Fall Dormancy Effect on 3-Cut First Year Alfalfa Quality and Yield

Mylen Bohle, Rhonda Bafus, Jim Smith, and Rich Roseburg

Abstract

Alfalfa is an important crop for central Oregon. Six varieties, representing fall dormancy (FD) 1-6, were planted in August of 1998 at the Central Oregon Agricultural Research Center, Powell Butte, Oregon. The trial was conducted as a 3-cut harvest management system. There were no total yield or total digestible yield differences between varieties. There were significant differences on first and third cutting. As FD increased, yield decreased and quality and energy increased on first cutting; and as FD increased on third cutting, yield increased and quality and energy decreased in general. There were quality differences between varieties on all cuttings.

Introduction

Alfalfa continues to be an important crop for central and eastern Oregon. Over the years, there has been a range of perhaps 35,000 to 50,000 acres of alfalfa grown in the three counties. The alfalfa is grown in pure stands and grass/alfalfa mixtures for hay. Locally the hay produced is marketed to livestock producers, dairies and feed stores in Oregon, Washington, and California. Some alfalfa is exported to Pacific Rim countries. Alfalfa is an important rotational crop to help break up disease and insect problems, and adds nitrogen to the soil for subsequent crops. Alfalfa fixes its own nitrogen, so does not require additional nitrogen applications. Seed companies continue to develop and market numerous varieties.

In past years, normally varieties with a fall dormancy rating of 1-3 have been planted. In recent years, some producers have begun planting more fall dormancy 4 varieties, with an occasional FD 5 variety planted. The higher rated fall dormancy varieties need to be tested locally for their adaptability and yield potential. The information generated by these trials are important to producers, fieldmen, seed suppliers, and the seed companies.

In general, American alfalfa cultivars trace to 9 different distinct sources of germplasm from different regions of the world. These germplasm sources are M. falcate, Ladak, M. varia, Turkistan, Flemish, Chilean, Peruvian, Indian, and African, listed in their approximate descending order of winter hardiness and fall dormancy characteristics. A 10th source of very nondormant germplasm from Saudia Arabia has generally gone unrecognized.

The expression of fall dormancy is dependant upon the combination of shortening day length and cool temperatures. Under short day conditions, differences among dormant and nondormant cultivars are more pronounced at low temperatures. At cool temperatures, dormant cultivars have the greatest dormancy response and nondormant cultivars have the least response. Maximum dormancy seems to be induced at a temperature of 15.5 degrees C and a photoperiod of 12 hours. Accordingly a decrease in

photoperiod and temperature causes a greater decrease in top growth of fall dormant cultivars than in the non fall dormant cultivars. Under long day conditions there is little difference in regrowth between dormant and nondormant cultivars.

Fall dormancy is classified on the basis of vegetative growth observed in the autumn, particularily in northern latitudes. Dormants are northern types and nondrmants are southern types. (Alfalfa and Alfalfa Improvement, ASA Monograph 29. 1988 pp. 265-266.)

Seed companies continue to develop and market numerous varieties. In past years, varieties with a fall dormancy rating of 1-3, and some 4's have been typically planted. In recent years, some producers in central Oregon have begun planting more FD 4 varieties, with an occasional FD 5 variety planted. In even more recent years the genes for winter hardiness and dormancy have been delinked.

The higher rated fall dormancy varieties need to be tested locally for their adaptability and yield potential. The information generated by this trial is limited though, because only one entry represented each fall dormancy rating. It will begin to build an information base that is important to producers, fieldmen, seed suppliers, and the seed companies who are involved in central Oregon forage production.

Selecting an alfalfa variety is important. Fall dormancy and winter hardiness genes in alfalfa have been de-linked in recent years. There has been more interest in planting alfalfa varieties with higher fall dormancy ratings.

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Materials and Methods

Soil samples were taken and analyzed by the Oregon State University Plant and Soil Analytical Laboratory, Corvallis Oregon (see table 1). Based on the soil test results, lime, phosphorus, potassium, sulfur, and boron were applied and worked (disked) into the top six inches of soil on April 18, 1998 (see table 2.). The field was then leveled and rolled prior to planting.

Table 1. Soil test analyses from alfalfa variety trial soil samples taken at the COARC, Madras. Oregon

Date	Depth (in)	OM (%)	pH	P (ppm)	K (ppm)	Ca (meq/100g)	Mg (meq/100g)	B (ppm)	Zn (ppm)	Sol Salts Mmhos/cm	Se (ppm)	Mn (ppm)	Total Bases
7/10/1995	0-12	3.33	5.7	40	230	6.0	2.6	0.34		0.50			
8/3/1998	0-10		5.8	47	177	6.0	2.5	0.40	0.6	--	--	15	9.0

Table 2. Nutrient applications made to the alfalfa variety trial at the COARC, Madras, Oregon

Date Applied	N	P2O5 (lb/ac)	K2O (lb/ac)	Ca (lb/ac)	S (lb/ac)	B (lb/ac)	Zn (lb/ac)
4/11/1998	19	0	217	2.5 ton	14	2.2	0
4/17/1998	28	0	0	172	32	0	0
3/241999	0	72	144	202	38	0	0

Six alfalfa varieties, representing fall dormancy 1-6, were planted at the Central Oregon Agricultural Research Center (COARC) at the Powell Butte site, on August 24, 1998. The trial site is located a seven miles west of Prineville and 12 miles east of Redmond and the elevation is 3180 feet. Eighteen pounds of inoculated seed were planted with a small plot cone type drill with nine rows, six inch row spacing. The field was rolled after planting. Plot size is 5 feet x 20 feet, while harvested area is 3.5 feet x 15 feet.

