

QUALITY AND YIELD COMPARISON OF ORCHARDGRASS VARIETIES IN THEIR FOURTH PRODUCTION YEAR

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Abstract

Thirteen orchardgrass varieties were planted at the Central Oregon Agricultural Research Center's Powell Butte site in August of 1987. The trial was completed in 1992. Many of the orchardgrass varieties outyielded 'Latar', the check variety. 'Napier', 'Sterling', 'Potomac', 'Comet' and 'Orion' ranked first through fifth, respectively, for the 5 year trial. 'Fawn', the check variety, was among the lowest yielders. In the 1991 production year (4th year), the highest overall yielding varieties, with no significant difference, were ranked Napier, Potomac, Syn 887, Comet, Sterling, Paiute, and Latar. There were some quality differences between varieties on first and third cuttings. All of the entries were ranked as "good", "premium", and "premium" quality with in all three cuttings, respectively, based on USDA grass hay quality guidelines (protein).

Introduction

Grass hay and pasture are important agricultural crops in central Oregon, either grown as pure stands or in mixtures with alfalfa and clover. Grass forage is an important market for many producers in the local, regional, and export hay markets, as well as for utilization in grass pastures for the grazing of livestock. While forage quality is important, lack of funding in the past has not allowed any replicated orchardgrass variety quality research. The last grass variety trial was conducted from 1968 to 1972 at Redmond, Oregon. Species in that trial included, and ranked in order of most productive to least productive were orchardgrass, timothy, brome grass, meadow foxtail, intermediate wheatgrass, tall fescue and Kentucky bluegrass. There was no forage quality data generated from that trial. This new orchardgrass trial was initiated in 1987 because many new varieties had been introduced since the last trial. Very little comparative quality information is available for Orchardgrass varieties in central Oregon, so the varieties were tested for quality in the 4th year of production. In the past, variety recommendations were made on the basis of yield performance only, so quality analysis was conducted to determine if quality differences between varieties would alter variety recommendations in Orchardgrass, though only based on one year of data. Producers, buyers, and local crop consultants will benefit from the quality comparison information.

Materials and Methods

Non-coated, non-treated seed of 13 orchardgrass cultivars (Table 1) was hand broadcast on August 21 and 22, 1987 at the Powell Butte site of the Central Oregon Agricultural Research Center. Eighteen pounds of seed per acre was planted into 6 ft. by 20 ft plots in a randomized complete block design and replicated four times. The seed was broadcast, raked in and rolled with a corrugated roller.

*These trials were partially supported by testing fees collected from Cenex/Land O'Lakes, Daehnfelddt, Inc., International Seeds, Inc., Northrup King Co., Turf Seed, Inc., and Willamette Seed and Grain.

Table 1. Orchardgrass cultivar names and sources of each cultivar planted in 1987 at Powell Butte.

Cultivar	Source or Originating Agency
1 Rancho	<i>Cenex/Land O'Lakes</i>
2 Phyllox	<i>Daehnfeldt, Inc.</i>
3 Ambassador	<i>International Seeds, Inc.</i>
4 Comet	<i>Northrup King Co.</i>
5 Orion	<i>Northrup King Co.</i>
6 Syn 8SM	<i>Turf Seed, Inc.</i>
7 Syn 885	<i>Turf Seed, Inc.</i>
8 Syn 887	<i>Turf Seed, Inc.</i>
9 Napier	<i>Willamette Seed & Grain</i>
10 Paiute	<i>USDA</i>
11 Latar	#
12 Potomac	#
13 Sterling	#

#Gooding Seed Co. or Round Butte Seed Growers

Soil tests were conducted on the trial site (see table 2). A broadcast fertilizer application of 16-20-0-15 at 410 lb/acre (65.5 N - 82 P₂O₅ - 0 K₂O - 61.5 S lb/acre) was incorporated into the seedbed in August 17, 1987 prior to planting. On April 4, 1988, 500 pounds of 16-20-0-15 (80 N - 100 P₂O₅ - 0 K₂O - 75 S lb/acre) was top-dressed for the 1988 season. The rest of the fertility program is presented in Table 3.

Table 2 Soil test results values from samples taken on June 1, 1987, at the Central Oregon Ag Research Center, Powell Butte site.

Soil Depth (in.)	pH	P (ppm)	K (ppm)	N-NO ₃ (ppm)
0-12	6.5	13	281	6.2

Table 3. Nitrogen and sulfur fertilizer applied annually per cutting in the trial in pounds per acre at Powell Butte.

Year	1 st Cut		2 nd Cut		3 rd Cut		Total	
	N	S	N	S	N	S	N	S
1987 (establish year)	66	62	N/A		N/A		66	62
1988	80	75	---		---		80	75
1989	80	60	80	0	---		160	60
1990	90	60	80	0	---		170	60
1991	100	60	90	0	90	0	280	60

Plot size harvested in 1991 was 3.5 x 15 ft. Approximately one to two pound forage sample was oven-dried to determine dry matter. Moisture and quality samples were dried at 149°F. Yield and all quality variable results are reported on an oven dry weight basis.

Forage samples were ground with a Wiley mill with a 1.0 mm screen. The samples were reground in an Udy mill with a 0.5 mm screen. The samples were submitted for NIRS quality prediction analysis at the Klamath Experiment Station in 1992. The NIRS has not been calibrated for every variable predicted. No chemical analyses were performed on any of these orchardgrass samples. The NIRS provides good relative values between cuttings and cultivars.

Term Definitions are as follows:

TDN = total digestible nutrients (Penn State calculation)

TDN CA = total digestible nutrients (California calculation)

TDN TRIST = total digestible nutrients (Tristate 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 invitro 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

