

Summary Report of Conventional and Roundup Ready Alfalfa Variety Yield and Quality over Four Production Years in Central Oregon, 2011-2015

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Abstract

An alfalfa variety trial was established in August, 2011 at the Central Oregon Agricultural Research Center in Madras, Oregon. The trial includes ten conventional varieties and seven Roundup Ready varieties. Yield and quality data were collected under a 4-cut management system over four production seasons from 2012 to 2015. Results indicate average annual hay yields of 8.5 to 11 tons/acre and average Relative Feed Value (RFV) ranging from 145 to 160, largely in the Premium quality rating. Initial stand establishment and stand longevity were 90 percent or better across all varieties.

Introduction

Alfalfa is an important crop for central Oregon, with hay produced in the three counties used for feed on local ranches and marketed to livestock producers and dairies 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 are important components 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 signals 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 research project was 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, were included with the conventional varieties for comparison. This timely information provides alfalfa seed companies, field consultants, hay growers and the agricultural community-at-large with data important to decision-making in central Oregon and eastern Oregon.

Materials & Methods

2011-2012 Season:

This alfalfa variety evaluation was established at Central Oregon Agricultural Research Center (COARC) near Madras, Oregon. Based on soil samples prior to planting, lime was applied at 1 ton/acre on August 23 followed by tilling. Fertilizer was applied at 150 lbs/acre of Mesz (or hydroyl) 12-40-0-10 with 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, although some varieties were coated by the provider.

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 with a non-ionic surfactant at 4 pts/100gal on October 12, 2011 per label recommendation.

2013 Season:

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/100 gal on February 18, 2013. The Roundup Ready[®] trial was sprayed with Roundup PowerMAX[®] at 44oz/acre plus Quest[®] at 2 pts/100 gal on April 3, 2013 per label recommendation.

2014 Season:

The conventional trial was sprayed on February 26 and the Roundup Ready[®] trial was sprayed on April 7 with the same products used in 2013. 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 per acre.

2015 Season:

In this final year both the conventional and Roundup Ready[®] portions of the trial was sprayed on February 11 with the conventional herbicide treatment used previous years across both the conventional and Roundup Ready[®] portions of the trial to clean up the entire plot area in the final year of production.

Irrigation:

The plot area is irrigated using solid-set sprinklers (9/64-inch Rainbird nozzles) on a 30-ft by 40-ft spacing. Configuration of the sprinklers included every other line being off-set to provide a more uniform application. The off-sets were rotated following each cutting, with the initial half-length of pipe on every other line moving to the adjacent line that had been a full-length pipe.

Harvest:

Plots were harvested four times throughout the growing season during early June, early to mid-July, early to mid-August and early to mid-October. Seventeen foot plots, after cutting 3 ft

alleyways, were harvested using a small-plot, forage harvester. After each of the four harvests, the trial area was swathed, dried for 4 days, baled and hay removed to simulate grower practice.

Sample Processing:

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.

Initial Stand Establishment and Stand Longevity:

Percent stand establishment was visually rated as percent green in the rows on September 15, 2011, 15 days after planting and 10 days after emergence. After the final harvest on October 19, 2015 the number of plants present compared to a full stand with no skips was visually rated as percent stand.

Results and Discussion

Yield Data: Yearly total yields averaged across varieties increased each of the four years for both conventional and Roundup Ready® varieties (Table 1). Yield increases in the third and fourth years are likely the result of a warmer than normal third production year followed by an unusually warm fourth production year. Across seasons, first cutting yields were highest followed by the second cutting, with third and fourth cutting providing similar, lower yields. Specific varietal performances averaged across the four years range from 8.5 to 11.0 ton/acre for conventional varieties and 9.7 to 10.6 tons/acre for Roundup Ready® varieties (Table 2).

Quality Data: Average Relative Feed Value (RFV), an indicator of feed quality, averaged across varieties for each cutting across the four years saw increasing quality over the growing season for both conventional and Roundup Ready® varieties (Table 3). Varietal average RFV ratings by year across the four-cut season ranged from 145 to 155 for conventional varieties and 151 to 160 for Roundup Ready® varieties. These ratings are largely within the Premium quality rating (Addendum 1).