The alfalfa was harvested with a sickle bar forage plot harvester, and fresh wet yield was weighed directly in the field. Aftermath from the plots are swathed, raked and baled with fairly high moisture content (rather than waiting for typical moisture to bale) to help clear the field and get the irrigation water back on the field as soon as possible. Harvest dates are listed for each cutting in the annual yield tables.

Moisture samples (0.5 to 1.0 pound) are taken for each plot and dried at 145 degrees Fahrenheit until no change in weight. Yields are presented on an oven-dry, dry matter basis. The trial was laid out in a randomized block design with four replications. SAS statistical software program was used for analysis of variance and results are reported out using Protected Least Significant Difference (PLSD) for mean separation at the P = 0.10, 0.05, and 0.01 probability level.

The trial was solid-set, sprinkler irrigated with a 30 x 40 feet spacing as needed for establishment and during the season. Nelson rotating head Windfighter 2000 7/64-inch nozzles were used. Irrigation is determined by crop water use prediction by the Agri-met weather station program and by probing the soil with a soil probe. There is an Agri-met weather station located at the COARC. The trial was usually irrigated two times per week, depending upon time of year.

Pursuit (1 DG Eco Pak bag), Poast (0.47 lb/a a.i.) and two quarts of crop oil were applied for weed control September 17, 1998 of the establishment year.

Table 3. The fall dormancy, winter hardiness, disease, insect, and pest ratings for the 1998 planted alfalfa fall dormancy variety trial conducted at COARC, Powell Butte, OR.

Variety	FD	WH	Bw	Vw	Fw	An	PRR	SAA	PA	BAA	SN	APH	SNKN	NRKN	RLN
Spredor III	1	--	4	1	4	1	1	4	2	1	3	1	1	1	1
5262	2	--	5	2	3	1	4	4	4	1	3	1	1	1	1
Innovator +Z	3	--	5	4	5	5	5	3	4	1	4	4	1	1	1
5396	4	--	4	4	4	5	4	4	4	1	4	1	1	3	1
Archer	5	--	3	3	5	4	4	5	5	4	4	1	1	4	1
Lobo	6	--	3	4	5	4	4	4	4	4	4	1	1	1	1

FD = Fall Dormancy, * = was supposed to be a FD 4, but company revised the rating after the trial was planted, WH = Winter Hardiness, BW = Bacterial Wilt, VW = Verticillium Wilt, FW = Fusarium Wilt, AN = Anthracnose Race 1, PRR = Phytophthora Root Rot, SAA = Spotted Alfalfa Aphid, PA = Pea Aphid, BAA = Blue Alfalfa Aphid, SN = Stem Nematode, APH = Aphanomyces, SKN = Southern Root Knot Nematode, NRKN = Northern Root Knot Nematode, RLN = Root Lesion Nematode.

Fall Dormancy (FD) Ratings: 1 = most dormant, 11 = least dormant. Winter Hardiness (WH): 1 = most winter hardy, 6 = least winter hardy.

Resistance Ratings: 1 = Susceptible (S) (0-5% of plants) or has not been tested, 2 = Low Resistance (LR) (5-15%), 3 = Moderate Resistance (MR) (15-30% of plants), 4 = Resistance (R) (30-50% of plants), 5 = High Resistance (HR) (> 50% of plants)

The samples were ground with a Wiley mill with a 1.0 mm screen. The samples were reground in a Udy mill with a 0.5 mm screen. The samples were submitted to the NIRS at the Klamath Experiment Station for quality analysis. The NIRS has not been calibrated for every variable predicted. No wet chemistry tests were conducted on any of these alfalfa samples.

Statistical analysis was performed with MSTAT, Michigan State University software program.

Term Definitions are as follows:
TDN = total digestible nutrients (Penn State calculation)
TDN CA = total digestible nutrients (California calculation)
TDN TRIST = total digestible nutrients (Tri state calculation)
RFV = relative feed value
Moist. = moisture %
DM = Dry matter %
Protein = crude protein %
AV Protein = available protein %
DProtein = digestible protein %
NEL = net energy of lactation (mcal/lb)
ENE = energy estimate (therms per cwt. weight)
ME = metabolizable energy (mcal/lb)
NEM = net energy of maintenance (mcal/lb)
NEG = net energy of gain (mcal/lb)
DDM = digestible dry matter %
DMI = dry matter intake %
NDF = neutral detergent fiber %
ADF = acid detergent fiber %
ADP = available digestible protein %
NDFD = 48 hour in vitro NDF digestibility as % of NDF
NFC = non fibrous carbohydrate (% of DM)
TDNL total digestible nutrients for alfalfa, clovers, and legume/grass mixtures
RFQ = relative forage quality
Fat =
ADP =
Ash =
Lignin =

Definition of calculation equations:
TDN = 4.898 + (89.796 * NEL)