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

$$\text{NDFD} = \text{dNDF 48 hour} / \text{NDF} * 100$$

$$\text{NFC} = 100 - ((\text{NDF} - 2) + \text{Protein} + 2.5 + \text{Ash})$$

$$\text{TDNL} = (\text{NFC} * 0.98) + (\text{Protein} * 0.93) + (1.5 * 0.97 * 2.25) + ((\text{NDF} - 2) * (\text{NDFD} / 100)) - 7$$

$$\text{DMI1} = (((0.0120 * 1350) / (\text{NDF} / 100))) + ((\text{NDFD} - 45) * 0.374) / 1350 * 100$$

$$\text{RFQ} = (\text{DMI1} * \text{TDNL}) / 1.23$$

$$\text{Lb of uptake N per ton DM} = \text{N uptake} / \text{Yield (ton/acre)}$$

$$1 \text{ lb of uptake N} = \text{lb of DM (yield)} = \text{pounds of DM yield/acre} / \text{pounds of uptake N/acre}$$

$$\text{Lb of fertilizer N per ton of DM} = \text{pounds of fertilizer N applied} / \text{tons DM yield}$$

$$1 \text{ lb of fertilizer N} = \text{lb of DM} = \text{pounds of DM yield/acre} / \text{pounds of fertilizer N/acre}$$

$$\text{Total N uptake} = \text{total yield (lb/acre)} * \text{percent N}$$

$$\text{N use efficiency} = \text{N uptake} / \text{N applied}$$

$$\text{Extra N uptake} = \text{total N uptake} - \text{total N applied}$$

$$\text{Protein yield} = \text{percent protein} * \text{DM yield (lb/acre)}$$

$$\text{ADF yield} = (100 - \text{ADF}) * \text{DM yield (lb/acre)}$$

$$\text{TDN yield} = \text{TDN} * \text{DM yield (lb/acre)}$$

$$\text{DDM yield} = \text{DDM} * \text{DM yield (lb/acre)}$$

The USDA grass hay quality guidelines are presented in table 4.

Table 4. USDA grass hay quality guidelines.

Quality Designation	Crude Protein (%)
Premium	> 13
Good	9-13
Fair	5-9
Low	< 5

MSTAT statistical software was used for ANOVA's and separation of means.

Results and Discussion

Yield results for the 1988 crop year are published in "Central Oregon Crop Research 1987-1988, OSU Agricultural Experiment Station Special Report 847, October 1989". The forage yield data for 1989, 1990, 1991, and 1992 are published in "Central Oregon Crop Research 1987-1988, OSU Agricultural Experiment Station Special Report 922, October 1990-1992". Quality (and yield again) results are presented in this article are only from 1991.

Total Yield and Other Total Variables

The total yield and total other variables for the 1991 orchardgrass variety trial are presented in Table 5a and 5b.

There were significant differences between varieties for total yield, pounds of DM produced by a lb of uptake N, total protein yield, total N uptake, total N use efficiency, total extra N uptake, total ADF yield, total TDN yield, total DDM yield, total Ca uptake, total P uptake, and K uptake. The top ranked varieties for yield were Napier, Potomac, SYN 887, Comet, Sterling, Paiute, and Latar; there were no significant differences between these varieties for yield. There were differences between varieties for lb of fertilizer to produce 1 ton of DM and total lb of DM produced from a pound of applied fertilizer N. There were some significant differences for total protein yield, total ADF yield, total TDN yield, and total DDM yield. The differences followed the ranking of yield. Total Ca, P, and K uptake were different for the varieties, which would of course have been directly related to yield.

Table 5a. Total yield, pounds of uptake N to produce a ton of DM, 1 lb of uptake N to produce pounds of DM, pounds fertilizer N to produce 1 ton of DM, 1 pound of Fertilizer N to produce pounds of DM, total N use efficiency, and total extra N uptake results for the August planted orchardgrass variety trial at the COARC, Powell Butte, Oregon. (sorted by yield)

Entry # / Variety	Total Yield O% (t/ac)	Lb of Uptake N per ton DM	1 lb of Uptake N = lb of DM	Lb of Fert N = ton DM	1 lb of Fert N = lb of DM	Total N Uptake (lb/ac)	Total N Use Eff. > Fert. N (%)	Total Extra N Uptake (lb/ac)
9 Napier	7.17	40.2	49.8	39.2	51.2	288.0	102.9	8.0
12 Potomac	7.02	40.3	49.8	40.1	50.1	281.8	100.6	1.8
8 SYN 887	6.86	38.8	51.7	41.0	49.0	265.9	95.0	-14.2
4 Comet	6.85	41.8	48.0	41.0	48.9	285.6	102.0	5.6
13 Sterling	6.80	40.9	49.0	41.3	48.6	278.3	99.4	-1.8
10 Paiute	6.75	40.1	50.0	41.8	48.2	270.1	96.5	-9.9
11 Latar	6.70	40.1	50.0	42.3	48.8	268.4	95.9	-11.6
5 Orion	6.46	39.2	51.1	43.4	46.1	253.1	90.4	-26.9
3 Ambassador	6.43	39.8	50.3	43.8	45.9	256.2	91.5	-23.9
1 Rancho	6.34	41.3	48.4	44.4	45.3	262.0	93.6	-18.0
6 Syn 85M	6.19	39.5	50.8	45.4	44.3	243.8	87.1	-36.2
7 Syn 885	6.05	41.7	48.1	47.0	43.2	250.8	89.6	-29.2
2 Phyllox	5.91	40.8	49.2	47.5	42.2	240.9	86.0	-39.1
Mean	6.58	0.4115	49.7	42.9	47.0	265.0	94.6	-15.0
PLSD 0.01	0.86	NS	NS	5.8	6.2	37.7	NS	NS
PLSD 0.05	0.64	NS	NS	4.4	4.6	28.1	10.0	28.1
PLSD 0.10	0.54	NS	NS	3.6	3.8	23.4	8.4	23.4
Prob. > F	0.0064	0.4115	0.4139	0.0066	0.0063	0.0160	0.0159	0.0160
CV %	6.8	4.4	4.4	7.1	6.8	7.4	7.4	-130.5

Table 5b. Total protein yield, ADF yield, total TDN yield, total DDM yield, total calcium uptake, total phosphorus uptake, total potassium uptake, and total magnesium uptake results for the 1991 orchardgrass variety trial planted in August of 1987 at the COARC, Powell Butte, Oregon.

Entry # / Variety	Total Protein Yield (lb/ac)	Total ADF Yield (lb/ac)	Total TDN Yield (lb/ac)	Total DDM Yield (lb/ac)	Total Ca Uptake (lb/ac)	Total P Uptake (lb/ac)	Total K Uptake (lb/ac)	Total Mg Uptake (lb/ac)
9 Napier	1,800	9,499	8,248	8,977	53.5	41.1	489.1	20.0
12 Potomac	1,761	9,269	8,043	8,763	54.7	38.9	469.3	21.1
8 SYN 887	1,662	9,031	7,826	8,545	49.3	37.9	459.5	19.7
4 Comet	1,785	9,061	7,867	8,565	48.3	39.3	471.5	20.5
13 Sterling	1,739	9,016	7,829	8,520	52.9	39.3	467.0	20.9
10 Paiute	1,688	8,878	7,693	8,401	46.6	38.3	460.0	19.4
11 Latar	1,677	8,800	7,622	8,329	48.3	36.9	435.0	19.7
5 Orion	1,582	8,464	7,224	8,014	41.8	37.7	436.4	18.4
3 Ambassador	1,601	8,493	7,368	8,030	47.9	35.4	412.0	18.3
1 Rancho	1,638	8,438	7,340	7,967	49.4	36.2	421.0	18.7
6 Syn 85M	1,524	8,178	7,095	7,733	40.1	35.3	410.8	18.5
7 Syn 885	1,568	8,168	7,140	7,693	48.0	34.9	401.0	18.8
2 Phyllox	1,505	7,921	6,904	7,472	44.8	34.5	398.4	17.6
Mean	1,656	8,709	7,561	8,231	48.1	37.3	440.8	19.3
PLSD 0.01	NS	NS	NS	NS	7.5	NS	NS	NS
PLSD 0.05	176	888	784	832	5.6	NS	59.5	NS
PLSD 0.10	146	739	653	692	4.7	3.6	49.5	NS
Prob. > F	0.0160	0.0254	0.0381	0.0201	0.0001	0.0815	0.0386	0.1510
CV %	7.4	7.1	7.2	7.1	8.1	8.1	9.4	9.0

