

Seeding Rate Effect on Four-cut Alfalfa Forage Production

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Abstract

Alfalfa is an important crop for central Oregon. As inputs increase in cost, and with the release of Roundup Ready® alfalfa (Monsanto), seeding rate effects on yield warranted another look. Seeding rates for establishing an alfalfa field have continued to creep upward over the years. Cost of alfalfa seed has increased over the years; and Roundup Ready alfalfa seed price plus the additional technology fee raise the price even higher. Seeding rates of 4 to 32 lb/acre, in 4-lb increments (seed germination of 78 percent) were planted at the Central Oregon Agricultural Research Center Madras site in August of 1998. The trial was conducted as a 4-cut harvest management regime and run from 1999 to 2003. Only the first (cut 1) and fourth years (cuts 1, 2, and 3) showed significant yield differences between the seeding rates. The 5-year cumulative yield ranged from 38.33 ton/acre (4-lb/acre seed rate) to 42.65 ton/acre (32-lb/acre seed rate). While the 4-lb/acre seed rate yield was significantly lower compared to the other seeding rate yields, there were no statistical cumulative yield differences between the 8- to 32-lb/acre seed rates. Yield was compensated for by stem weight increasing with reduced numbers of stems/ft².

Introduction

All hay ranks number two in farm gate dollar value for the central and eastern Oregon agricultural economies. Over the years, there has been a range of perhaps 35,000 to 50,000 acres of pure alfalfa stands grown in the three central Oregon counties. Alfalfa is grown in pure stands and grass/alfalfa mixtures for hay. Local hay produced is marketed to livestock producers, dairies, and feed stores in Oregon, Washington, Idaho, California, and Canada. Some alfalfa from the region is exported to Pacific Rim countries. Alfalfa is an important rotational crop that breaks disease and insect problem cycles, and adds nitrogen to the soil through natural fixation for subsequent crops, reducing N inputs and saving money.

Extension seeding rate recommendations have been in the range of 12-15 lbs/acre. Over the years, seeding rates have continued to creep upwards, sometimes with planting rates of 25 to 30 lbs of seed/acre. Seed cost for private alfalfa varieties has continued to increase over the years along with the increased seeding rates. With the release of Roundup Ready alfalfa, with seed cost plus technology fee, the cost per pound of alfalfa seed has reached an all-time high. Hay prices, while perhaps “profitable” over the years, have not kept pace with the cost of inputs. The only previous alfalfa plant population study (comparing the range of two-thirds of a plant, to eight plants/ft² in a three-cut trial) was conducted from 1973 to 1975 (Murphy et al. 1976). A new look at the effect of seeding rates on long-term alfalfa forage production is necessary to see if reducing seeding rates is an economically viable option to help cut input costs, without sacrificing yield and income.

Materials and Methods

'Trical 102' triticale was planted in the experimental field the previous fall and plowed down as a green manure crop in early summer (after heading). Soil samples were taken in August of 1998 and analyzed by the Oregon State University Plant and Soil Analytical Laboratory, Corvallis, Oregon and the soil fertility was adjusted for phosphorus, sulfur, boron, and potassium (Table 1). Fertilizer was applied prior to planting and incorporated into the top 6 inches of soil (Table 2). The field was then leveled and packed prior to planting. Table 2 has the full fertility program for the trial.

Table 1. Soil test analyses from alfalfa variety trial soil samples taken at the Central Oregon Agricultural Research Center, Madras, Oregon.

Date	Depth (in)	pH	P (ppm)	K (ppm)	Ca (meq/100g)	Mg (meq/100g)	B (ppm)	Zn (ppm)	Sol salts Mmhos/cm	Se (ppm)	Na Meg/100 g
1998	0-10	6.7	25	539	10.3	5.4	0.4	0.5			0.37
2002	0-10	6.7	29	215	--	--					
3/2003	0-12	7.4	29	386	10.9	4.7	0.6	0.52	0.7	<0.10*	

* below the minimum detectable level.

