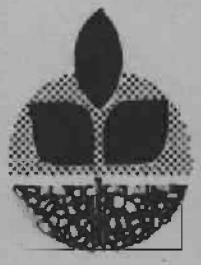
Hay and Pasture Research in the Klamath Basin, Oregon 1981

A RESEARCH PROGRESS REPORT the Klamath Experiment Station



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HAY AND PASTURE RESEARCH IN THE KLAMATH BASIN, OREGON

A RESEARCH PROGRESS REPORT

THE KLAMATH EXPERIMENT STATION

CONTENTS

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DISCLAIMER

The use of product names in this report does not imply any endorsement by the Klamath Experiment Station or Oregon State University.

ALFALFA VARIETY TRIALS

A 21-variety alfalfa trial was cut four times at Klamath Falls in 1981. The varieties were cut on June 16, July 17, August 19, and October 13 and windrows were dried in the field. Yields were collected from 3-by-20 foot plots with a Carter flail harvester. One pound subsamples were dried at 50° C to determine moisture. The plots were sprinkler irrigated at 2 inches of water in 24 hours each week to replace evapotranspiration estimated by open pan evaporation.

Record temperatures during the growth of second cutting forced flowering approximately two weeks early. The mean yield for all varieties in 1980 was 9,880 pound and in 1981 was 12,840 pound per acre (Table 1). The record high temperatures and lack of cloudy days in 1981 resulted in 30 percent higher yields than 1980. Most varieties had rank orders in 1981 similar to 1980. Exceptions were Gladiator, rank 16 and 1; Vernal, rank 1 and 8; Grimm, rank 21 and 4; and Haymaker, rank 13 and 2 in 1980 and 1981, respectively. Each year, several varieties had drastic rank order shifts. Most varieties shifted rank in at least one year and few patterns were obvious.

Table 1. The 1981 dry matter yield for 21 alfalfa varieties at Klamath Experiment Station

Variety	Cutting					Rank
	1st	2nd	3rd	4th	Total	
	lb DM/A					
Thor	4,082	2,967	3,289	1,933	12,271	16
Resistador 2	3,382	2,986	2,927	1,585	10,880	21
Gladiator	5,582	3,424	2,924	1,957	13,887	1
Narragansett	4,720	3,860	3,127	2,063	13,770	3
Ranger	4,496	3,295	2,996	2,366	13,153	9
Vernal	5,095	3,466	2,791	1,881	13,233	8
Grimm	4,671	3,183	3,296	2,531	13,681	4
Ladak	4,933	3,738	2,614	1,792	13,077	11
Action	4,239	3,721	2,850	1,726	12,536	14
Valor	4,229	3,076	3,481	2,271	13,057	12
Pacer	5,053	3,524	2,951	2,024	13,552	6
Haydak	4,906	2,728	2,691	1,543	11,868	18
Rambler	4,530	2,995	2,531	1,304	11,360	20
Haymaker	4,668	3,532	3,335	2,338	13,873	2
Titan	4,624	3,429	2,654	1,776	12,483	15
Lahontan	4,139	3,105	3,374	2,209	12,827	13
Anchor	4,462	2,947	2,819	2,036	12,264	17
Rhisoma	4,475	3,593	3,458	2,079	13,605	5
WL 309	4,271	3,505	2,974	2,400	13,150	10
WL 318	4,514	3,251	3,399	2,250	13,414	7
Apollo	4,109	2,881	2,838	1,928	11,756	19
SD					1,158 lb	
LSD (.05)					1,638 lb	
CV					9.0 %	

ALFALFA N, P, K, S FERTILIZER APPLICATION

The fertilizer experiment was planted on May 26, 1981 and harvested on July 23 and October 12, 1981. The nitrogen, phosphorus, potassium, and sulphur (N,P,K,S) treatments were applied as ammonium nitrate, triplephosphate, potassium chloride, and calcium sulphate. The N and K applications were split with half banded at planting and half broadcast after first cutting. The soil was fumigated on April 13, 1981 with 30 gallons per acre Telone II to remove microbes, nematodes, and grasses. The alfalfa, a coated type, was hand inoculated from three commercial sources to ensure *Rhizobium* infection. Eptam and Baylan were applied as pre-emergence weed control.

The yield of Valor alfalfa without fertilizer application was 3 tons per acre (Table 2). The addition of P, K, and S in any combination did not increase the yield. The addition of 40, 80, and 160 pounds N per acre to Valor increased the dry matter yield by 625, 1,095, and 1,674 pounds per acre, respectively. This was approximately 500 pounds more alfalfa for each twofold increment of nitrogen. The yield of Vernal was not affected by 40 pounds of N. Yield was increased by 376 pounds for the 80 pounds N and 675 pounds for 160 pounds N application. Vernal yield was increased significantly by P and P, K, S applications but not by P, K or N, P, K, S applications. Plant height at first cutting was increased significantly at 40 and 160 pounds N but not at 80 pounds N. The plant height at second cutting was not affected by any fertilizer treatment.