First Cutting

The yield, dry matter, moisture, protein, ADF, NDF, TDN, DDM, DMI, and RFV variables are presented in Table 6.

There were no differences in yield between the top 8 yielding entries. The differences in quality were, in general, the inverse order of yield for ADF, NDF, TDN, DDM, DMI, and RFV. The two lowest yielding varieties (SYN 885 and Phyllox), had significantly higher quality than most of the other entries. There were about 8 of the varieties that were not significantly different from each other for variables ADF, NDF, TDN, DDM, DMI, and RFV. Potomac, Sterling, and Comet were in the top half of the second tier grouping for overall quality. Potomac was one of the highest yielding and had high quality. Paiute, one of the highest yielding varieties, was ranked last for overall quality. Differences in plant growth stage maturity were not measured.

All of the varieties produced “good” quality hay though, based on the USDA grass hay quality guidelines (table 3).

Table 6. First cutting yield, dry matter, moisture, protein, ADF, NDF, TDN, DDM, DMI, and RFV for the 1991 production year of the Orchardgrass variety trial planted in 1987 at the COARC, Powell Butte, Oregon.

Entry # / Variety	Yield									
	DM (t/ac)	DM (%)	Moist. (%)	Protein (%)	ADF (%)	NDF (%)	TDN (%)	DDM (%)	DMI (%)	RFV
10 Paiute	3.57	26.8	73.2	9.8	36.3	58.2	54.7	60.7	2.07	97
12 Potomac	3.56	26.5	73.5	10.7	34.5	55.2	56.7	62.1	2.18	105
9 Napier	3.55	26.0	74.1	10.3	34.9	56.2	56.3	61.8	2.14	102
8 Syn 887	3.44	26.1	73.9	9.7	35.4	57.3	55.7	61.4	2.10	100
5 Orion	3.42	23.9	76.1	10.0	35.7	57.7	55.3	61.1	2.08	99
4 Comet	3.34	26.0	74.0	11.0	34.8	56.1	56.3	61.8	2.14	103
3 Ambassador	3.33	26.1	74.0	10.3	34.8	56.5	56.3	61.8	2.12	102
13 Sterling	3.27	24.7	75.3	10.8	34.0	55.0	57.3	62.4	2.18	106
1 Rancho	3.16	24.5	75.5	10.6	34.6	56.5	56.5	61.9	2.13	102
11 Latar	3.16	24.6	75.4	10.7	34.6	56.4	56.6	62.0	2.13	102
6 Syn 85M	2.98	24.1	75.9	10.5	34.3	56.2	56.9	62.2	2.14	103
7 Syn 885	2.92	26.1	73.9	11.0	32.7	54.3	58.8	63.5	2.21	109
2 Phyllox	2.89	25.7	74.3	10.1	32.6	53.4	58.9	63.5	2.25	111
Mean	3.28	25.5	74.5	10.4	34.5	56.1	56.6	62.0	2.14	103
PLSD 0.01	NS	NS	NS	NS	2.1	2.8	2.4	1.6	0.11	8
PLSD 0.05	0.47	NS	NS	NS	1.5	2.1	1.8	1.2	0.08	6
PLSD 0.10	0.39	NS	NS	(0.8)	1.3	1.7	1.5	1.0	0.07	5
Prob. > F	0.0375	-----	-----	0.1018	0.0010	0.0022	0.0012	0.0010	0.0026	0.0013
CV %	9.9	8.0	2.7	6.1	3.1	2.6	2.2	1.4	2.6	3.8

--- = MSTAT does not print out a Prob. > F number when very high.

First cutting nitrogen use efficiency, extra N uptake, lb of uptake N to produce a ton of DM, 1 lb of uptake N to produce lb of DM, lb of fertilizer N to produce a ton of DM, 1 lb of fertilizer N produces lb of DM, protein yield, ADF yield, TND yield, and DDM yield are presented in Table 7.

There were no differences in N use efficiency and extra N uptake, nor were there any differences in protein, ADF, TDN, and DDM yield. There were differences between varieties however with the pounds of uptake N to produce a ton of DM, 1 pound of uptake N to produce a ton/acre of DM, pounds of fertilizer N to produce a ton of DM, and 1 pound of fertilizer N produced pounds of DM.

Table 7. First cutting nitrogen use efficiency, extra N uptake, lb of uptake N to produce a ton of DM, 1 lb of uptake N to produces lb of DM, lb of fertilizer N to produce a ton of DM, 1 lb of fertilizer N produces lb of DM, protein yield, ADF yield, TND yield, and DDM yield for the 1991 production year of the Orchardgrass variety trial planted in 1987 at the COARC, Powell Butte, Oregon. (Sorted by N use efficiency)