Stand Establishment and Longevity: Initial stand establishment ranged from 86% to 100% for both conventional and Roundup Ready® varieties. Stand counts at the end of the trial ranged from 84% to 95% for conventional varieties and 89% to 95% for Roundup Ready® varieties.

Summary Information: 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. Average yields for conventional and Roundup Ready® varieties by cutting across four years of hay production, Madras, OR, 2012-2015.

Variety	1st Cutting Yield	2nd Cutting Yield	3rd Cutting Yield	4th Cutting Yield	Yearly Total Yield
----- (tons/acre) -----					
<i>Conventional</i>					
2012	3.1	1.8	1.7	1.7	8.5
2013	3.2	2.0	2.0	1.4	8.6
2014	3.8	2.6	2.4	1.8	10.6
2015	4.1	3.2	2.3	3.2	12.8
<i>Average</i>	3.6	2.4	2.1	2.0	10.1
<i>Roundup Ready®</i>					
2012	3.1	1.8	1.7	1.8	8.4
2013	3.5	2.5	1.8	1.5	9.4
2014	3.4	2.8	2.3	1.8	10.3
2015	3.9	3.2	2.3	3.2	12.6
<i>Average</i>	3.5	2.6	2.0	2.1	10.2

Table 2. Annual total yield by alfalfa variety across four years of hay production, Madras, OR, 2012-2015.

Variety	2012	2013	2014	2015	4 Year Aver.
----- (ton/acre) -----					
<i>Conventional</i>					
WL 354HQ	9.0	8.8	11.8	14.4	11.0
6422Q	8.4	8.8	11.6	13.1	10.5
Pioneer 54V09	8.9	9.3	11.3	12.3	10.5
Mountaineer 2.0	8.8	8.7	11.3	12.6	10.4
Pioneer 54Q25	8.1	8.7	10.9	14.0	10.4
445NT	8.8	8.8	11.0	12.5	10.3
WL 363HQ	8.6	8.5	11.1	12.6	10.2
Plumas	8.4	8.4	10.6	12.8	10.1
Integra 8420	7.9	8.3	10.7	12.7	9.9
Vernal	7.6	7.2	8.5	10.5	8.5
<i>Average</i>	8.5	8.6	10.9	12.8	10.2
<i>Roundup Ready®</i>					
Ameristand 415NT-RR	8.5	9.3	11.7	13.0	10.6
DKA 43-22RR	8.3	9.3	11.0	13.4	10.5
Pioneer 54R014	8.4	9.5	10.6	12.4	10.2
4R200	8.4	9.1	10.4	12.6	10.1
RR Nemastar	8.5	9.6	9.9	12.4	10.1
433TRR	8.4	9.4	9.7	12.2	9.9
Integra 8444 RR	8.0	9.2	9.7	11.9	9.7
<i>Average</i>	8.4	9.3	10.4	12.6	10.2

Table 3. Average Relative Feed Value (RFV) ratings for conventional and Roundup Ready® varieties by cutting across four years of hay production, Madras, OR, 2012-2015.

Variety	1st Cutting Yield	2nd Cutting Yield	3rd Cutting Yield	4th Cutting Yield	Yearly Aver.
----- (% dry matter) -----					
<i>Conventional</i>					
2012	135	137	155	184	153
2013	138	140	149	173	150
2014	140	143	142	179	151
2015	146	139	156	174	154
<i>Average</i>	<i>140</i>	<i>140</i>	<i>151</i>	<i>178</i>	<i>152</i>
<i>Roundup Ready®</i>					
2012	139	150	162	188	160
2013	135	143	153	180	153
2014	145	141	137	182	151
2015	159	144	157	165	156
<i>Average</i>	<i>145</i>	<i>145</i>	<i>152</i>	<i>179</i>	<i>155</i>

Table 4. Annual average Relative Feed Value (RFV) ratings by alfalfa variety across four years of hay production, Madras, OR, 2012-2015.