Table 2. Yield and height of alfalfa grown at Klamath Experiment Station, 1981

Fertilizer Rate					Valor			Vernal		
N	P_2O_5	K_2O	S	Ht.	1st	2nd	Total	1st	2nd	Total
lb/A				in.	lb/A					
0	0	0	0	18.5	2662	3397	6059	2700	3217	5917
0	200	0	0	19.3	2827	3311	6138	3174	3470	6644
0	0	400	0	17.8	2740	3276	6017	2641	3515	6156
0	0	0	80	17.0	2644	3429	6072	2786	3243	6035
0	200	400	0	17.8	2484	3275	5759	2667	3247	5914
0	0	400	80	17.8	2445	3610	6055	2770	2990	5984
0	200	400	80	18.7	2706	3459	6165	3420	3593	7013
40	200	400	80	20.8	3057	3627	6684	2950	3077	6026
80	200	400	80	18.8	3510	3644	7154	2975	3427	6402
160	200	400	80	21.5	3851	3881	7733	3165	3535	6701
			SD	1.8	434	440	466			
			CV	9.7%	14.9%	12.9%	7.37%			
			P(F)	0.1%	0.77%	4.77%	3.46%			

Ammonium nitrate applications at 40, 80, and 160 pounds N increased alfalfa by 519, 989, and 1,568 pounds, respectively. Ammonium nitrate cost $224 per ton and alfalfa sold for $70 per ton.

Table 3. The 1981 economic analysis of nitrogen application to alfalfa

	Nitrogen in lb/A			
	0	40	80	160
	$ per Acre			
Cost of N per A	-0-	13.72	27.50	55.00
Alfalfa Value, Total	247.00	267.00	286.00	309.00
Alfalfa Value, Increase	-0-	20.00	39.00	62.00
Alfalfa Value - N Cost	-0-	6.28	11.50	7.00

The application of 40, 80, and 160 pounds N per acre returned an extra $6.28, $11.50, and $7 per acre, respectively, more than alfalfa plots where no nitrogen was applied at high levels of P, K, and S. No labor or equipment costs have been assigned to the fertilizer treatments in this experiment.

Irrigation of the fertility experiment was two inches of water per week by sprinkler. This was applied in 24 hours and replaced open pan evaporation for that location. This application rate was used until first cutting to allow adequate establishment. After first cut, irrigation treatments were applied to fertility treatments. The irrigation levels were 2 and 1.5 inches applied, with two weeks per cutting without irrigation. The third irrigation level was two inches applied weekly through the entire growing season. No effect of irrigation nor of irrigation interaction with fertility was observed in the first year.

SQUIRREL STUDIES

Belding ground squirrels were trapped during late April 1981. Adult and juveniles were actively feeding and accepted treated oat groat baits. Squirrels were trapped and moved to wire cages with solid floors of 24 by 18 by 10 inches. Water was available *ad libitum* and the room temperature was 65 to 75° F. Oat groats were treated with 1.6 percent strychnine alkaloid or 0.28 percent sodium monofluoroacetate (1080). Treated groats were offered to single squirrels and the number consumed and days to death were recorded (Table 4).

Two groats treated with 1080 were sufficient to cause death. More than two groats were consumed on occasion as determined by appetite. Death resulted within 24 hours of 1080 consumption. The number of strychnine groats and days to death were extremely variable. The strychnine groats were not consumed on the first day and death did not result within two days of the consumption of four groats. It would appear from this limited number of squirrels that 1080 was more effective in oat groat baits as a rodenticide for squirrel control.

Table 4. The number of 1080 or strychnine treated oat groats and days to death of Belding ground squirrel, 1981

	Date	wt.	1080	Strych.	Days
		grams	groats		
Adult	14 Apr.	243		11	4
	16 Apr.	249	5		2
	26 Apr.	260	2		1
	26 Apr.	265	4		1
	27 Apr.	259	2		1
	28 Apr.	271		6	3
	30 Apr.	261	3		1
Juvenile	10 Apr.	82	6		1
	10 Apr.	93		6	2
	16 Apr.	61	2		1
	24 Apr.	134	2		1
	27 Apr.	151		2	2
	mean groats		3.25	6.25	
	mean days		1.13	2.75	

Hay Yield, Protein, and Digestibility of Grasses and Legumes

Twenty-eight entries of legumes and forty entries of grasses were harvested a second year from 5 by 25-foot plots replicated four times. Ammonium sulfate at 60 pounds N per acre was applied to the grass plots in April and after first and second cuttings. The plots were cut on June 9, July 20, August 25, and October 13 with a 3-foot Carter flail harvester. Record high temperatures and an unusually long growing season resulted in four cuttings in an area where three are normally optimum. Irrigation was supplied by sprinkler at the rate of 2 inches in 24 hours each week.