Table 2. Nutrient applications made to the alfalfa variety trial at the Central Oregon Agricultural Research Center, Madras, Oregon.

Date applied	N (lb/acre)	P2O5 (lb/acre)	K2O (lb/acre)	Ca (lb/acre)	S (lb/acre)	B (lb/acre)	Zn (lb/acre)
8/21/1998	33	259			72	2.6	
3/24/2000		94	0		47		
3/22/2001		90	180	210	40	2.0	10
3/21/2002		90	180	210	40		
3/12/2003				252	48		

'Ultra' alfalfa variety (Table 3) was selected and planted at the Central Oregon Agricultural Research Center (COARC) at the Madras site on August 25, 1998. Germination of the seed was 78 percent. The fall dormancy, winter hardiness, disease, insect, and pest ratings are presented in Table 3.

Table 3. The fall dormancy, winter hardiness, disease, insect, and pest ratings for 'Ultra' alfalfa planted on August 25, 1998, in the seeding rate trial conducted at the Central Oregon Agricultural Research Center, Madras, Oregon.

Variety	FD ¹	WH	Bw	Vw	Fw	An	PRR	SAA	PA	BAA	SN	APH	SNKN	NRKN	RLN
Ultra	3 ²	4	3 ³	4	4	5	3	2	4	1	4	1	1	1	1

¹FD = Fall Dormancy, 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.

²Fall Dormancy (FD) ratings: 1 = most dormant, 11 = least dormant. Winter Hardiness (WH): 1 = most winter hardy, 6 = least winter hardy.

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

The trial site is located 2 miles north of Madras, Oregon and the elevation is 2,440 ft. Four, 8, 12, 16, 20, 24, 28, and 32 lbs/acre of inoculated seed (seed germination of 78 percent) were planted with a small-plot cone-type drill with 9 rows, 6-inch row spacing. The field was rolled after planting. Plot size was 5 ft by 20 ft, while harvested area was approximately 3.5 ft by 15 ft (exact length of plot harvest was measured to the nearest 0.1 ft, with every other plot measured). Stubble height at each harvest was 2-2.5 inches. 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 was cleaned off of the field the following day with a large tractor (125 hp) and grass seed “vac”. Within a day or two after harvest, usually, the irrigation water was reapplied.

Moisture samples (0.5-1.0 lb) were taken for each plot and dried at 145°F until no further change in weight occurred. Yields are presented on an oven-dry, dry matter basis.

The trial was solid-set, sprinkler irrigated with a 30- by 40-ft spacing as needed for establishment and during the season. Nelson rotating head Windfighter 2000 7/64-inch nozzles (Nelson Irrigation Corp., Walla Walla Washington) were used. The size of nozzle use was a mistake (they were supposed to be and we thought they were 9/64-inch nozzles). This was discovered between the third and fourth cutting in 2001. The nozzles were changed to 9/64 inch. Irrigation is determined by crop water use prediction by the AgriMet weather station program and by probing the soil with a soil probe. There is an AgriMet weather station located at COARC. The trial was usually irrigated two times per week, depending upon time of year.

Weed control for the trial was as follows. Pursuit[®] (1 DG Eco Pak bag), Poast[®] (0.47 lb/acre a.i.) and 2 quarts of crop oil were applied for weed control on September 18, 1998 of the establishment year. Poast (2 pts/acre) was also applied on April 7, 1999 to control volunteer triticale. The first winter dormant weed control included applying Velpar[®] L (0.75 lb/acre a.i.), Gramoxone Extra[®] (0.5 lb/acre a.i.) and Kerb[®] (1 lb/acre a.i.), on February 9, 2000. Velpar L (0.75 lb/acre a.i.), Kerb (4 lb/acre a.i.), and Gramoxone Extra (0.5 lb/acre a.i.) were applied on November 30, 2000 for the third production year. Velpar (0.75 lb/acre a.i.) and Gramoxone Extra (0.5 lb/ac a.i.) were applied in late fall 2001. Velpar L (0.75 lb/ac a.i.) and Gramoxone Extra (0.5 a.i. lb/acre) were applied on January 8, 2002. Gramoxone (0.5 a.i. lb/acre) and Sencor[®] (0.5 a.i. lb/acre) were applied on February 14, 2003.