TDN CA = (82.38- (.7515 * ADF)) * 0.9
TDN TRIST = (54.32 + (0.7387 * protein)) – (0.2915 * ADF)
RFV = (DMI * DDM) / 1.29
Moist. = 100.0 – dry matter
AV Protein = (1.16 * protein) – (1.6 * ADP)
D Protein = 1.44 + (0.68 * protein) – (1.28 * ADP)
NEL = 1.044 – (0.0119 * ADF)
ENE = 82.6 * NEL
ME = 0.01642 * TDN
NEM = -0.508 + (1.37 * ME) – (0.3042 * ME *ME) + (0.051 * ME * ME * ME)
NEG = -0.7484 + (1.42 * ME) - (0.3836 * ME * ME) + (0.0593 * ME * ME *ME)
DDM = 88.90 – (0.779 * ADF)
DMI = 120 / NDF
If (AV Protein > Protein) AV Protein = Protein
If (D Protein > Protein) D Protein = Protein
NDFD = dNDF 48 hour / NDF * 100
NFC = 100 – ((NDF – 2) + Protein + 2.5 + Ash)
TDNL = (NFC * 0.98) + (Protein * 0.93) + (1.5 * 0.97 * 2.25) + ((NDF – 2) * (NDFD / 100)) – 7
DMI1 = ((((0.0120 * 1350) / (NDF / 100))) + ((NDFD – 45) * 0.374)) / 1350 * 100
RFQ = (DMI1 * TDNL) / 1.23

Table 4. USDA alfalfa quality guidelines for domestic livestock use and not more than 10 percent grass.

Quality Class	ADF (%)	NDF (%)	RFV*	TDN** (100% DM)	TDN** (90% DM)	Crude Protein (%)
Supreme	< 27	< 34	> 185	> 62	> 55.9	> 22
Premium	27 – 29	34 – 36	170 – 185	60.5 – 62	54.5 – 55.9	20 – 22
Good	29 – 32	36 – 40	150 – 170	58 – 60	52.5 – 54.5	18 – 20
Fair	32 – 35	40 – 44	130 – 150	56 – 58	50.5 – 52.5	16 – 18
Low	> 35	> 44	< 130	< 56	< 50.5	< 16

* RFV calculated using the Wis./Minn. Formula. ** TDN calculated using the western formula. Quantitative factors are approximate and many factors can affect feeding value. Values based on 100% dry matter (TDN showing both 100% and 90% dry matter). Guidelines are to be use with visual appearance and intent of sale (usage).

Results and Discussion

There was an irrigation problem with this year of the trial - equal coverage, and there was an irrigation that was missed during second cutting. Weed control was excellent for the trial. The winter was relatively mild.

Cutting x Variety (FD)

Cutting x variety (FD) statistics were run for the trial. All variables tested were significantly different between cuttings. Out of the 43 variables tested 33 were significantly different for varieties (FD), 10 variables were not significantly different. For the cutting x variety interaction, 35 variables were significantly different and 8 were not. The cutting x variety data are presented in tables 18-21.

Total Yield and Other Total Variables

The only variables that were significantly different, was total yield and Phosphorus uptake at the PLSD 0.10 level (Table 5). In general the more dormant varieties (FD) were higher yielding and had greater phosphorus uptake than the nondormant varieties.

Table 5. 1999 total yield, total N fixed, total protein yield, total TDN yield, total TDN CA, total TDN PNW yield, total Ca uptake, total P uptake, total K uptake, and total Mg uptake data for the fall dormancy alfalfa trial planted in 1998 at the COARC, Powell Butte, OR.

Treatment	Total Yield (lb/ac)	Total N Fixed (lb/ac)	Total Protein Yield (lb/ac)	Total TDN Yield (lb/ac)	Total CA TDN Yield (lb/ac)	Total PNW TDN Yield (lb/ac)	Total Ca Uptake (lb/ac)	Total P Uptake (lb/ac)	Total K Uptake (lb/ac)	Total Mg Uptake (lb/ac)
1	6.35	446.5	2,790	8,802	7,054	7,841	213.9	45.2	381.4	43.0
2	6.33	438.3	2,739	8,704	6,991	7,769	210.4	44.4	372.1	42.7
3	6.39	465.5	2,909	8,900	7,129	7,921	213.8	46.3	374.7	43.7
4	6.27	435.2	2,720	8,578	6,897	7,663	210.5	43.1	361.8	42.3
5	6.19	447.7	2,798	8,498	6,826	7,585	208.4	43.9	361.1	42.4
6	6.18	440.4	2,752	8,441	6,790	7,543	207.9	43.0	362.1	41.9
Mean	6.28	445.6	2,785	8,654	6,948	7,720	210.8	44.3	368.9	42.7
PLSD 0.01	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*
PLSD 0,05	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*
PLSD 0.10	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	2.0	*NS*	*NS*
Prob. > F	-----	0.1048	0.1052	0.2180	0.2956	0.2922	-----	0.0655	-----	-----
CV%	4.9	4.9	4.9	4.8	4.8	4.8	6.3	5.4	6.6	6.4

First Cutting

First cut yield was significantly different between varieties at the PLSD 0.10 level (Table 6.). As dormancy rating increased, yield decreased on first cutting. FD entries 3, 5 and 6 were higher in protein, RFV, RFQ, and lower in ADF, NDF, dNDF. FD 4 entry had lower NDFD than the rest of the entries.

Table 6. 1999 first cut yield, dry matter, moisture, protein, ADF, NDF, dNDF, NDFD, RFV, and RFQ data for the fall dormancy alfalfa trial planted in 1998 at the COARC, Powell Butte, OR.