The top yielding legumes were WL 220 alfalfa, Florex red clover, Apollo, Cimarron, NAPB 53 alfalfa, Redland II, and Kenland red clover (Table 5). The WL 220 alfalfa yielded 8.5 tons of dry matter or 9.4 tons of hay at 10 percent moisture. Several entries did not persist past the first year and no yield was obtained. These included subterranean clover, common and hairy vetch, strawberry clover, and big trefoil. Hairy vetch and sub clover produced very well in the first year but were not allowed to reseed. Both would do well if managed as annuals.

The top yielding grasses were Bonita, NAPB 0051, Meritra, Terhoy, NAPB 150 ryegrasses, RP6 pasture mix, Alta tall fescue, Napier orchardgrass, Deborah smooth brome, and Reubens Canada bluegrass (Table 6). Bonita ryegrass yielded 4.4 tons of dry matter or 4.9 tons of hay at 10 percent moisture. The lowest yields were observed for Potomac and S143 orchardgrass, Artal and Grinalda ryegrass, tall wheatgrass, Timfor

Table 5. The 1981 yield of legumes at the Klamath Experiment Station, Klamath Falls, Oregon

Variety	Specie	Cutting 1st	2nd	3rd	4th	Total	Rank
		lbs DM/A					
Kenland	Red clover	5,025	4,206	3,230	2,845	15,306	7
Florex		5,674	4,540	3,575	2,762	16,551	2
Redland II		5,665	4,061	3,180	2,771	15,677	6
Mt. Baker	Sub clover	-0-	-0-	-0-	-0-	-0-	0
NK 256	White clover	3,178	2,648	2,886	2,290	11,002	17
Ladino		3,556	3,667	3,707	3,125	14,055	12
Medium	Red clover	4,184	4,458	3,325	2,298	14,265	11
Common	Alsike clover	3,895	2,351	2,132	-0-	8,378	22
Hungrapoly	Red clover	4,977	4,500	2,826	2,340	14,643	9
ESKI	Sainfoin	6,070	2,961	2,354	1,412	12,797	14
VIVA		4,427	3,736	3,152	2,360	13,675	13
Remont		5,431	4,120	3,130	1,928	14,609	10
Common	Common vetch	-0-	-0-	-0-	-0-	-0-	0
Common	Hairy vetch	2,555	-0-	-0-	-0-	2,555	24
Palastine	Strawberry clover	-0-	-0-	-0-	-0-	-0-	0
Common	Big trefoil	-0-	-0-	-0-	-0-	-0-	0
Empire	Birdsfoot trefoil	4,451	3,704	3,137	-0-	11,292	16
Dawn		3,905	4,033	2,787	-0-	10,725	18
Granger		3,257	3,953	3,320	-0-	10,430	19
V-10		3,242	3,032	2,876	-0-	9,150	21
Lutana	Cicer milkvetch	3,038	2,084	2,769	-0-	7,891	23
Teton-Travois	Alfalfa	4,491	4,076	3,553	3,087	15,207	8
WL 220		5,037	3,922	3,733	4,270	16,962	1
NAPB 53		4,759	4,299	3,657	3,016	15,371	5
Apollo		4,391	4,247	3,315	4,153	16,106	3
Trefoil & Orchardgrass		4,000	2,986	2,209	-0-	9,195	20
Common Coated	Red clover	4,179	4,037	2,825	1,638	12,679	15
Cimarron	Alfalfa	4,319	4,634	4,095	3,032	16,080	4
	SD					1,168.7	
	LSD (.05)					1,652.7	
	% CV					9.2	

Table 6. The 1981 yield of grasses at the Klamath Experiment Station, Klamath Falls, Oregon