Entry # / Variety	N Use Eff (%)	Extra N Uptake (lb/ac)	Lb of Uptake N = ton of DM	1 lb of Uptake N = lb of DM	Lb of Fert N = ton of DM	1 lb of Fert N = lb of DM	Protein Yield (lb/ac)	ADF Yield (lb/ac)	TDN Yield (lb/ac)	DDM Yield (lb/ac)
12 Potomac	120.9	20.9	34.2	58.8	28.4	71.2	756	4,653	4,022	4,407
9 Napier	117.5	17.5	33.1	60.5	28.4	71.0	734	4,616	3,985	4,377
4 Comet	116.8	16.8	35.1	57.3	30.0	66.8	730	4,356	3,764	4,128
13 Sterling	112.6	12.6	34.5	58.2	30.9	65.4	704	4,313	3,741	4,079
10 Paiute	111.7	11.7	31.2	64.4	28.5	71.5	698	4,554	3,905	4,334
3 Ambassador	109.4	9.4	32.9	61.1	30.2	66.6	684	4,344	3,754	4,117
5 Orion	109.2	9.2	32.0	62.6	29.6	68.3	683	4,397	3,782	4,177
11 Latar	108.6	8.6	34.1	58.8	32.5	63.3	679	4,143	3,584	3,923
1 Rancho	107.0	7.0	33.8	59.3	31.9	63.2	669	4,126	3,566	3,908
8 Syn 887	106.3	6.3	31.0	64.9	29.3	68.7	664	4,438	3,823	4,213
7 Syn 885	101.6	1.6	35.1	57.1	35.5	58.4	635	3,932	3,432	3,705
6 Syn 85M	99.3	-0.8	33.4	60.1	33.8	59.7	621	3,919	3,394	3,710
2 Phyllox	93.3	-6.7	32.4	62.0	35.3	57.8	583	3,885	3,391	3,662
Mean	108.8	8.8	33.3	60.4	31.1	65.5	680	4,283	3,703	4,057
PLSD 0.01	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
PLSD 0.05	NS	NS	NS	NS	4.8	9.3	NS	NS	NS	NS
PSD 0.10	NS	NS	2.5	4.6	4.0	7.8	NS	NS	NS	NS
Prob. > F	0.1899	0.1899	0.0987	0.1004	0.0322	0.0376	0.1892	0.1836	0.2777	0.1433
CV %	11.7	144.7	6.2	6.3	10.8	9.9	11.7	10.1	10.3	10.1

The first cutting percent N, N uptake, percent P, P uptake, percent Ca, Ca uptake, percent K, K uptake, percent Mg, and Mg uptake are presented in table 8.

There were somewhat significant differences between varieties in percent N which would be the same as the percent protein variable. There was a large range in N uptake for the varieties, though they were not significantly different. There were differences between varieties for percent P, percent Ca, Ca uptake, and K uptake. The uptakes that were significant would be directly related to yield.

Table 8. First cutting percent N, N uptake, percent P, P uptake, percent Ca, Ca uptake, percent K, K uptake, percent Mg, and Mg uptake for the 1991 production year of the orchardgrass variety trial planted in 1987 at the COARC, Powell Butte, Oregon. (sorted by N uptake)

Variety	N		P		Ca		K		Mg	
	N (%)	Uptake (lb/ac)	P (%)	Uptake (lb/ac)	Ca (%)	Uptake (lb/ac)	K (%)	Uptake (lb/ac)	Mg (%)	Uptake (lb/ac)
12 Potomac	1.71	120.9	0.260	18.5	0.283	19.7	3.16	224.8	0.133	9.3
9 Napier	1.65	117.5	0.263	18.7	0.260	18.3	3.17	225.5	0.117	8.4
4 Comet	1.76	116.8	0.260	17.4	0.215	14.4	3.20	213.6	0.125	8.4
13 Sterling	1.73	112.6	0.270	17.6	0.273	17.8	3.19	208.4	0.132	8.7
10 Paiute	1.57	111.7	0.253	18.0	0.200	14.3	3.14	223.3	0.117	8.4
3 Ambassador	1.65	109.4	0.255	17.0	0.253	16.9	2.97	197.9	0.117	7.9
5 Orion	1.60	109.2	0.273	18.6	0.185	12.6	3.13	213.2	0.120	8.2
11 Latar	1.71	108.6	0.260	16.5	0.215	14.0	3.01	190.2	0.127	8.1
1 Rancho	1.70	107.0	0.267	16.9	0.240	15.1	3.07	194.3	0.120	7.6
8 Syn 887	1.55	106.3	0.250	17.2	0.237	16.3	3.03	208.1	0.120	8.3
7 Syn 885	1.76	101.6	0.267	15.5	0.275	16.1	3.08	179.2	0.130	7.6
6 Syn 85M	1.68	99.3	0.267	15.9	0.195	11.5	3.14	187.2	0.130	7.7
2 Phyllox	1.62	93.3	0.270	15.6	0.265	15.1	3.05	176.6	0.122	7.1
Mean	1.66	108.8	0.263	17.2	0.238	15.5	3.10	203.3	0.124	8.1
PLSD 0.01	NS	NS	NS	NS	0.086	NS	NS	NS	NS	NS
PLSD 0.05	NS	NS	*	NS	0.064	4.1	NS	NS	NS	NS
PLSD 0.10	(0.13)	NS	*	NS	0.054	3.4	NS	29.5	NS	NS
Prob. > F	0.1018	0.1899	0.0308	0.1852	0.0077	0.0161	-----	0.0705	0.1742	0.3515
CV %	6.1	11.7	3.7	10.5	16.5	18.5	6.1	12.1	7.7	13.1

* significant, but error mean square was too small (< 0.000) for MSTAT, to determine PLSD's
 ----- = MSTAT does not provide a Prob. > F number when very high.

First cutting ADP, AV protein, D protein, NEL, ENE, ME, NEM, and NEG data are presented in Table 9.

Phyllox and SYN 885 had higher NEL, ENE, ME, NEM, and NEG values than the rest of the varieties. There were differences in AV protein and D protein as well. The two lowest yielding varieties, 'Phyllox' and 'Syn 885', had the highest energy numbers. 'Sterling' and 'Potomac', two of the highest yielding entries, ranked #4 and #6 for having the best energy, out of the 13 entries. 'Paiute', the highest numerical yielder on first cutting, ranked last for energy, but was not significantly different from the bottom 3 entries.

Table 9. First cutting ADP, AV protein, D protein, NEL, ENE, ME, NEM, and NEG results for the 1991 production year of the orchardgrass variety trial planted in August, 1987 at the COARC, Powell Butte, Oregon. (sorted by ENE)