The trial was laid out in a randomized block design with four replications. Stem weight is a calculated weight. SAS statistical software (SAS Institute, Inc., Cary, North Carolina) was used for analysis of variance and results are reported using Protected Least Significant Difference (PLSD) for mean separation at the $P > F = 0.01, 0.05, \text{ and } 0.10$ level.

Results

There were some irrigation problems in this trial with equal coverage and amount of water applied. In 1999, there was an irrigation set that was missed during second cutting. In 2000, there was a coverage problem on the third cutting, which would have also affected the fourth cutting. More coverage problems occurred throughout the growing season in 2001. At the end of the third cutting in 2001, it was “discovered” that the source of the irrigation problem was too-small nozzles. Between the third and fourth cutting in 2001, the nozzles were changed from 7/64 inch to 9/64 inch (Nelson rotating head Wind-fighter 2000 nozzles), but irrigation problems continued in 2002. There appeared to be no irrigation problems in 2003. There may have been some soil compaction (from the large tractor and “vac”) in certain areas as well as the coverage problems.

Weed control was excellent and winters were relatively mild for the 5 years of the trial. Harsh winter weather was not a factor in the trial.

Total Yield

At the end of 5 years, the only seeding rate that yielded a significantly different (lower) rate from the rest of the seeding rates was the 4-lb/acre seeding rate (Table 4.). Eight- to 32-lb/acre seeding rates yielded equally higher than the 4-lb/acre seeding rate. The higher the seeding rate, the more stems/ft² there were in general. There were no significant differences between the 4- and 8-lb/acre seeding rate for stems/ft².

The total yield range was 38.33 ton/acre for the 4-lb/acre seed rate to 42.65 ton/acre for the 32-lb/acre rate. Statistically there was no reason to plant more than 8 lb/acre of seed (in this case, 6.2 lb/acre pure live seed [PLS]).

Annual Yields

There were significant differences in annual yield only 2 out of 5 years (Table 5.). The first year (1999) showed large differences in yield between the 4-lb/acre rate and the rest of the seeding rates. Annual yield from the other seeding rates were statistically the same, with the exception of the 20-lb/acre rate. The 20-lb/acre rate was the same as all other rates except 4, 8, 24 lb/acre. In year 2 (2000) there were no differences, although there was a trend for the 4-lb/acre rate to yield less than all of the other rates. In year 3 (2001) annual yields were not different, though again there was a trend for the 4-lb/acre rate to yield less than the other rates. In the fourth year (2002), the 4-lb/acre rate yielded significantly less. There were some differences between the other rates. The 32-lb/acre rate yielded significantly higher than all of the other rates except for the 20 lb/acre rate. There were no differences in 2003.

The first 3 years showed significant differences between seeding rates for average annual stems/ft². There were no statistical differences in average annual stems/ft² for the last 2 years, although the trend was for more stems with the higher seeding rates.. Whatever advantage there may have been (finer stems?) in having more stems/ft² with higher seeding rates, those advantages were gone by the fourth year.

Table 4. 1999-2003 cumulative yield and cumulative average stems/ft² results for 'Ultra' alfalfa seeding rate trial managed under a four-cut harvest management regime, planted in August of 1998 at the Central Oregon Agricultural Research Center, Madras, Oregon.