Variety	Specie	Cutting 1st	2nd	3rd	Total	Rank
		lbs DM/A				
Potomac	Orchardgrass	2,756	1,635	1,013	5,404	40
S 143		3,154	1,681	1,442	6,277	36
Comet		3,489	1,907	1,413	6,809	24
Napier		4,027	1,990	1,548	7,565	8
Hawk		3,426	1,883	1,248	6,557	28
NAPB 7501		3,528	1,734	1,177	6,439	29
Ina		3,258	2,040	1,422	6,720	27
Sterling		3,662	2,177	1,466	7,305	14
Baylor	Smooth brome	4,433	1,355	1,718	7,506	9
Deborah		3,466	1,572	1,730	6,768	25
Manchar		3,847	1,326	1,251	6,424	30
Lincoln		4,064	951	1,965	6.980	19
Rise	Red Canarygrass	3,991	2,288	1,164	7,443	12
Vantage		3,331	2,276	1,312	6,919	20
NK Common		3,466	2,098	1,522	7,086	18
NK Tetraploid	Ryegrass	3,690	2,049	1,409	7,148	17
NAPB 150		3,966	2,473	1,483	7,922	5
Artal		2,985	1,190	1,234	5,409	39
Grinalda		3,538	1,163	1,103	5,804	38
Fawn	Tall fescue	3,685	1,962	1,621	7,268	15
Alta		3,948	2,191	1,518	7,657	7
Timfor	Timothy	3,435	1,548	1,298	6,281	35
Climax		3,700	1,718	1,404	6,822	23
Toro		3,753	1,308	1,247	6,308	33
Common	Meadow foxtail	3,016	1,956	1,319	6,291	34
Garrison		3,686	1,280	1,376	6,342	31
Beaumont	Meadow fescue	3,944	1,507	1,290	6,741	26
NK Common	Kentucky bluegrass	1,897	1,114	1,280	4,291	41
Troy		3,713	1,538	1,621	6,872	22
Reubens	Canada bluegrass	4,151	1,609	1,732	7,492	10
Common	Tall wheatgrass	2,940	1,506	1,811	6,257	37
Alkar		3,822	1,436	1,948	7,206	16
Klamath	Quackgrass	3,698	1,222	1,410	6,330	32
Greenleaf	Pubescent wheatgrass	4,226	1,399	1,669	7,324	13
Oahe	Intermediate wheatgrass	4,831	1,201	1,417	7,449	11
RP 3	Pasture mix	3,208	2,142	1,560	6,910	21
RP 6		3,623	2,155	1,943	7,721	6
NAPB 0051	Ryegrass	2,711	3,992	1,984	8,617	2
Meritra		3,823	2,613	1,703	8,139	3
Terhoy Tetraploid		4,037	1,643	2,443	8,123	4
Bonita		4,561	2,254	1,999	8,814	1
	SD				1,498.6	
	LSD (.05)				2,098.2	
	% CV				21.6	

and Toro timothy, Common and Garrison meadow foxtail, and quackgrass. In general, no grass specie was superior in yeild. Each specie contained varieties which produced well and others with low yields.

The white blossom clovers, white clover, ladino, and alsike clover had protein contents in excess of 20 percent (Table 7). Dawn and V-10 trefoil, Lutana cicer milkvetch, NAPB 53, and Cimarron alfalfas had protein contents near 20 percent. Ladino and white clover were 75 percent digestible. The remainder of the clovers were near 70 percent digestible. Eski, Viva, and Remont sainfoin were low in both protein and digestible dry matter content. This was the result of a very stemmy growth habit. Apollo and Cimarron alfalfa were surprisingly low in digestibility at 61 percent *in vitro* dry matter digestibility.

The protein and digestibility of RP6 pasture mix were high at 14.6 and 63.9 percent, respectively (Table 8). The high yield and quality of RP6 indicate that cattle gains could be excellent on this pasture mix. The protein and digestibility were low for Fawn and Alta tall fescue. The digestibility values of near 50 percent for tall fescue may be the result of alkaloids in the grass. Timothy demonstrated adequate protein and high digestibility content as it did in 1980.

Table 7. Crude protein and *in vitro* digestibility of second cutting legumes from the Klamath Experiment Station, 1981

Variety	Specie	C P	IVDMD
		% DM	
Kenland	Red clover	16.6	70.9
Florex		18.4	69.4
Redland II		18.2	70.7
Mt. Barker	Sub clover	-0-	-0-
NK 256	White clover	23.4	75.7
Ladino		20.7	75.1
Medium	Red clover	19.2	69.6
Common	Alsike clover	21.0	69.9
Hungrapoly	Red clover	18.3	71.2
ESKI	Sainfoin	17.7	64.5
VIVA		14.3	63.0
Remont		13.8	64.7
Common	Common vetch	-0-	-0-
Common	Hairy vetch	-0-	-0-
Palastine	Strawberry clover	-0-	-0-
Common	Big trefoil	-0-	-0-
Empire	Birdsfoot trefoil	17.1	66.0
Dawn		19.9	67.9
Granger		18.6	66.9
V-10		20.7	65.8
Lutana	Cicer milkvetch	19.5	69.7
Teton-Travois	Alfalfa	17.1	65.2
WL 220		16.0	65.2
NAPB 53		19.6	65.5
Apollo		17.7	61.4
Granger/Potomac	Trefoil/Orchardgrass	15.3	65.7
Common Coated	Red clover	18.7	70.7
Cimarron	Alfalfa	19.3	61.4
	SD	1.5	3.0
	LSD(.05)	2.2	4.3
	% CV	8.4	4.5