Variety	ADP	AV Protein (%)	D Protein (%)	NEL (mcal/lb)	ENE (mcal/lb)	ME (mcal/lb)	NEM (mcal/lb)	NEG (mcal/lb)
2 Phyllox	0.227	11.4	8.1	0.680	56.2	0.968	0.580	0.320
7 Syn 885	0.325	12.3	8.5	0.683	56.2	0.965	0.575	0.320
13 Sterling	0.325	12.0	8.4	0.663	54.8	0.942	0.553	0.297
6 Syn 85M	0.358	11.5	8.1	0.663	54.5	0.935	0.547	0.293
12 Potomac	0.352	11.8	8.3	0.657	54.3	0.930	0.545	0.290
1 Rancho	0.385	11.6	8.1	0.655	54.2	0.927	0.543	0.288
11 Latar	0.355	11.8	8.3	0.657	54.2	0.927	0.545	0.288
3 Ambassador	0.375	11.3	8.0	0.653	54.0	0.928	0.538	0.282
4 Comet	0.365	12.1	8.5	0.652	54.0	0.925	0.540	0.283
9 Napier	0.357	11.5	8.0	0.652	53.9	0.920	0.540	0.282
8 Syn 887	0.368	10.6	7.6	0.647	53.4	0.913	0.530	0.273
5 Orion	0.328	11.1	7.9	0.642	53.1	0.910	0.522	0.270
10 Paiute	0.377	10.7	7.6	0.635	52.5	0.898	0.515	0.260
Mean	0.346	11.5	8.1	0.657	54.2	0.930	0.544	0.288
PLSD 0.01	NS	NS	NS	*	2.1	*	*	*
PLSD 0.05	NS	1.0	0.6	*	1.6	*	*	*
PLSD 0.10	NS	0.8	0.5	*	1.3	*	*	*
Prob. > F	0.1094	0.0497	0.0321	0.0008	0.0011	0.0017	0.0024	0.0006
CV %	18.1	6.1	4.9	2.0	2.0	2.3	3.6	6.0

* significant, but error mean square was too small (< 0.000) for MSTAT software, to determine PLSD's

Second Cutting

Second cutting yield, dry matter, moisture, protein, ADF, NDF, TDN, DDM, DMI, and RFV are presented in Table 10.

There was no difference between the top 6 yielding varieties (PLSD 0.10). Interestingly, there were differences between varieties for harvest moisture and DM. There were no differences in quality (protein, ADF, NDF, TDN, DDM, DMI, and RFV).

All of the varieties produced “premium” quality hay based on the USDA grass hay quality guidelines (protein).

Table 10. Second cutting yield, dry matter, moisture, protein, ADF, NDF, TDN, DDM, DMI, and RFV for the 1991 production year of the Orchardgrass variety trial planted in 1987 at the COARC, Powell Butte, Oregon. (sorted by yield)

Variety	Yield (t/ac)	DM (%)	Moist. (%)	Protein (%)	ADF (%)	NDF (%)	TDN (%)	DDM (%)	DMI (%)	RFV
9 Napier	2.38	25.0	75.0	14.3	35.6	57.5	55.4	61.2	2.09	99
13 Sterling	2.33	25.4	74.6	14.3	36.9	58.9	53.9	60.2	2.04	95
11 Latar	2.29	24.0	76.0	13.8	37.3	59.8	53.5	59.9	2.01	93
4 Comet	2.28	24.6	75.4	14.7	36.1	58.1	54.9	60.8	2.07	98
8 Syn 887	2.26	23.3	76.7	14.1	35.8	57.9	55.2	61.0	2.08	98
12 Potomac	2.18	26.7	73.3	14.0	36.7	59.2	54.2	60.3	2.03	95
6 Syn 85M	2.12	23.6	76.5	13.2	37.2	60.4	53.5	59.9	1.99	92
5 Orion	2.05	23.5	76.6	14.0	37.0	58.6	53.9	60.2	2.05	96
3 Ambassador	2.03	25.9	74.1	14.2	36.2	58.8	54.7	60.7	2.04	96
1 Rancho	2.02	25.2	74.8	15.2	35.5	57.9	55.6	61.3	2.08	99
10 Paiute	1.99	26.1	73.9	14.9	35.6	57.1	55.5	61.2	2.11	100
2 Phyllox	1.95	24.4	75.6	14.4	36.1	58.1	54.8	60.8	2.07	97
7 Syn 885	1.95	23.7	76.3	14.7	35.4	58.6	55.7	61.3	2.05	97
Mean	2.14	24.7	75.3	14.3	36.3	58.5	54.7	60.7	2.05	97
PLSD 0.01	0.33	2.4	2.4	NS	NS	NS	NS	NS	NS	NS
PLSD 0.05	0.24	1.8	1.8	NS	NS	NS	NS	NS	NS	NS
PLSD 0.10	0.20	1.5	1.5	NS	NS	NS	NS	NS	NS	NS
Prob. > F	0.0033	0.0036	0.0036	0.1452	0.2900	-----	0.2796	0.3021	-----	0.3955
CV %	8.0	5.0	1.7	5.8	3.3	3.4	2.5	1.6	3.6	5.1

----- = MSTAT does not provide a Prob. > F number when very high.

Second cutting nitrogen use efficiency, extra N uptake, lb of uptake N to produce a ton of DM, 1 lb of uptake N to produces lb of DM, lb of fertilizer N to produce a ton of DM, 1 lb of fertilizer N produces lb of DM, protein yield, ADF yield, TDN yield, and DDM yield are presented in Table 11.

There were differences between varieties in all of these variables with the exception of lb of uptake N to produce a ton of DM and 1 lb of uptake N to produce pounds of DM. There were no differences between the top five varieties for nitrogen use efficiency, protein yield, ADF yield, TDN yield, and DDM yield.

Table 11. Second cutting nitrogen use efficiency, extra N uptake, lb of uptake N to produce a ton of DM, 1 lb of uptake N to produces lb of DM, lb of fertilizer N to produce a ton of DM, 1 lb of fertilizer N produces lb of DM, protein yield, ADF yield, TDN yield, and DDM yield for the 1991 production year of the Orchardgrass variety trial planted in 1987 at the COARC, Powell Butte, Oregon. (sorted by N use efficiency)