Seeding rate (lb/acre) Actual – PLS*	1-year yield (ton/acre)	1-year** avg. stems/ft ²	2-year total yield (ton/acre)	2-year** avg. stems/ft ²	3-year total yield (ton/acre)	3-year** avg. stems/ft ²	4-year total yield (ton/acre)	4-year** avg. stems/ft ²	5-year total yield (ton/acre)	5-year** avg. stems/ft ²
4 – 3.1	7.45	87.2	15.93	86.9	23.33	80.9	30.30	80.2	38.33	75.4
8 – 6.2	8.16	93.9	17.12	89.6	25.11	83.6	32.76	81.8	41.36	77.1
12 – 9.4	8.63	107.9	17.40	99.4	25.13	93.9	32.96	90.3	42.09	85.5
16 – 12.5	8.71	115.8	17.72	101.5	25.52	95.7	32.86	91.4	41.06	85.6
20 – 15.6	8.85	117.0	17.68	107.2	25.75	98.8	33.77	94.3	42.51	88.9
24 – 18.7	8.28	128.0	17.22	110.6	25.04	104.2	32.83	101.8	41.34	94.8
28 – 21.8	8.60	131.1	17.55	113.3	25.65	103.3	33.39	99.4	42.30	92.3
32 – 25.0	8.66	145.3	17.36	124.8	25.31	112.6	33.52	106.4	42.65	99.2
Mean	8.42	115.8	17.25	104.2	25.1	96.6	32.80	93.2	41.54	87.3
PLSD 0.01	0.91	21.4	NS	10.0	NS	8.1	2.23	9.8	2.85	
PLSD 0.05	0.67	15.7	1.07	7.3	1.38	6.0	1.64	7.2	2.09	7.0
PLSD 0.10	0.55	13.0	0.88	6.0	1.15	4.9	1.36	5.9	1.73	
CV %	5.4	9.3	4.2	4.8	3.8	4.2	3.4	5.2	3.4	5.4
Prob.	0.0068	0.0001	0.0505	0.0001	0.0407	0.0001	0.0092	0.0001	0.0076	0.0001

*PLS = pure live seed.

** average stems/ft², averaged over cumulative years.

Table 5. 1999-2003 annual yields and annual average stems/ft² results for the 'Ultra' alfalfa seeding rate trial, managed under a four-cut harvest management regime, planted in August of 1998 at the Central Oregon Agricultural Research Center, Madras, Oregon.

Seeding rate (lb/acre) Actual – PLS	1999 yield (ton/acre)	1999* avg. stems/ft ²	2000 yield (ton/acre)	2000* avg. stems/ft ²	2001 yield (ton/acre)	2001* Avg. stems/ft ²	2002 yield (ton/acre)	2002* avg. stems/ft ²	2003 yield (ton/acre)	2003* avg. stems/ft ²
4 – 3.1	7.45	87.2	8.48	86.5	7.40	69.0	6.97	78.1	8.03	56.1
8 – 6.2	8.16	93.9	8.96	85.4	7.99	71.6	7.65	76.3	8.60	58.2
12 – 9.4	8.63	107.9	8.77	90.9	7.73	82.9	7.83	79.3	9.13	66.2
16 – 12.5	8.71	115.8	9.02	87.2	7.79	84.2	7.34	78.5	8.20	62.3
20 – 15.6	8.85	117.0	8.83	97.5	8.07	81.9	8.02	80.9	8.74	67.2
24 – 18.7	8.28	128.0	8.94	93.2	7.81	91.3	7.79	94.8	8.51	66.9
28 – 21.8	8.60	131.1	8.95	95.5	8.10	83.3	7.74	87.8	8.91	64.0
32 – 25.0	8.66	145.3	8.69	104.4	7.95	88.2	8.21	87.7	9.14	70.3
Mean	8.42	115.8	8.82	92.6	7.85	81.6	7.69	82.9	8.66	63.9
PLSD 0.01	0.91	21.4	NS	11.5	NS	14.7	0.57	NS	NS	NS
PLSD 0.05	0.67	15.7	NS	8.4	NS	10.8	0.42	NS	NS	NS
PLSD 0.10	0.55	13.0	NS	7.0	NS	8.9	0.35	NS	NS	NS
CV %	5.4	9.3	4.5	6.2	6.1	9.0	3.7	13.7	7.3	11.4
Prob.	0.0068	0.0001	0.5936	0.0017	0.5243	0.0043	0.0002	0.2995	0.1778	0.1538

* average stems/ft², averaged over the cuttings for the individual year.