Table 8. Crude protein and *in vitro* digestibility of second cutting grasses from the Klamath Experiment Station, 1981

Variety	Specie	C P	IVDMD
		% DM	
Potomac	Orchardgrass	11.8	58.5
S 143		12.6	58.7
Comet		11.7	57.7
Napier		11.6	58.4
Hawk		12.0	58.7
NAPB 7501		12.0	59.6
INA		10.9	62.6
Sterling		10.9	58.8
Baylor	Smooth brome	15.1	57.8
Deborah		13.8	56.0
Manchar		13.9	57.2
Lincoln		14.6	59.0
Rise	Reed canarygrass	12.4	57.0
Vantage		12.5	55.2
NK Common		12.1	54.3
NK Tetraploid	Ryegrass	11.7	59.8
NAPB 150		9.2	54.1
Artal		12.8	57.3
Grinalda		13.6	58.4
Fawn	Tall fescue	11.1	48.9
ALTA		11.7	50.9
Timfor	Timothy	12.4	65.2
Climax		12.3	63.6
Toro		12.3	61.5
Common	Meadow foxtail	12.0	55.8
Garrison		12.8	62.5
Beaumont	Meadow fescue	12.1	61.2
NK Common	Kentucky bluegrass	14.2	57.3
Troy		13.5	53.1
Reubens	Canada bluegrass	12.3	58.7
Common	Tall wheatgrass	13.3	57.1
Alkar		11.4	58.4
Klamath	Quackgrass	14.7	54.0
Greenleaf	Pubescent wheatgrass	10.9	57.5
Oahe	Intermediate wheatgrass	13.4	58.9
RP 3	Pasture mix	12.5	60.4
RP 6		14.6	63.9
NAPB 0051	Ryegrass	9.1	54.1
Meritra		10.0	51.2
Terhoy tetraploid perennial		15.2	58.9
Bonita		13.5	52.4
	SD	1.1	3.8
	LSD (.05)	1.5	5.3
	%CV	8.8	6.5

TURFGRASS VARIETIES

Sixty-three varieties of Kentucky bluegrass, perennial ryegrass, and fescue turf were fertilized at 40 pounds N per acre with ammonium sulfate and sprinkler irrigated weekly at 2 inches of water in 24 hours. Half the plots were mowed each week with a rear bagging mower and the clippings were removed. The second half of each plot was mowed with a mulching mower. The plots were rated by five observers in November 1981 and February 1982. The turf was in the state of winter dormancy at both dates.

The mulched plots were rated at 4.5 and 3.0 and bagged plots at 3.6 and 2.5 for November and February, respectively (Table 9). The higher rating for mulched plots was the result of better color and was more apparent in November than in February. The turf was more dormant in February and subsequently rated lower than in November. The fescues held color much better than dormant bluegrass. Several of the bluegrasses were straw colored and rated between 1 and 2 in February. The mulching mower resulted in higher rated winter dormant turf of bluegrass, ryegrass, and fescue.

Table 9. Turfgrass varieties rated during 1981-1982 at the Klamath Experiment Station, Klamath Falls, Oregon

Variety	November		February	
	Bagged	Mulched	Bagged	Mulched
	score†			
Kentucky Bluegrass				
Adelphi	3.2††	3.6	2.8	3.4
Cheri	3.4	4.2	2.6	3.2
Eclipse	3.4	4.0	2.6	3.0
Glade	3.8	4.4	2.6	3.0
Ram I	4.4	4.8	2.6	2.8
239	3.6	4.2	3.2	3.4
243	3.6	4.2	3.2	3.4
America	2.8	3.6	2.6	3.0
Banff	3.8	4.0	3.2	3.6
Delta	3.6	4.2	2.8	3.4
Nugget	3.4	3.8	1.0	1.0
Park	1.4	1.8	2.0	2.0
Touchdown	3.6	4.2	1.2	1.4
Bristol	3.8	4.6	1.8	2.6
Victa	3.8	4.2	1.8	1.8
Vantage	2.8	3.0	1.6	1.6
Columbia	3.2	4.0	2.6	3.2
Shasta	3.2	4.0	2.0	2.0
1528T	3.6	4.6	1.8	2.0
Holiday	2.8	3.4	2.0	2.0
Kenblue	2.6	3.2	1.8	1.8
Parade	4.0	4.6	2.6	3.0
Plush	3.2	3.4	1.6	2.0
South Dakota	2.4	2.6	1.2	1.2
Merit	3.8	4.2	1.8	1.8
Scenic	2.4	2.8	1.6	1.6
Merion	2.8	3.2	1.6	1.8
Perennial Ryegrass				
Blazer	3.2	3.4	3.0	3.2
Dasher	3.0	3.2	2.4	3.0
Fiesta	3.0	3.2	3.0	3.0
Derby	3.2	3.4	3.0	3.2
Elka	3.0	3.4	2.4	3.0
Acclaim	4.4	5.4	2.4	3.0
Caravelle	3.8	5.4	3.2	3.4
Loretta	3.6	4.8	2.6	3.0
Citation	4.4	5.0	2.6	3.4
Manhattan	4.4	5.0	3.0	3.4
Omega	4.4	5.0	3.0	3.8