Entry # / Variety	N Use Eff (%)	Extra N Uptake (lb/ac)	Lb Uptake N = ton of DM	1 lb of Uptake N = lb of DM	Lb of Fert N = ton of DM	1 lb of Fert N = lb of DM	Protein Yield (lb/ac)	ADF Yield (lb/ac)	TDN Yield (lb/ac)	DDM Yield (lb/ac)
9 Napier	121.2	19.0	45.9	43.7	37.8	52.9	682	3062	2633	2908
4 Comet	119.4	17.5	47.2	42.5	39.6	50.7	672	2917	2504	2775
13 Sterling	118.1	16.2	45.6	44.0	38.7	51.8	664	2940	2511	2802
8 Syn 887	112.9	11.6	45.0	44.6	40.1	50.1	635	2898	2491	2754
11 Latar	112.5	11.3	44.3	45.2	39.8	50.9	633	2870	2447	2740
1 Rancho	108.9	8.0	48.5	41.4	44.5	45.0	613	2614	2251	2482
12 Potomac	108.2	7.4	44.7	45.2	41.5	48.4	609	2755	2357	2625
10 Paiute	105.4	4.8	47.6	42.2	45.3	44.2	593	2564	2207	2435
3 Ambassador	102.4	2.2	45.4	44.3	44.9	45.0	576	2585	2217	2460
7 Syn 885	102.0	1.8	47.1	42.6	46.2	43.4	574	2522	2172	2394
5 Orion	101.5	1.4	44.7	44.8	44.5	45.6	571	2582	2205	2463
2 Phyllox	100.1	0.0	46.2	43.3	46.4	43.3	563	2488	2135	2366
6 Syn 85M	99.8	-0.2	42.2	47.7	42.7	47.1	562	2663	2272	2540
Mean	108.6	7.8	45.7	44.0	42.5	47.6	611	2728	2339	2596
PLSD 0.01	NS	NS	NS	NS	6.6	7.3	NS	419	364	396
PLSD 0.05	14.6	13.1	NS	NS	4.9	5.4	82	312	272	296
PLSD 0.10	12.1	10.9	NS	NS	4.1	4.5	68	260	226	246
Prob. > F	0.0309	0.0317	0.1484	0.2007	0.0046	0.0033	0.0316	0.0052	0.0069	0.0046
CV %	9.3	117.9	5.8	6.3	8.1	8.0	9.4	8.0	8.1	7.9

Second cutting percent N, N uptake, percent P, P uptake, percent Ca, Ca uptake, percent K, K uptake, percent Mg, and Mg uptake are presented in Table 12.

There were no differences in the top 5 orchardgrass varieties for N uptake. There were significant differences between varieties for P, Ca, and K uptake, but no differences for the percent P, Ca, K, and Mg minerals. Yield was the contributing factor for the amount of uptake differences.

Table 12. Second cutting percent N, N uptake, percent P, P uptake, percent Ca, Ca uptake, percent K, K uptake, percent Mg, and Mg uptake for the 1991 production year of the Orchardgrass variety trial planted in 1987 at the COARC, Powell Butte, Oregon. (sorted by N uptake)

Entry # / Variety	N (%)	N Uptake (lb/ac)	P (%)	P Uptake (lb/ac)	Ca (%)	Ca Uptake (lb/ac)	K (%)	K Uptake (lb/ac)	Mg (%)	Mg Uptake (lb/ac)
9 Napier	2.29	109.0	0.313	14.9	0.365	17.4	3.92	186.3	0.163	7.7
4 Comet	2.35	107.5	0.313	14.3	0.358	16.3	3.96	180.7	0.178	8.1
13 Sterling	2.29	106.2	0.305	14.2	0.370	17.3	3.96	184.6	0.180	8.4
8 Syn 887	2.26	101.6	0.300	13.6	0.353	15.9	3.97	179.4	0.168	7.6
11 Latar	2.21	101.3	0.295	13.5	0.352	16.1	3.72	170.7	0.165	7.6
1 Rancho	2.43	98.0	0.308	12.5	0.397	16.1	3.88	157.4	0.180	7.3
12 Potomac	2.24	97.4	0.295	12.9	0.360	15.7	3.85	167.8	0.173	7.6
10 Paiute	2.38	94.8	0.323	12.8	0.358	14.3	4.01	159.8	0.175	7.0
3 Ambassador	2.27	92.2	0.295	12.0	0.375	15.2	3.74	151.5	0.173	7.0
7 Syn 885	2.35	91.8	0.310	12.1	0.380	14.8	3.84	149.9	0.183	7.1
5 Orion	2.24	91.4	0.310	12.7	0.340	13.9	3.87	159.9	0.165	6.8
2 Phyllox	2.30	90.0	0.310	12.1	0.365	14.2	3.96	154.1	0.180	7.0
6 Syn 85M	2.11	89.8	0.297	12.6	0.300	12.8	3.74	158.7	0.168	7.1
Mean	2.29	97.8	0.306	13.1	0.359	15.4	3.88	166.2	0.173	7.4
PLSD 0.01	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
PLSD 0.05	NS	13.1	NS	NS	NS	2.7	NS	NS	NS	NS
PLSD 0.10	NS	10.9	NS	1.6	NS	2.3	NS	22.2	NS	NS
Prob. > F	0.1452	0.0317	0.3660	0.0545	0.2741	0.0485	0.3714	0.0640	-----	0.3017
CV %	5.8	9.4	5.3	10.0	11.3	12.3	4.8	11.2	8.5	11.6

----- = MSTAT does not give a Prob. > F number when very high.

Second cutting ADP, AV protein, D protein, NEL, ENE, ME, NEM, and NEG are presented in Table 13.

There were no differences between varieties for any of the variables.

Table 13. Second cutting ADP, AV protein, D protein, NEL, ENE, ME, NEM, and NEG for the 1991 production year of the Orchardgrass variety trial planted in 1987 at the COARC, Powell Butte, Oregon. (sorted by ENE)

Variety	AV		D		NEL (mcal/lb)	ENE (mcal/lb)	ME (mcal/lb)	NEM (mcal/lb)	NEG (mcal/lb)
	ADP	Protein (%)	Protein (%)						
1 Rancho	0.647	16.5	10.9	0.645	53.3	0.913	0.527	0.273	
2 Phyllox	0.610	15.8	10.5	0.637	52.6	0.900	0.515	0.265	
3 Ambassador	0.627	15.5	10.3	0.635	52.5	0.900	0.515	0.260	
4 Comet	0.580	16.2	10.7	0.638	52.7	0.902	0.517	0.263	
5 Orion	0.610	15.3	10.2	0.627	51.8	0.883	0.500	0.248	
6 Syn 85M	0.668	14.3	9.6	0.625	51.5	0.880	0.492	0.242	
7 Syn 885	0.655	16.0	10.6	0.647	53.4	0.913	0.527	0.273	
8 Syn 887	0.550	15.4	10.3	0.642	53.0	0.905	0.522	0.267	
9 Napier	0.527	15.8	10.5	0.642	53.1	0.907	0.527	0.270	
10 Paiute	0.568	16.4	10.9	0.645	53.2	0.910	0.525	0.273	
11 Latar	0.645	15.0	10.0	0.623	51.4	0.877	0.495	0.242	
12 Potomac	0.638	15.2	10.2	0.632	52.0	0.887	0.507	0.250	
13 Sterling	0.637	15.5	10.3	0.630	51.8	0.888	0.500	0.250	
Mean	0.613	15.6	10.4	0.636	52.5	0.897	0.513	0.260	
PLSD 0.01	NS	NS	NS	NS	NS	NS	NS	NS	
PLSD 0.05	NS	NS	NS	NS	NS	NS	NS	NS	
PLSD 0.10	NS	NS	NS	NS	NS	NS	NS	NS	
Prob. > F	-----	0.1246	0.1355	0.3320	0.2790	0.2772	0.2928	0.2617	
CV %	17.7	6.2	5.5	2.4	2.4	2.5	4.5	7.9	

----- = MSTAT does not give a Prob. > F number when very high.