1999

First cutting (Table 6): The 4-lb/acre seeding rate was significantly lower yielding than all other rates. The 8-lb/acre rate was significantly lower yielding than the 12- to 32-lb/acre rates. The 12- to 32-lb/acre seeding rates yielded the same. The low seeding rate had less lodging than the 8-lb/acre rate, which had lower lodging than the rest of the higher seeding rates. The range in lodging was from 2.5 percent (4 lb/acre) to 95 percent (32 lb/acre). The stems/ft² increased significantly with increasing seeding rates (range of 70.2 to 155.3), while there was an inverse relationship for stem weight. Although there was a 220 percent increase in number of stems, yield (145 percent) did not increase correspondingly.

Second cutting (Table 7): There were no differences in yield between the seeding rates. There were large differences in stems/ft². There was a trend for increased stems, from the 12- to 28-lb/acre rates, but numbers were the same statistically. The 32-lb/acre rate had significantly higher number of stems than the rest of the rates. There was an inverse relationship for stem weight.

Third cutting (Table 8): There was no difference in yield between the seeding rates. Stems/ft² increased from 102.4 to 146.9 with increasing seeding rates and there were significant differences. There was an inverse relationship for the stem weight, and there were significant differences between the rates. The lowest seed rate had a stem weight of 0.35 g to 0.24 g for the high seed rate.

Fourth cutting (Table 9): There were no differences in yield between the seeding rates. While there were significant differences in stems/ft², the range was less and the differences were not as great. The 16-lb/acre rate was different from the 12- and 20-lb/acre rate, but not different than the 24- to 32-lb/acre rates. In general there was the same significant inverse relationship for stem weight.

Table 6. First cutting 1999 seeding rate effect on yield and stems/ft² results for ‘Ultra’ alfalfa under a four-cut harvest management regime, planted in August, 1998 at the Central Oregon Agricultural Research Center, Madras, Oregon.

Seeding rate (lb/acre) Actual - PLS	Yield (ton/acre)	DM (%)	Moist. (%)	Lodge (%)	Stems/ft ²	Wt./stem (g)
4 – 3.1	2.41	18.1	81.9	2.5	70.2	0.73
8 – 6.2	2.88	17.8	82.2	32.5	76.2	0.80
12 – 9.4	3.37	17.6	82.4	76.3	101.4	0.69
16 – 12.5	3.42	18.1	81.9	67.5	102.4	0.70
20 – 15.6	3.46	18.6	81.4	90.0	120.8	0.62
24 – 18.7	3.32	17.6	82.4	90.0	136.0	0.52
28 – 21.8	3.48	19.8	80.2	82.5	130.8	0.57
32 – 25.0	3.49	18.6	81.4	95.0	155.3	0.48
Mean	3.23	18.3	81.7	67.0	111.6	0.64
PLSD 0.01	0.51	NS	NS	37.6	35.2	0.24
PLSD 0.05	0.38	NS	NS	27.6	25.9	0.17
PLSD 0.10	0.31	NS	NS	22.9	21.4	0.14
CV %	7.9	7.1	1.6	28.0	15.7	18.5
Prob. > F	0.0001	0.3108	0.3108	0.0001	0.0001	0.0108
Harvest date	6/4					

Table 7. Second cutting 1999 seeding rate effect on yield and stems/ft² results for ‘Ultra’ alfalfa under a four-cut harvest management regime, planted in August, 1998 at the Central Oregon Agricultural Research Center, Madras, Oregon.