Table 9. Turfgrass varieties rated during 1981-82 at the Klamath Experiment Station, Klamath Falls, Oregon (continued)

Variety		November		February	
		Bagged	Mulched	Bagged	Mulched
		score†			
Fescues					
Agram	FF	4.0††	5.0	3.0	4.4
Rolax	FF	4.2	5.2	2.8	4.6
Tournament	FF	3.8	4.8	2.2	3.2
Banner	FF	3.4	4.6	2.6	3.6
Biljart	FF	3.8	5.4	2.8	4.0
Fortress	RF	3.8	5.2	2.2	3.8
577	TF	3.2	4.6	2.6	3.6
GTF	TF	3.2	4.6	2.6	3.6
STF	TF	3.0	4.4	2.8	4.2
Ruby	RF	3.4	5.0	2.8	4.0
Durar	HF	2.6	3.2	2.6	3.2
Scaldis	HF	4.4	6.6	2.6	3.8
Ensylva	CRF	3.8	5.6	2.8	3.6
Highlight	CF	3.8	5.8	2.8	3.6
Checker	CF	4.6	6.2	2.8	3.8
Checker	CF	4.4	6.2	2.4	3.8
Turf Mix					
Futura		3.8	5.6	2.2	3.4
Plush-Holiday		3.8	4.6	1.4	2.4
Festive		4.2	6.0	2.2	3.4
Standard		4.0	5.0	2.4	3.2
Varsity		4.0	6.0	2.2	3.2
Manhattan	Special	4.0	5.2	2.4	2.8
Festive	Coated	4.4	5.8	2.6	3.3
Standard	Coated	4.0	4.6	2.4	3.2
Varsity	Coated	3.8	5.2	2.6	3.2
Manhattan	Sp. Coated	4.2	5.0	2.6	2.6
$\bar{X}$		3.6	4.5	2.5	3.0
LSD (.05)		1.5	1.2		
P (F) variety		0.00%	0.00		
P (F) mower		0.00%	0.00		
P (F) interaction		NS	NS		

† 1 = brown, matted, open or heavily diseased turf
10 = green, erect, dense, disease-free turf

†† Each value is the average of five observations of one plot

BARLEY STRAW AMMONIATION

Barley straw was baled in 1980 and stored under cover at the Klamath Experiment Station. In August 1981 the straw was moved outside and covered with 6 mil black plastic. Anhydrous ammonia was placed in 55-gallon drums in the straw stack at 60 pounds ammonia (NH_3) per ton of straw on August 7, 1981. Untreated straw from 1981 was stored under cover.

Five weanling heifers averaging 420 pounds were assigned to each of two pens per feed ration. The rations were straw, straw plus 1.78 pounds dry matter alfalfa, ammoniated straw, and ammoniated straw plus 1.78 pounds alfalfa. Straw, trace mineral salt, and water were fed *ad libitum*. The heifers were fed daily and rejected straw was weighed out of the feeders. The rejected straw averaged seven percent of the straw fed. Samples were bored with a Penn State core sampler from half the bales fed and analyzed in the lab. The heifers were fed untreated straw for seven days. After the background period, the heifers were weighed and assigned to pens. The experimental rations were fed from October 15 to January 13, 1981-82. Heifers were weighed each 28 days through the 84-day trial. At the end of the study, three heifers from one pen of each feed ration were selected for rumen fluid withdrawal. Feed and water were removed at 8 a.m. and rumen fluid withdrawn at 2-hour intervals. Rumen fluid was withdrawn by tube suction via the esophagus. The first 100 milliliters of fluid was discarded.

