433TRR	19.9	34.3	39.4	58	147
4R200	19.5	34.1	39.4	57	147
RR Nemastar (FGI R48W224)	18.3	34.1	39.9	57	145
Ameristand 415NT-RR (R470K215)	19.1	34.8	40.8	56	141
<i>Average</i>	<i>19.1</i>	<i>34.3</i>	<i>39.6</i>	<i>57</i>	<i>145</i>

**Table 5.** Second cutting alfalfa variety quality evaluation July 8, 2014 at COARC, Madras, OR.

Variety	Crude Protein	ADF	NDF	TDN	RFV
<i>Conventional</i>	----- (% dry matter) -----				
445NT	23.4	29.0	38.1	66	162
Plumas	23.7	31.8	39.0	65	153
WL 363HQ	22.9	32.9	40.8	64	144
Pioneer 54V09	23.9	32.8	41.2	64	143
Pioneer 54Q25	23.7	33.1	41.3	64	142
Vernal	23.2	32.9	41.6	65	141
6422Q	23.5	32.7	42.2	62	140
Mountaineer 2.0	23.1	33.1	42.7	62	137
Integra 8420	22.4	33.4	42.9	63	136
(FGI 48W202)					
WL 354HQ	22.4	33.9	43.2	64	135
<i>Average</i>	23.2	32.6	41.3	64	143
<i>Roundup Ready®</i>					
4R200	25.0	31.9	39.6	65	150
433TRR	24.1	33.5	40.2	64	145
RR Nemastar	22.3	33.2	40.6	65	144
(FGI R48W224)					
Pioneer 54R014	24.1	33.0	41.0	64	143
Integra 8444 RR	21.8	33.6	41.8	63	140
(FGI R58HG236)					
DKA 43-22RR	23.4	33.1	42.2	63	139
Ameristand 415NT-RR	22.7	34.9	45.3	63	127
(R470K215)					
<i>Average</i>	23.3	33.3	41.5	64	141

**Table 6.** Third cutting alfalfa variety quality evaluation August 12, 2014, COARC, Madras, OR.

Variety	Crude Protein	ADF	NDF	TDN	RFV
----- (% dry matter) -----					
<i>Conventional</i>					
WL 363HQ	22.4	32.0	38.1	62	156
WL 354HQ	22.0	32.4	38.5	63	154
445NT	22.6	32.7	38.8	60	152
Vernal	22.0	32.8	39.2	60	150
6422Q	22.4	32.7	40.3	62	146
Mountaineer 2.0	22.1	36.0	40.8	58	139
Plumas	21.3	36.5	41.7	57	135
Pioneer 54Q25	20.7	37.3	42.6	57	131
Integra 8420	20.5	36.8	42.7	56	131
(FGI 48W202)					
Pioneer 54V09	20.5	39.2	43.4	54	125
<i>Average</i>	<i>21.7</i>	<i>34.8</i>	<i>40.6</i>	<i>59</i>	<i>142</i>
<i>Roundup Ready®</i>					
RR Nemastar	21.4	34.5	41.1	60	141
(FGI R48W224)					
Pioneer 54R014	21.8	34.7	40.8	60	141
Ameristand 415NT-RR	20.6	34.8	41.3	59	139
(R470K215)					
Integra 8444 RR	20.7	35.0	41.4	59	138
(FGI R58HG236)					
4R200	22.8	37.8	40.5	56	136
433TRR	22.2	36.9	41.6	59	135
DKA 43-22RR	19.7	38.8	42.7	54	128
<i>Average</i>	<i>21.3</i>	<i>36.1</i>	<i>41.3</i>	<i>58</i>	<i>137</i>

**Table 7.** Fourth cutting alfalfa variety quality evaluation October 10, 2014, COARC, Madras, OR.

Variety	Crude Protein	ADF	NDF	TDN	RFV
<i>Conventional</i>					
----- (% dry matter) -----					
6422Q	23.2	27.5	33.1	65	189
Pioneer 54V09	23.0	27.8	33.7	66	186
WL 363HQ	24.4	28.6	33.4	64	186
WL 354HQ	23.1	29.2	33.0	64	186
Integra 8420	23.8	28.8	35.1	64	176
(FGI 48W202)					
Pioneer 54Q25	22.7	28.0	35.7	66	175
445NT	23.5	29.5	35.0	64	175
Plumas	22.6	28.7	35.8	65	173
Vernal	22.1	29.2	36.3	65	170
Mountaineer 2.0	22.8	30.0	36.0	63	169
<i>Average</i>	<i>23.1</i>	<i>28.7</i>	<i>34.7</i>	<i>65</i>	<i>179</i>
<i>Roundup Ready®</i>					
433TRR	24.5	28.0	32.6	66	191
DKA 43-22RR	24.4	28.4	33.4	66	186
Integra 8444 RR	24.3	27.5	34.1	65	184
(FGI R58HG236)					
Pioneer 54R014	24.5	28.5	33.7	65	184
4R200					
Ameristand 415NT-RR	23.3	29.9	35.1	64	174
(R470K215)					
RR Nemastar	22.5	30.0	35.1	64	174
(FGI R48W224)					
<i>Average</i>	<i>24.0</i>	<i>28.7</i>	<i>34.0</i>	<i>65</i>	<i>182</i>

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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

Variety	FD <sup>1</sup>	WSI <sup>2</sup>	BW <sup>3</sup>	VW	FW	Anth1	PRR	SAA	PA	SN	APH 1	APH 2	NRKN	MFE	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
445NT	4		HR	R	HR	HR	HR	HR	R	HR	R		HR	M	C
Integra 8420															
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

varieties.

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

Variety	FD <sup>1</sup>	WSI <sup>2</sup>	BW <sup>3</sup>	VW	FW	Anth 1	PRR	SAA	PA	BAA	SN	APH 1	NRKN	MF E	Tech
Ameristand 415NT-RR															
433TRR	3	2.5	HR	R	R	HR	HR		R			HR			R
Integra 8444 RR															R
RR Nemastar															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

FD = Fall Dormancy<sup>1</sup>, WSI = Winter Survival Index<sup>2</sup>, 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 = Aphanomyces Race 1, APH2 = Aphanomyces 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 – Hybrid, R – Roundup Ready)

<sup>1</sup>Fall Dormancy Rating: 1 = most dormant to 11 = least dormant

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

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