Variety	2012	2013	2014	2015	4 Year Aver.
----- (% dry matter) -----					
<i>Conventional</i>					
WL 354HQ	153	151	153	161	155
6422Q	156	148	154	157	154
Integra 8420	158	149	150	158	154
Plumas	155	154	151	152	153
WL 363HQ	156	149	156	152	153
Pioneer 54Q25	152	152	145	157	152
445NT	150	148	160	147	151
Vernal	148	155	149	151	151
Pioneer 54V09	151	145	148	156	150
Mountaineer 2.0	145	149	144	140	145
<i>Average</i>	<i>152</i>	<i>150</i>	<i>151</i>	<i>153</i>	<i>152</i>
<i>Roundup Ready®</i>					
433TRR	165	158	155	162	160
Integra 8444 RR	163	156	153	158	158
Pioneer 54R014	160	151	152	160	156
4R200	159	151	154	156	155
RR Nemastar	164	154	151	148	154
DKA 43-22RR	156	150	150	154	153
Ameristand 415NT-RR	151	152	145	154	151
<i>Average</i>	<i>160</i>	<i>153</i>	<i>151</i>	<i>156</i>	<i>155</i>

Table 5. Initial stand establishment on September 15, 2011 and stand longevity ratings on October 19, 2015 based on a visual evaluation of percent stand.

Variety	Stand Count Following Planting	Stand Count at Final Harvest	Change in Stand Count
<i>Conventional</i>			
	----- (%) -----		
Pioneer 54V09	100	95	-5
Plumas	100	94	-6
Pioneer 54Q25	100	93	-7
WL 354HQ	95	91	-4
Mountaineer 2.0	89	90	+1
Integra 8420	86	89	+3
WL 363HQ	93	89	-4
6422Q	89	88	-1
Vernal	90	86	-4
445NT	92	84	-8
<i>Average</i>	93	90	-3
<i>Roundup Ready®</i>			
DKA 43-22RR	86	95	+9
Pioneer 54R014	89	94	+5
4R200	100	93	-7
Integra 8444 RR	95	91	-4
RR Nemastar	92	91	-1
433TRR	93	89	-4
Ameristand 415NT-RR	89	89	0
<i>Average</i>	92	92	0

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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	W SI ²	B W ₃	V W	F W	Anth1	PR R	SA A	PA	S N	AP H1	AP H2	NR KN	MF E	Tech
6422Q	4	1	H R	H R	HR	HR	HR		R	R	HR			H	C
WL 363HQ	5	1	H R	H R	HR	HR	HR		HR	H R	HR		HR	H	C
WL 354HQ	4	1	H R	H R	HR	HR	HR	HR	HR	R	HR	HR		H	C
445NT	4		H R	R	HR	HR	HR	HR	R	H R	R		HR	M	C
Integra 8420															
Mountaineer 2.0	5	2	H R	R	HR	HR	HR	R	HR	H R	R		R	H	C
Pioneer 54V09	4		H R	H R	R	HR	HR	R	HR	H R	R	M R	HR		C
Pioneer 54Q25	4		H R	H R	HR	HR	HR	R	R	H R	R		HR		C
Vernal	2		R		M R								MR		C
Plumas	4	2	H R	R	HR	HR	HR	R	R	H R	HR		R	H	C

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

Variety	F D ¹	W SI ²	B W ₃	V W	F W	Anth1	P R R	S A A	P A A	B A A	S N	AP H1	NR KN	M FE	Tech
Ameristand 415NT-RR															R
433TRR	3	2.5	H R	R	R	HR	H R		R			HR			R
Integra 8444 RR															R
RR Nemastar															R
DKA 43-22RR	4	2	H R	H R	H R	HR	H R				H R	HR	R	H	R
Pioneer 54R01	4	2	H R	H R	H R	HR	H R	R	R		R	HR	R	H	R
4R200	4	2	H R	H R	H R	HR	H R	M R	R	M R	H R	HR	R	H	R

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 = Aphanomyces Race 1, APH2 = Aphanomyces 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