FD / Variety	Yield (t/a)	Dry Matter (%)	Moist. (%)	Protein (%)	ADF (%)	NDF (%)	dNDF (%)	NDFD (%)	RFV	RFQ
1	3.19	19.2	80.8	21.0	28.7	36.4	19.4	53.3	171	191
2	3.02	19.2	80.8	20.9	28.9	36.6	19.4	53.1	169	190
3	3.00	20.2	79.8	22.2	28.2	35.4	19.0	53.8	176	199
4	2.99	18.9	81.1	20.9	29.6	37.4	19.2	51.4	164	181
5	2.81	20.1	79.9	22.5	27.8	34.9	18.7	53.7	179	200
6	2.82	19.2	80.8	22.0	28.0	35.1	18.6	53.1	178	198
Mean	2.97	19.4	80.6	21.6	28.5	35.9	19.0	53.0	173	193
PLSD 0.10	*NS*	*NS*	*NS*	1.1	*NS*	1.6	*NS*	*NS*	11	13
PLSD 0.05	*NS*	*NS*	*NS*	0.8	1.0	1.2	0.6	1.4	8	10
PLSD 0.10	0.23	*NS*	*NS*	0.7	0.9	1.0	0.5	0.2	7	8
Prob. > F	0.0807	0.3535	0.3535	0.0001	0.0148	0.0007	0.0439	0.0189	0.0022	0.0028
CV %	8.9	7.4	1.8	3.6	3.6	3.2	3.0	2.6	4.5	5.0

There were significant differences between varieties for first cut TDN, DDM, DMI, DMI 1, CA TDN, and PNW TDN at the PLSD 0.10 level or higher (Table 7). The FD 3, 5 and 6 had higher TDN, DDM, CA TDN, and PNW TDN compared to FD 1, 2 and 4. FD 3 had the highest DMI, but FD 5 and 6 were similar to FD 3 for DMI 1.

Table 7. 1999 First Cut TDN, DDM, ash, lignin, fat, DMI, DMI1, NFC, TDNL, TDN CA, and TDN PNW data for the 1998 fall dormancy alfalfa trial planted in 1998 at the COARC, Powell Butte, OR.

FD/Variety	TDN (%)	DDM (%)	Ash (%)	Lignin (%)	Fat (%)	DMI (%)	DMI1 (%)	NFC (%)	TDNL (%)	TDN CA (%)	TDN PNW (%)
1	68.0	66.5	9.12	6.66	1.87	3.31	3.54	33.1	67.5	54.7	60.8
2	67.7	66.4	8.95	6.64	1.87	3.28	3.51	33.1	66.5	54.6	60.7
3	68.5	66.9	8.98	6.60	1.84	3.96	3.64	33.0	67.1	55.1	61.2
4	67.0	65.9	8.81	7.01	1.84	3.22	3.39	32.4	65.6	54.1	60.2
5	69.0	67.3	9.46	6.59	1.74	3.44	3.68	32.6	66.8	55.4	61.5
6	68.7	67.1	9.33	6.43	1.80	3.42	3.64	33.1	66.7	55.2	61.3
Mean	68.2	66.8	9.11	6.66	1.82	3.34	3.57	32.9	66.5	53.6	59.6
PLSD 0.10	*NS*	*NS*	*NS*	*NS*	*NS*	0.15	0.18	*NS*	*NS*	*NS*	*NS*
PLSD 0.05	1.1	0.8	*NS*	*NS*	*NS*	0.11	0.14	*NS*	*NS*	0.7	0.8
PLSD 0.10	0.9	0.7	*NS*	*NS*	*NS*	0.09	0.11	*NS*	*NS*	0.6	0.6
Prob. > F	0.0129	0.0159	-----	0.3392	0.3270	0.0012	0.0010	-----	0.1472	0.0120	0.0108
CV%	1.6	1.2	9.0	7.5	6.7	3.3	3.7	3.6	1.7	1.9	1.9

First cut NEL, ENE, ME, NEM, NEG, and pounds of nitrogen per ton of DM, were all significantly different at the PLSD 0.10 level or higher (Table 8). FD 3, 5, and 6 had higher NEL, ENE, ME, NEM, and NEG than did FD 1, 2 and 4. FD 4 had the lowest NEL, ENE, ME, NEM, and NEG. FD 5 had the greatest pounds of N per ton of dry matter yield.

Table 8. 1999 First Cut Protein yield, TDN yield, TDN CA yield, TDN PNW yield, DDM yield, NEL, ENE, ME, NEM, NEG, and pounds of N fixed per ton of DM data for the 1998 fall dormancy alfalfa trial planted in 1998 at the COARC , Powell Butte, OR.

FD/Variety	Protein Yield (lb/ac)	TDN Yield (lb/ac)	TDN CA Yield (lb/ac)	TDN PNW Yield (lb/ac)	DDM Yield (lb/ac)	NEL (mcal/lb)	ENE (mcal/lb)	ME (mcal/lb)	NEM (mcal/lb)	NEG (mcal/lb)	Lb of N Per ton DM
1	1331	4328	3484	3872	4237	0.700	58.01	1.115	0.712	0.440	67.0
2	1257	4087	3294	3660	4006	0.700	57.80	1.111	0.709	0.437	66.8
3	1328	4106	3302	3668	4013	0.709	58.49	1.126	0.720	0.447	71.0
4	1250	4007	3236	3595	3937	0.690	57.16	1.101	0.700	0.430	66.9
5	1266	3880	3114	3460	3783	0.714	58.93	1.131	0.728	0.454	72.1
6	1242	3871	3111	3456	3780	0.710	58.71	1.129	0.724	0.450	70.5
Mean	1279	4046	3257	3619	3959	0.704	58.18	1.119	0.715	0.443	69.0
PLSD 0.10	*NS*	*NS*	*NS*	*NS*	*NS*	*	*NS*	*NS*	*NS*	*NS*	3.4
PLSD 0.05	*NS*	*NS*	*NS*	*NS*	*NS*	*	1.04	*	*	*	2.5
PLSD 0.10	*NS*	*NS*	*NS*	*NS*	*NS*	*	0.86	*	*	*	2.1
Prob. > F	0.3358	0.1162	0.1092	0.1076	0.1052	0.0053	0.0153	0.0131	0.0311	0.0195	0.0001
CV%	8.1	8.6	8.7	8.7	8.7	1.8	1.8	1.6	2.4	3.2	3.6