Seeding rate (lb/acre) Actual - PLS	Yield (ton/acre)	DM (%)	Moist. (%)	Stems/ft ²	Wt./stem (g)
4 – 3.1	1.85	21.2	78.8	90.8	0.44
8 – 6.2	1.92	21.0	79.0	107.1	0.38
12 – 9.4	1.91	22.1	77.9	122.8	0.32
16 – 12.5	1.91	22.2	77.8	131.5	0.31
20 – 15.6	1.91	22.3	77.7	129.9	0.32
24 – 18.7	1.64	22.1	77.9	133.7	0.26
28 – 21.8	1.71	26.9	73.1	139.6	0.26
32 – 25.0	1.95	22.8	77.2	163.1	0.25
Mean	1.85	22.6	77.4	127.3	0.32
PLSD 0.01	NS	NS	NS	29.0	0.15
PLSD 0.05	NS	NS	NS	21.3	0.11
PLSD 0.10	NS	NS	NS	17.6	0.09
CV %	16.5	20.9	6.1	11.4	24.0
Prob. > F	0.4479	0.7461	0.7461	0.0001	0.237
Harvest date	7/13				

Table 8. Third cutting 1999 seeding rate effect on yield and stems/ft² results for ‘Ultra’ alfalfa under a four-cut harvest management regime, planted in August, 1998 at the Central Oregon Agricultural Research Center, Madras, Oregon.

Seeding rate (lb/acre) – Actual - PLS	Yield (ton/acre)	DM (%)	Moist. (%)	Stems/ft ²	Wt./stem (g)
4 – 3.1	1.71	17.2	82.8	102.4	0.35
8 – 6.2	1.83	17.2	82.8	105.3	0.36
12 – 9.4	1.79	17.6	82.4	113.4	0.33
16 – 12.5	1.81	17.5	82.5	120.7	0.32
20 – 15.6	1.84	17.4	82.6	122.5	0.32
24 – 18.7	1.77	17.2	82.8	131.2	0.28
28 – 21.8	1.80	17.8	82.2	138.5	0.27
32 – 25.0	1.72	17.2	82.8	146.9	0.24
Mean	1.78	17.4	82.6	122.6	0.31
PLSD 0.01	NS	NS	NS	24.3	NS
PLSD 0.05	NS	NS	NS	17.9	0.07
PLSD 0.10	NS	NS	NS	14.8	0.06
CV %	6.8	2.4	0.5	9.9	14.6
Prob. > F	0.7294	0.2771	0.2771	0.0003	0.0179
Harvest date	8/18				

Table 9. Fourth cutting 1999 seeding rate effect on yield and stems/ft² results for ‘Ultra’ alfalfa under a four-cut harvest management regime, planted in August, 1998 at the Central Oregon Agricultural Research Center, Madras, Oregon.

Seeding rate (lb/acre) Actual - PLS	Yield (ton/acre)	DM (%)	Moist. (%)	Stems/ft ²	Wt./stem (g)
4 – 3.1	1.48	23.0	77.0	85.5	0.37
8 – 6.2	1.54	22.9	77.1	86.9	0.37
12 – 9.4	1.56	23.1	76.9	94.1	0.35
16 – 12.5	1.56	22.6	77.4	108.6	0.30
20 – 15.6	1.64	22.2	77.8	94.6	0.38
24 – 18.7	1.56	22.7	77.3	111.2	0.30
28 – 21.8	1.61	23.0	77.0	115.5	0.29
32 – 25.0	1.50	21.8	78.2	115.6	0.28
Mean	1.56	22.7	77.3	101.5	0.33
PLSD 0.01	NS	NS	NS	23.7	0.09
PLSD 0.05	NS	NS	NS	17.4	0.07
PLSD 0.10	NS	NS	NS	14.4	0.06
CV %	9.1	3.9	1.1	11.7	13.8
Prob. > F	0.8164	0.4517	0.4517	0.0033	0.0168
Harvest date	10/14				

2000

First cutting (Table 10): There were no differences in yield between seeding rates. While the range was not as great as in previous cuttings, there were differences for stems/ft², but the trend was less clear cut. All of the seeding rates had the same stem weight, with the exception of the 8-lb and 32-lb/acre rate.