The ammoniated barley straw contained more cell wall than untreated straw. This was reflected in the NDF, ADF, cellulose, and lignin content of Table 10. The *in vitro* dry matter digestibility was 2 percent units higher in ammoniated straw than untreated straw. The cell wall content of 76.6 percent indicated the digestibility of straw was increased from approximately 40 percent to 48.3 percent *in vitro* dry matter digestibility. This increase in digestibility was equivalent to increases obtained in lab studies in 1980. The decrease in apparent hemicellulose content was the result of ammonolysis as described by Buettner *et. al.*, (1982)[1]. The protein content of straw was increased from 4.10 to 7.03 percent by ammoniation.

The protein and *in vitro* dry matter digestibility content of ammoniated feed rations were greater than the content of untreated rations (Table 11). The intake of straw and straw plus alfalfa was increased 1.63 and 0.64 pounds per head per day by ammoniation. The gain per heifer increased by 24.5 pounds per 84 days when alfalfa was added to the ration. The gain increased by 33.7 pounds for ammoniated straw compared to untreated straw. The addition of 1.78 pounds alfalfa per day to the ammoniated ration did not result in significant ($P<0.05$) additional intake or gain. This indicated heifers obtained protein and energy from alfalfa that replaced protein and energy from ammoniated straw. The alfalfa only replaced ammoniated straw in the ration with little additional benefit.

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[1] Buettner, M.R., V.L. Lechtenberg, K.S. Hendrix, and J.M. Hertel. 1982. Journal of Animal Science 54:173-178

Table 10. Effect of anhydrous ammonia on barley straw protein and cell wall content and digestibility, Klamath Experiment Station, 1981

Straw	Protein	IVDMD	NDF	ADF	Hemicellulose	Cellulose	Lignin
	% DM						
NH_3	7.03†	48.3	76.6	55.9	20.7	39.5	9.04
Control	4.10	46.3	73.1	50.2	22.9	35.8	8.81
$LSD_{(.05)}$	1.40	2.1	2.4	2.1	1.5	1.1	NS
P(F)	.000	.059	.013	.001	.013	.000	.570
CV	5.96	2.58	1.87	2.29	4.00	1.73	6.20

† Average of four subsamples from a stack

Table 11. Effect of anhydrous ammonia treated straw on feed ration content, intake, and weight gain of weanling heifers, Klamath Experiment Station, 1981

Feed	Protein	IVDMD	Intake		Gain
			Straw	Total	
	% DM		lb/day		lb/84 day
Straw	4.19†	47.1	6.94	6.94	-20.5
Straw + alfalfa	7.61	51.3	6.17	8.00	4.0
NH_3 straw	6.85	47.5	8.57	8.57	13.2
NH_3 + alfalfa	9.87	53.6	6.86	8.64	13.9
$LSD_{(.05)}$	0.70	1.83	0.57	0.56	20.7
P(F)	.000	.006	.005	.012	.000
CV	4.97	1.87	4.09	3.60	

† Average of two pens with five heifers each

Rumen fluid from heifers fed straw contained 37.2, 30.4, 35.5, and 38.5 percent of the ammonia nitrogen at 2, 4, 6, and 8 hours after feeding, respectively, compared to rumen fluid from heifers fed ammoniated straw (Table 12). Rumen fluid from heifers fed straw plus 1.78 pounds of alfalfa per day contained 76.6, 80.6, 73.6, and 47.4 percent of the ammonia nitrogen at 2, 4, 6, and 8 hours that rumen fluid from heifers fed ammoniated straw contained. After 8 hours of digestion, the rumen ammonia for straw plus alfalfa and ammoniated straw was 1.2 and 2.6 fold the levels of the straw treatment.

The ammoniation of straw resulted in significantly greater levels of rumen ammonia during the digestion process. The ammoniated straw ration resulted in 1.3, 1.3, 1.9, and 1.7 fold rumen ammonia levels at 2, 4, 6, and 8 hours compared to the ammoniated straw plus alfalfa ration. The alfalfa content of the ammoniated straw plus alfalfa ration was 20.6 percent of the ration. The rumen ammonia content after 8 hours was reduced to nearly half that of ammoniated straw without alfalfa. It appeared the nutrients from alfalfa stimulated the rumen utilization of ammoniated straw compared to rations of ammoniated straw without alfalfa.

Table 12. Effect of anhydrous ammonia treated straw on heifer rumen ammonia content, Klamath Experiment Station, 1981

Feed	Hours after feeding			
	2	4	6	8
	mg NH_3-N/100 ml			
Straw	10.5†	5.8	3.9	3.0
Straw + alfalfa	21.6	15.4	8.1	3.7
NH_3 straw	28.2	19.1	11.0	7.8
NH_3 + alfalfa	22.1	14.3	5.8	4.7
$LSD_{(.05)}$	2.4			
P(F) interaction	.000			
CV	12.2			

† Average of three heifers per ration

SELENIUM SUPPLEMENT FOR PASTURE

Tall fescue and quackgrass paddocks of 1.5-acre were grazed by five pregnant heifers. The heifers were rotated from one-half paddock to the other each 28 days. The paddocks were fertilized with ammonium sulfate at 80 pounds of N per acre and flood irrigated as necessary. The heifers were placed on pasture on July 16 and removed on October 6. A mineral supplement (Table 13) was supplied to each paddock at the rate of 1 ounce per head per day. Sodium selenite was added to the mineral supplement at 200 and 400 parts per million (ppm) selenium. Each grass by selenium treatment was replicated twice in a completely random design.