There were significant differences for first cut N%, P uptake, K uptake, and Mg % at the PLSD 0.10 level or higher (Table 9). Percent N difference is the same as Protein percentage. The nondormants had lower P uptake and K uptake than the more dormant entries, which would be dependant upon yield which was similar in the same way. FD 5 and 6 had higher Mg % than FD 1-3, and FD 4 had the lowest Mg%.

Table 9. 1999 First cut percent N, N fixed, percent Ca, Ca uptake, percent P, P uptake, percent K, K uptake, percent Mg, and Mg uptake data for the fall dormancy alfalfa trial planted in 1998 at the COARC, Powell Butte, OR.

FD /Variety	N (%)	N Fixed (lb/ac)	Ca (%)	Ca Uptake (lb/ac)	P (%)	P Uptake (lb/ac)	K (%)	K Uptake (lb/ac)	Mg (%)	Mg Uptake (lb/ac)
1	3.35	213.0	1.63	103.8	0.346	22.1	2.85	181.5	0.345	22.0
2	3.34	201.0	1.61	96.7	0.339	20.4	2.81	169.6	0.341	20.6
3	3.55	212.4	1.61	96.8	0.353	21.1	2.80	167.7	0.345	20.7
4	3.35	200.0	1.62	96.6	0.331	19.8	2.69	160.8	0.335	20.1
5	3.61	202.6	1.65	92.4	0.345	19.4	2.79	157.1	0.358	20.1
6	3.52	198.7	1.68	94.4	0.336	18.9	2.82	158.9	0.355	20.0
Mean	3.45	204.6	1.63	96.8	0.342	20.3	2.79	165.9	0.346	20.6
PLSD 0.10	0.17	*NS*	*NS*	*NS*	*NS*	2.3	*NS*	*NS*	*NS*	*NS*
PLSD 0.05	0.12	*NS*	*NS*	*NS*	*NS*	1.7	*NS*	*NS*	*NS*	*NS*
PLSD 0.10	0.10	*NS*	*NS*	*NS*	*NS*	1.4	*NS*	14.3	*	*NS*
Prob. > F	0.0001	0.3358	-----	0.3384	0.2102	0.0073	0.1874	0.0659	0.0716	-----
CV%	3.6	8.1	5.7	10.3	4.5	8.3	4.5	10.2	4.6	10.6

Second Cutting

There were significant differences between varieties for second cut protein, ADF, NDF, dNDF, RFV, and RFQ at the PLSD 0.10 level or higher (Table 10). Protein was different, but nothing could be attributed to FD. In general, FD 4-6 had higher ADF, NDF, dNDF, RFV, and RFQ than FD 1-3. There no doubt were other factors that were responsible for differences or non differences.

Table 10. 1999 second cut yield, dry matter, moisture, protein, ADF, NDF, dNDF, NDFD, RFV, and RFQ data for the fall dormancy alfalfa trial planted in 1998 at the COARC, Powell Butte, OR.

FD /Variety	Yield (t/a)	Dry Matter (%)	Moist. (%)	Protein (%)	ADF (%)	NDF (%)	dNDF (%)	NDFD (%)	RFV	RFQ
1	1.76	16.8	83.2	22.8	29.4	36.6	20.5	56.2	169	197
2	1.91	17.8	82.2	22.0	30.3	37.7	21.0	55.8	162	190
3	1.83	17.3	82.7	23.0	28.9	35.9	20.6	57.5	173	205
4	1.81	17.2	82.8	21.9	31.0	38.5	21.2	55.0	157	183
5	1.82	17.6	82.4	22.5	31.1	38.4	21.3	55.4	157	185
6	1.81	17.0	83.0	22.3	31.4	38.6	21.3	55.2	156	183
Mean	1.82	17.3	82.7	22.4	30.4	37.6	21.0	55.9	162	190
PLSD 0.10	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*
PLSD 0.05	*NS*	*NS*	*NS*	*NS*	1.6	1.9	0.6	*NS*	11.3	14.5
PLSD 0.10	*NS*	*NS*	*NS*	0.7	1.3	1.5	0.5	*NS*	9.4	12.1
Prob. > F	0.4115	0.1598	0.1598	0.0984	0.0123	0.0216	0.0463	0.1049	0.0174	0.0231
CV%	7.4	4.9	1.0	3.9	5.1	4.9	2.9	3.3	6.9	7.5

There were significant differences for second cut TDN, DDM, lignin, fat, DMI, DMI 1, NFC, TDNL CA TDN, and PNW TDN at the PLSD 0.10 level (Table 11). The more dormant varieties FD 1-3 had higher TDN, DDM, DMI, DMI 1, NFC, TDNL, CA TDN, and PNW TDN than the FD 4-6 entries.