Third Cutting

Third cutting yield, dry matter, moisture, protein, ADF, NDF, TDN, DDM, DMI, and RFV are presented in Table 14.

There were differences only with the NDF and RFV variables. Though there were no differences between varieties for protein, all of the entries would have had premium quality hay based on USDA grass hay quality guidelines. Orion had the lowest NDF and highest RFV value and was almost significantly lower and higher than all other varieties. There was 3.8 % NDF difference between varieties and 16 points difference in RFV values. While there was a fair difference between varieties for yield, though there were no statistical differences.

Table 14. Third cutting yield, dry matter, moisture, protein, ADF, NDF, TDN, DDM, DMI, and RFV for the 1991 production year of the Orchardgrass variety trial planted in August of 1987 at the COARC, Powell Butte, Oregon. (sorted by yield)

Variety	Yield (t/ac)	DM (%)	Moist. (%)	Protein (%)	ADF (%)	NDF (%)	TDN (%)	DDM (%)	DMI (%)	RFV
12 Potomac	1.28	32.0	68.0	15.7	27.2	46.4	65.1	67.7	2.59	136
9 Napier	1.25	32.0	68.0	15.6	26.9	45.7	65.5	68.0	2.63	139
11 Latar	1.24	31.3	68.7	14.7	28.1	46.9	64.0	67.0	2.56	133
4 Comet	1.23	32.3	67.7	15.7	27.0	46.3	65.3	67.9	2.60	137
13 Sterling	1.21	30.7	69.3	15.3	27.1	46.6	65.3	67.8	2.58	136
10 Paiute	1.19	29.3	70.7	16.7	25.9	45.1	66.5	68.7	2.66	142
8 Syn 887	1.18	31.6	68.4	15.5	27.8	47.3	64.4	67.3	2.55	133
7 Syn 885	1.17	31.7	68.3	15.3	26.9	46.3	65.4	68.0	2.60	137
1 Rancho	1.15	32.2	67.8	15.4	26.3	45.2	66.1	68.4	2.66	141
6 Syn 85M	1.09	32.1	67.9	15.8	26.6	46.0	65.8	68.2	2.62	138
2 Phyllox	1.08	31.8	68.2	16.7	28.2	47.3	64.0	66.9	2.54	132
3 Ambassador	1.07	31.5	68.5	16.0	27.1	45.9	65.3	67.8	2.62	138
5 Orion	0.99	30.1	69.9	16.5	25.3	43.5	67.3	69.2	2.76	148
Mean	1.16	31.4	68.6	15.7	26.9	46.0	65.4	67.9	2.61	138
PLSD 0.01	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
PLSD 0.05	NS	NS	NS	NS	NS	2.0	NS	NS	0.11	9
PLSD 0.10	NS	NS	NS	NS	NS	1.7	NS	NS	0.09	7
Prob. > F	0.3332	-----	-----	0.1913	0.1611	0.0401	0.1609	0.1439	0.0308	0.0453
CV %	13.2	7.6	3.5	9.1	4.9	3.1	2.3	1.5	3.0	4.4

----- = MSTAT does not give a Prob. > F number when very high.

Third cutting percent N, N uptake, percent P, P uptake, percent Ca, Ca uptake, percent K, K uptake, percent Mg, and Mg uptake are presented in Table 15.

There were no differences between any of the varieties for these variables.

Table 15. Third cutting percent N, N uptake, percent P, P uptake, percent Ca, Ca uptake, percent K, K uptake, percent Mg, and Mg uptake for the 1991 production year of the Orchardgrass variety trial planted in August of 1987 at the COARC, Powell Butte, Oregon. (sorted by N use efficiency)

Entry # / Variety	N Use Eff (%)	Extra N Uptake (lb/ac)	Lb Uptake N = ton of DM	1 lb Uptake N = lb of DM	Lb of Fert N = ton of DM	1 lb of Fert N = lb of DM	Protein Yield (lb/ac)	ADF Yield (lb/ac)	TDN Yield (lb/ac)	DDM Yield (lb/ac)
10 Paiute	70.7	-26.4	53.6	37.6	76.4	26.4	398	1760	1581	1633
12 Potomac	70.6	-26.5	50.0	40.4	71.4	28.4	397	1861	1663	1731
9 Napier	68.3	-28.6	49.8	40.6	73.9	27.7	384	1821	1630	1693
4 Comet	68.1	-28.7	50.2	40.5	73.9	27.2	383	1788	1600	1662
13 Sterling	66.0	-30.6	49.1	40.9	75.7	26.8	372	1763	1577	1639
11 Latar	65.1	-31.4	47.1	42.8	73.9	27.6	366	1787	1592	1666
8 Syn 887	64.5	-32.0	49.6	40.7	78.4	26.1	362	1698	1512	1579
2 Phyllox	63.9	-32.5	53.5	37.5	86.3	23.9	360	1548	1378	1443
7 Syn 885	63.8	-32.5	48.7	41.2	77.8	26.1	359	1715	1536	1594
1 Rancho	63.5	-32.9	49.2	40.8	80.5	25.6	357	1699	1524	1577
6 Syn 85M	60.8	-35.3	50.5	40.0	84.1	24.2	342	1596	1430	1482
3 Ambassador	60.6	-35.4	50.9	39.7	84.6	23.8	341	1563	1398	1453
5 Orion	58.4	-37.5	52.7	38.0	95.4	22.1	329	1484	1337	1375
Mean	64.9	-31.5	50.4	40.0	79.4	25.8	365	1699	1520	1579
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	NS	NS	NS
Prob. > F	-----	-----	-----	-----	0.2534	0.3316	-----	0.4632	-----	0.4419
CV %	16.5	-30.5	9.2	9.2	14.7	13.2	16.5	13.7	13.9	13.6

----- = MSTAT does not give a Prob. > F number when very high.

Third cutting ADP, AV protein, D protein, NEL, ENE, ME, NEM, and NEG are presented in Table 16.

There was a difference between varieties for percent calcium, only.