Heifers on quackgrass pastures demonstrated a linear rise in whole blood selenium from 0.05 to 0.16 ppm and from 0.05 to 0.25 ppm after 84 days of 200 and 400 ppm selenium mineral intake (Table 14). The blood selenium of tall fescue groups increased from 0.04 to 0.16 ppm and from 0.04 to 0.22 ppm after intake of 200 and 400 ppm selenium mineral. After 84 days on tall fescue pasture, heifers fed 400 ppm selenium mineral had significantly lower ($P<.08$) blood selenium content than equivalent heifers on quackgrass pasture.

The average daily gain (ADG) of heifers on unfertilized pastures was 1.62 pounds compared to 1.47 pounds on pastures fertilized at 150 pounds N per acre (Table 15). The ADG of heifers on quackgrass pasture was not different for the control or nitrogen fertilized groups. The ADG of heifers on nitrogen fertilized tall fescue was 83.1, 93.7, and 56.7 percent of the ADG on control fescue at 0, 200, and 400 ppm selenium

mineral rates. The weight gain of heifers on fertilized tall fescue was nearly half that of heifers on unfertilized pasture at 400 ppm selenium. The total alkaloid content of tall fescue pastures was 0.06 and 0.10 percent DM for control and 150 pounds nitrogen per acre, respectively. It appeared that some interaction of 400 ppm selenium mineral and the high alkaloid content of nitrogen fertilized tall fescue occurred to reduce cattle gain. This interaction between selenium and tall fescue was also observed in 1980 at the Klamath Experiment Station[2]. This interaction did not occur at the 200 ppm selenium mineral rate. For this reason selenium mineral supplement should not contain more than 200 ppm selenium when fed to cattle on tall fescue pasture.

Table 13. Hi-Phos, Hi-Copper Mineral Supplement for Klamath, Oregon, Area

Guaranteed Analysis		
Ash	(Max.)	65.000%
Calcium (CA)	(Min.)	8.000%
Calcium (CA)	(Max.)	9.000%
Phosphorus (P)	(Min.)	13.000%
Magnesium (g)	(Min.)	0.015%
Iron (FE)	(Min.)	0.250%
Cobalt	(Min.)	0.004%
Manganese (Mn)	(Min.)	0.080%
Copper (CU)	(Min.)	0.500%
Zinc (ZN)	(Min.)	0.400%
Iodine (I)	(Min.)	0.000%
Salt (NaCL)	(Min.)	4.500%
Salt (NaCL)	(Min.)	5.500%
Vitamin A	(Min.)	20,000 USP Units/lb
Vitamin D3	(Min.)	5,000 USP Units/lb

[2] Buettner, M.R. 1981. Hay and pasture research in the Klamath Basin, Oregon 1980. Oregon Agriculture Experiment Station Special Report No. 635.

Table 14. The whole blood selenium levels of heifers fed selenium mineral on pasture, 1981

Grass	N	Se	days on pasture		
			0	56	84
	lb/A	ppm	ppm Se		
Quackgrass	0	0	0.05	0.07	0.05
		400	0.06	0.14	0.22
	150	0	0.05	0.07	0.05
		200	0.06	0.13	0.16
		400	0.05	0.19	0.27
Tall fescue	0	0	0.04	0.06	0.04
		200	0.04	0.12	0.16
		400	0.04	0.15	0.21
	150	0	0.03	0.06	0.04
		200	0.03	0.13	0.17
		400	0.04	0.16	0.22
$LSD_{(.05)}$			0.02	0.02	0.02
CV			21.5%	8.70%	6.92%
P(F)			14.6%	5.83%	8.15%

Table 15. The average daily gain of heifers fed selenium mineral on pasture, 1981

Grass	N	Mineral Se content, ppm			Total Alkaloid
		0	200	400	
	lb/A	lb/hd/day			%
Quackgrass	0	1.01	-	1.64	0.00
	150	0.99	1.49	1.86	0.00
Tall fescue	0	1.66	2.06	2.01	0.06
	150	1.38	1.93	1.14	0.10
$LSD_{(.05)}$		0.42			
CV		30.5%			
P(F)		5.19%			