Table 11. 1999 second Cut TDN, DDM, ash, lignin, fat, DMI, DMI1, NFC, TDNL, TDN CA, and TDN PNW data for the 1998 fall dormancy alfalfa trial planted in 1998 at the COARC, Powell Butte, OR.

FD / Variety	TDN (%)	DDM (%)	Ash (%)	Lignin (%)	Fat (%)	DMI (%)	DMI1 (%)	NFC (%)	TDNL (%)	TDN CA (%)	TDN PNW (%)
1	67.2	66.0	9.18	5.06	1.87	3.29	3.60	31.0	67.2	54.3	60.3
2	66.3	65.3	8.98	5.39	1.80	3.19	3.49	30.9	66.9	53.6	59.6
3	67.8	66.4	9.08	4.97	1.94	3.35	3.70	31.5	68.0	54.6	60.7
4	65.6	64.8	8.85	5.53	1.79	3.12	3.40	30.3	66.4	53.2	59.1
5	65.4	64.7	9.02	5.23	1.72	3.13	3.42	29.6	66.3	53.1	59.0
6	65.1	64.4	9.06	5.37	1.78	3.11	3.40	29.5	66.2	52.9	58.8
Mean	66.2	65.3	9.03	5.26	1.82	3.20	3.50	30.4	66.8	55.6	61.8
PLSD 0.10	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	1.5	*NS*	1.4	1.6
PLSD 0.05	1.7	1.2	*NS*	0.33	0.13	0.16	0.21	1.1	1.2	1.0	1.2
PLSD 0.10	1.4	1.0	*NS*	0.28	0.11	0.14	0.17	0.9	1.0	0.9	1.0
Prob. > F	0.0116	0.0133	-----	0.0137	0.0247	0.0223	0.0262	0.0042	0.0275	0.0000	0.0000
CV%	2.5	1.8	5.8	6.2	7.1	5.1	5.9	3.6	1.7	1.4	1.4

There were significant differences between the varieties (FD) for second cut NEL, ENE, ME, NEM, NEG, and pounds of nitrogen per ton of dry matter at the PLSD 0.10 level (Table 12). The more dormant varieties FD 1-3 had higher NEL, ENE, ME, NEM, and NEG than the more nondormant entries FD 4-6.

Table 12. 1999 second cut protein yield, TDN yield, TDN CA yield, TDN PNW yield, DDM yield, NEL, ENE, ME, NEM, NEG, and pounds of N fixed per ton of DM data for the 1998 fall dormancy alfalfa trial planted in 1998 at the COARC , Powell Butte, OR.

FD/Variety	Protein Yield (lb/ac)	TDN Yield (lb/ac)	TDN CA Yield (lb/ac)	TDN PNW Yield (lb/ac)	DDM Yield (lb/ac)	NEL (mcal/lb)	ENE (mcal/lb)	ME (mcal/lb)	NEM (mcal/lb)	NEG (mcal/lb)	Lb of N Per ton DM
1	800	2364	1909	2121	2322	0.694	57.3	1.104	0.701	0.432	72.9
2	838	2526	2046	2273	2491	0.685	56.4	1.089	0.689	0.419	70.4
3	843	2484	2001	2223	2433	0.699	57.8	1.112	0.710	0.439	73.6
4	788	2368	1920	2133	2339	0.678	55.8	1.076	0.679	0.409	70.0
5	813	2371	1925	2139	2345	0.674	55.7	1.074	0.676	0.409	72.0
6	806	2351	1911	2123	2327	0.671	55.4	1.069	0.669	0.404	71.5
Mean	815	2411	1952	2169	2376	0.683	56.4	1.087	0.687	0.419	71.7
PLSD 0.10	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
PLSD 0.05	NS	NS	NS	NS	NS	*	1.53	0.032	0.032	*	NS
PLSD 0.10	NS	NS	NS	NS	NS	*	1.27	0.027	0.027	*	2.4
Prob. > F	0.3815	0.2756	0.3138	0.3147	0.3196	0.0244	0.0130	0.0143	0.0131	0.0121	0.0984
CV%	7.2	7.6	7.5	7.5	7.5	2.7	2.7	2.5	3.5	5.2	3.9

There were significant differences between varieties for second cut percent N at the PLSD 0.10 level, which is the same as the protein data (Table 13).

Table 13. 1999 second cut percent N, N fixed, percent Ca, Ca uptake, percent P, P uptake, percent K, K uptake, percent Mg, and Mg uptake data for the fall dormancy alfalfa trial planted in 1998 at the COARC, Powell Butte, OR.

FD / Variety	N (%)	N Uptake (lb/ac)	Ca (%)	Ca Uptake (lb/ac)	P (%)	P Uptake (lb/ac)	K (%)	K Uptake (lb/ac)	Mg (%)	Mg Uptake (lb/ac)
1	3.65	128.0	1.60	56.3	0.38	13.5	3.27	115.0	0.325	11.4
2	3.52	134.2	1.57	59.7	0.38	14.3	3.12	119.2	0.325	12.4
3	3.68	134.9	1.58	58.1	0.39	14.3	3.15	115.5	0.339	12.4
4	3.50	126.2	1.57	56.9	0.37	13.4	3.15	113.6	0.328	11.8
5	3.60	130.1	1.57	57.0	0.38	13.7	3.10	112.1	0.328	11.9
6	3.57	129.0	1.58	56.7	0.38	13.8	3.12	112.9	0.324	11.7
Mean	3.59	130.4	1.58	57.4	0.380	13.8	3.15	114.7	0.328	11.9
PLSD 0.10	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*
PLSD 0.05	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*
PLSD 0.10	0.12	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*
Prob. > F	0.0952	0.3828	-----	-----	-----	0.3687	0.3955	-----	-----	0.3279
CV%	3.9	7.2	4.4	8.6	4.8	7.7	5.4	8.2	5.5	8.8