Table 16. Third cutting ADP, AV protein, D protein, NEL, ENE, ME, NEM, and NEG for the 1991 production year of the Orchardgrass variety trial planted in 1987 at the COARC, Powell Butte, Oregon. (sorted by N uptake)

Variety	N (%)	N Uptake (lb/ac)	P (%)	P Uptake (lb/ac)	Ca (%)	Ca Uptake (lb/ac)	K (%)	K Uptake (lb/ac)	Mg (%)	Mg Uptake (lb/ac)
10 Paiute	2.67	63.7	0.318	7.5	0.757	18.1	3.25	76.9	0.170	4.1
12 Potomac	2.51	63.5	0.297	7.6	0.757	19.4	3.01	76.8	0.165	4.2
4 Comet	2.51	61.4	0.315	7.7	0.715	17.5	3.15	77.2	0.163	4.0
9 Napier	2.50	61.4	0.303	7.5	0.722	17.9	3.10	77.2	0.157	3.9
13 Sterling	2.49	59.5	0.308	7.5	0.743	17.9	3.05	74.0	0.162	3.9
11 Latar	2.35	58.6	0.280	7.0	0.733	18.2	2.98	74.1	0.160	4.0
8 Syn 887	2.48	58.0	0.307	7.2	0.732	17.1	3.06	71.9	0.165	3.9
2 Phyllox	2.67	57.5	0.315	6.8	0.718	15.5	3.13	67.6	0.165	3.6
7 Syn 885	2.45	57.5	0.307	7.2	0.733	17.2	3.06	71.9	0.170	4.0
1 Rancho	2.46	57.1	0.293	6.9	0.793	18.2	2.97	69.3	0.165	3.8
5 Orion	2.64	55.5	0.320	6.4	0.778	15.3	3.16	63.3	0.173	3.5
6 Syn 85M	2.53	54.7	0.310	6.7	0.727	15.8	2.98	64.9	0.165	3.6
3 Ambassador	2.56	54.6	0.297	6.4	0.737	15.8	2.94	62.6	0.163	3.5
Mean	2.51	58.5	0.305	7.1	0.742	17.2	3.06	71.3	0.165	3.8
PLSD 0.01	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
PLSD 0.05	NS	NS	NS	NS	0.045	NS	NS	NS	NS	NS
PLSD 0.10	NS	NS	NS	NS	0.038	NS	NS	NS	NS	NS
Prob. > F	0.1913	-----	0.3736	-----	0.0465	0.2659	-----	-----	-----	-----
CV %	9.1	16.5	7.0	16.1	4.4	12.8	6.1	15.3	6.3	15.5

----- = MSTAT does not give a Prob. > F number when very high.

Third cutting ADP, AV protein, D protein, NEL, ENE, ME, NEM, and NEG are presented in Table 17.

There were differences between varieties for ADP, only.

Table 17. Third cutting ADP, AV protein, D protein, NEL, ENE, ME, NEM, and NEG for the 1991 production year of the Orchardgrass variety trial planted in August of 1987 at the COARC, Powell Butte, Oregon. (sorted by ENE)

Variety	AV		D	NEL	ENE	ME	NEM	NEG
	ADP	Protein (%)	Protein (%)	(mcal/lb)	(mcal/lb)	(mcal/lb)	(mcal/lb)	(mcal/lb)
5 Orion	0.145	18.9	12.5	0.775	63.7	1.105	0.705	0.435
10 Paiute	0.243	19.0	12.5	0.765	63.1	1.090	0.690	0.420
1 Rancho	0.215	17.5	11.6	0.757	62.7	1.085	0.688	0.415
6 Syn 85M	0.267	17.9	11.8	0.755	62.4	1.080	0.683	0.412
9 Napier	0.228	17.7	11.8	0.752	62.2	1.075	0.680	0.410
7 Syn 885	0.285	17.2	11.5	0.752	62.1	1.075	0.675	0.410
4 Comet	0.255	17.8	11.8	0.752	62.0	1.073	0.675	0.407
3 Ambassador	0.290	18.0	11.9	0.750	61.9	1.073	0.672	0.405
13 Sterling	0.260	17.4	11.5	0.748	61.9	1.070	0.670	0.405
12 Potomac	0.285	17.7	11.7	0.748	61.8	1.070	0.667	0.405
8 Syn 887	0.317	17.5	11.6	0.740	61.2	1.055	0.662	0.392
11 Latar	0.247	16.7	11.1	0.740	60.8	1.053	0.655	0.387
2 Phyllox	0.427	18.7	12.3	0.738	60.7	1.050	0.652	0.390
Mean	0.267	17.8	11.8	0.752	62.0	1.073	0.675	0.407
PLSD 0.01	NS	NS	NS	NS	NS	NS	NS	NS
PLSD 0.05	0.11	NS	NS	NS	NS	NS	NS	NS
PLSD 0.10	0.09	NS	NS	NS	NS	NS	NS	NS
Prob. > F	0.0131	-----	-----	0.1183	0.1531	0.1600	0.1320	0.1072
CV %	30.0	9.2	8.0	2.1	2.2	2.3	3.4	4.8

----- = MSTAT does not give a Prob. > F number when very high.

Summary and Conclusions

An orchardgrass variety trial was conducted during 1987-1992 at the Powell Butte research site of the Central Oregon Agricultural Research Center. This report provides yield and quality evaluation data and statistical analyses for the 13 orchardgrass cultivars for the 1991 production season. Yield data for the entire trial have been previously reported in other publications. Stand longevity was good for all cultivars.

During the 1991 production year, there was a yield range of 1.12 ton/acre among the 13 entries. There were significant differences among entries. Napier was the top yielder (7.17 DM ton/acre) and Syn 885 was the lowest yielding cultivar (6.05 DM ton/acre), which was significant.

Quality analyses were performed by NIRS at the Klamath Experiment Station. This technique allows many quality parameters to be estimated simultaneously for use in ration formulation. No traditional chemistry analyses were performed. Significant differences among varieties for digestible yield and energy were found. These differences followed the same ranking as for yield data. USDA grass hay quality guidelines (percent protein) placed all entries in the same classification; "good" for the first cutting and "premium" for cuttings 2 and 3.

On the basis of this 1 year analysis of yield and quality for this orchardgrass variety trial, selection of varieties should be made primarily on the basis of yield potential. However, some consideration should be given to protein and fiber measures (due to their affect on digestibility). Based on these considerations, it would be impossible to separate any of the top 7 yielding cultivars and the same top 7 cultivars for quality measures, since they were not significantly different (at $P = 0.10\%$ level). The lowest yielding cultivar yielded 84.4% of the top yielding cultivar and for quality evaluation, the lowest cultivar was 83.4 and 83.6% of the top cultivar (DDM yield and protein yield).