Third Cutting

There were significant differences between varieties for yield, protein, ADF, NDF, dNDF, NDFD, RFV and RFQ at the PLSD 0.10 level or higher (Table 14). FD 3, 5 and 6 were higher yielding than FD 4, 2 and 1, so in general the nondormants were higher yielding on the last cutting. Protein was less clear cut for explanation. In general though, as the fall dormancy increased (especially to FD 5 and 6), ADF, NDF, dNDF increased, but NDFD, RFV and RFQ decreased. FD 5 and 6 had significantly higher ADF and NDF dNDF, and NDFD values and lower RFV and RFQ values than the more dormant entries. RFQ values were on average 29 points higher than RFV, but would not have changed the quality class for any of the entries.

Table 14. 1999 third cut yield, dry matter, moisture, protein, ADF, NDF, dNDF, NDFD, RFV, and RFQ data for the fall dormancy alfalfa trial planted in 1998 at the COARC, Powell Butte, OR.

FD / Variety	Yield (t/a)	Dry Matter (%)	Moist. (%)	Protein (%)	ADF (%)	NDF (%)	dNDF (%)	NDFD (%)	RFV	RFQ
1	1.40	22.3	77.7	23.6	21.7	27.0	15.9	59.2	249	281
2	1.41	22.1	77.9	23.0	22.8	28.5	16.6	58.1	233	262
3	1.56	22.3	77.7	23.7	22.9	28.2	16.3	57.9	235	266
4	1.48	22.0	78.0	23.0	22.6	28.3	16.2	57.4	235	263
5	1.56	22.1	77.9	23.1	24.8	30.4	17.3	56.7	213	241
6	1.55	22.5	77.5	22.7	25.3	31.3	17.3	55.2	206	231
Mean	1.49	22.2	77.8	22.2	23.4	28.9	16.6	57.4	228	257
PLSD 0.10	0.10	*NS*	*NS*	0.7	1.2	1.3	0.6	2.2	13.6	16.6
PLSD 0.05	0.07	*NS*	*NS*	0.5	0.9	0.9	0.5	1.7	10.1	12.4
PLSD 0.10	0.06	*NS*	*NS*	0.4	0.8	0.8	0.4	1.4	8.4	10.3
Prob. > F	0.0000	0.1465	0.1465	0.0013	0.0000	0.0000	0.0000	0.0007	0.0000	0.0000
CV%	4.8	2.0	0.6	2.1	3.9	3.4	2.7	2.9	4.4	4.7

There were significant differences between varieties for third cut TDN, DDM, lignin, fat, DMI, DMI 1, NFC, TDNL, CA TDN, and PNW TDN at the PLSD 0.10 level or higher (Table 15). As the dormancy increased, the TDN, DDM, fat, DMI, DMI1, NFC, TDNL, CA TDN, and PNW TDN decreased. Lignin was not as clear cut; FD 1 had the lowest lignin content, but FD 2 had higher content than FD 3, while FD 4 and 5 had the same content, while FD 6 had the highest lignin content.

Table 15. 1999 third Cut TDN, DDM, ash, lignin, fat, DMI, DMI1, NFC, TDNL, TDN CA, and TDN PNW data tfor the 1998 fall dormancy alfalfa trial planted in 1998 at the COARC, Powell Butte, OR.

FD / Variety	TDN (%)	DDM (%)	Ash (%)	Lignin (%)	Fat (%)	DMI (%)	DMI1 (%)	NFC (%)	TDNL (%)	TDN CA (%)	TDN PNW (%)
1	75.5	72.0	9.94	5.47	2.05	4.46	4.85	39.0	71.2	59.5	66.1
2	74.3	71.2	9.94	5.94	2.04	4.22	4.58	38.2	70.4	58.7	65.3
3	74.1	71.0	9.68	5.72	2.00	4.27	4.63	37.9	70.6	58.6	65.1
4	74.5	71.3	9.82	5.83	1.90	4.25	4.60	38.4	70.4	58.8	65.4
5	72.1	69.6	9.77	5.83	1.87	3.95	4.27	36.2	69.4	57.4	63.8
6	71.6	69.2	9.51	6.01	1.86	3.84	4.13	36.0	68.8	57.0	63.3
Mean	73.7	70.7	9.78	5.80	1.95	4.16	4.51	37.6	70.1	58.3	64.8
PLSD 0.10	1.3	1.0	*NS*	0.33	0.10	0.19	0.24	1.2	1.0	0.8	0.9
PLSD 0.05	1.0	0.7	*NS*	0.25	0.07	0.14	0.18	0.9	0.8	0.6	0.7
PLSD 0.10	0.8	0.6	*NS*	0.21	0.06	0.12	0.15	0.7	0.6	0.5	0.6
Prob. > F	0.0000	0.0000	-----	0.0020	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CV%	1.3	1.0	5.1	4.2	3.6	3.4	3.9	2.3	1.1	1.1	1.1

There were significant differences between varieties for all of the third cut variables in Table 16.
In general, as fall dormancy rating increases, the NEL, ENE, ME, NEM, and NEG values decrease.

Table 16. 1999 third cut protein yield, TDN yield, TDN CA yield, TDN PNW yield, DDM yield, NEL, ENE, ME, NEM, NEG, and pounds of N fixed per ton of DM data for the fall dormancy alfalfa trial planted in 1998 at the COARC, Powell Butte, OR.

FD/Variety	Protein Yield (lb/ac)	TDN Yield (lb/ac)	TDN CA Yield (lb/ac)	TDN PNW Yield (lb/ac)	DDM Yield (lb/ac)	NEL (mcal/lb)	ENE (mcal/lb)	ME (mcal/lb)	NEM (mcal/lb)	NEG (mcal/lb)	Lb of N Per ton DM
1	659	2109	1662	1847	2013	0.786	65.0	1.239	0.820	0.535	75.6
2	645	2091	1652	1836	2002	0.775	63.9	1.221	0.804	0.521	73.4
3	739	2310	1826	2029	2213	0.771	63.7	1.218	0.801	0.519	75.9
4	682	2203	1741	1934	2108	0.775	64.0	1.223	0.805	0.522	73.7
5	719	2248	1788	1986	2168	0.749	61.9	1.185	0.774	0.494	73.8
6	705	2220	1768	1964	2145	0.743	61.3	1.175	0.762	0.486	72.8
Mean	691	2197	1739	1933	2108	0.766	63.3	1.210	0.794	0.513	74.2
PLSD 0.01	47	150	117	130	142	*	1.2	*	*	*	2.1
PLSD 0.05	35	112	87	97	106	*	0.9	*	*	*	1.6
PLSD 0.10	29	93	73	81	88	*	0.8	*	*	*	1.3
Prob. > F	0.0000	0.0025	0.0010	0.0011	0.0009	0.0000	0.0000	0.0000	0.0000	0.0000	0.0012
CV%	5.0	5.0	4.9	5.0	4.9	1.6	1.4	1.3	1.8	2.4	2.1

There were significant differences between varieties for N%, N Fixed, Ca uptake, P uptake, K uptake, Mg %, and Mg uptake at the PLSD 0.10 level or higher in Table 17.. Percent N is the same as Protein. FD 3 had the Highest N Fixed. The FD 1-2 entries had less Ca, P, K and Mg uptake than the FD 3-6 entries, because of decreased yield. There were differences for percent magnesium.

Table 17. 1999 third cut percent N, N fixed, percent Ca, Ca uptake, percent P, P uptake, percent K, K uptake, percent Mg, and Mg uptake data for the fall dormancy alfalfa trial planted in 1998 at the COARC, Powell Butte, OR.

FD /Variety	N (%)	N Fixed (lb/ac)	Ca (%)	Ca Uptake (lb/ac)	P (%)	P Uptake (lb/ac)	K (%)	K Uptake (lb/ac)	Mg (%)	Mg Uptake (lb/ac)
1	3.78	105.5	1.93	53.9	0.348	9.7	3.03	84.9	0.344	9.6
2	3.67	103.2	1.92	53.9	0.344	9.7	2.95	83.2	0.345	9.7
3	3.79	118.2	1.90	59.0	0.349	10.8	2.94	91.4	0.337	10.5
4	3.69	109.0	1.93	57.0	0.335	9.9	2.96	87.6	0.351	10.4
5	3.69	114.9	1.88	58.7	0.348	10.8	2.96	92.0	0.335	10.5
6	3.64	112.8	1.84	57.0	0.332	10.3	2.92	90.3	0.329	10.2
Mean	3.71	110.6	1.90	56.6	0.343	10.2	2.96	88.2	0.340	10.1
PLSD 0.10	0.11	7.6	*NS*	*NS*	*NS*	1.0	*NS*	*NS*	*NS*	*NS*
PLSD 0.05	0.08	5.6	*NS*	4.0	*NS*	0.7	*NS*	6.0	*	0.6
PLSD 0.10	0.07	4.7	*NS*	3.3	*NS*	0.6	*NS*	5.0	*	0.5
Prob. > F	0.0011	0.0000	0.2163	0.0422	0.2792	0.0042	-----	0.0244	0.0132	0.0243
CV%	2.1	5.0	4.3	6.9	5.1	7.2	5.0	6.7	3.6	6.3

Discussion

Yield increased as FD increased in general on the third cutting, as one might expect, but the inverse was true on first cutting. Quality and energy variables, in general, increased as FD increased, though there maybe were other factors contributing on first cutting. Quality and energy decreased, in general, as FD increased on second cutting, and there were no yield differences. On third cutting, quality and energy decreased as FD increased, in general. But there were no total yield differences nor were there any total annual digestible yield differences.

Percent nutrients (P, Ca, K, and Mg) and nutrient uptake (for P, Ca, K, and Mg) are presented, for purposes of comparison. The numbers are within the range of previously published values.

Selection of an alfalfa variety is based on yield and quality potential, FD, and pest resistance ratings. This one year of data allowed a snap shot look at the quality of some alfalfa varieties with different FD's. It is difficult to base a selection of a variety on one year of data, but at least it offers some limited comparisons.

The quality tests were performed by NIRS. The present calibrations are more robust than just a few years ago, but none of the samples were tested by wet chemistry for comparison. While the actual numbers may not be completely accurate, we believe the ability of the NIRS to discern differences between varieties is real.