Second cutting (Table 11): There were no differences in yield, stems/ft², or stem weight between seeding rates.

Third cutting (Table 12): There was no difference in yield for the seeding rates. There were differences between seeding rates for stems/ft² and stem weight, but the trend was not clear cut.

Fourth cutting (Table 13): There were no differences in yield, stems/ft², and stem weight between the seeding rates. There was a fair trend for the 4-lb/acre rate to yield less and have greater stems/ft² than the rest of the seeding rates.

Table 10. First cutting 2000 seeding rate effect on yield and stems/ft² results for 'Ultra' alfalfa under a four-cut harvest management regime, planted in August, 1998 at the Central Oregon Agricultural Research Center, Madras, Oregon.

Seeding rate (lb/acre) Actual - PLS	Yield (ton/acre)	DM (%)	Moist. (%)	Stems/ft ²	Wt./stem (g)
4 – 3.1	2.67	20.9	79.1	83.9	0.67
8 – 6.2	3.03	21.7	78.3	81.9	0.77
12 – 9.4	2.68	20.4	79.6	85.2	0.66
16 – 12.5	2.87	21.0	79.0	90.4	0.67
20 – 15.6	2.96	21.3	78.7	97.2	0.64
24 – 18.7	2.82	21.6	78.4	92.7	0.64
28 – 21.8	2.86	22.1	77.9	90.6	0.66
32 – 25.0	2.71	21.3	78.7	101.7	0.56
Mean	2.82	21.3	78.7	90.4	0.66
PLSD 0.01	NS	NS	NS	NS	0.16
PLSD 0.05	NS	NS	NS	12.1	0.11
PLSD 0.10	NS	NS	NS	10.0	0.09
CV %	7.7	5.6	1.5	9.1	11.8
Prob. > F	0.1865	0.6172	0.6172	0.0352	0.0635
Harvest date	5/24				

Table 11. Second cutting 2000 seeding rate effect on yield and stems/ft² results for 'Ultra' alfalfa under a four-cut harvest management regime, planted in August, 1998 at the Central Oregon Agricultural Research Center, Madras, Oregon.

Seeding rate (lb/acre) Actual - PLS	Yield (ton/acre)	DM (%)	Moist. (%)	Stems/ft ²	Wt./stem (g)
4 – 3.1	2.30	18.0	82.0	102.7	0.47
8 – 6.2	2.28	17.5	82.5	100.8	0.47
12 – 9.4	2.29	18.0	82.0	102.6	0.48
16 – 12.5	2.23	16.5	83.5	105.9	0.46
20 – 15.6	2.26	17.7	82.3	117.8	0.41
24 – 18.7	2.36	17.6	82.4	114.4	0.43
28 – 21.8	2.21	17.6	82.4	129.7	0.36
32 – 25.0	2.26	18.1	81.9	138.8	0.34
Mean	2.27	17.6	82.4	114.1	0.43
PLSD 0.01	NS	NS	NS	NS	NS
PLSD 0.05	NS	NS	NS	NS	NS
PLSD 0.10	NS	NS	NS	NS	NS
CV %	7.1	5.0	1.1	17.8	18.2
Prob. > F	0.9423	0.3150	0.3150	0.1202	0.1117
Harvest date	7/5				

Table 12. Third cutting 2000 seeding rate effect on yield and stems/ft² results for 'Ultra' alfalfa under a four-cut harvest management regime, planted in August, 1998 at the Central Oregon Agricultural Research Center, Madras, Oregon.

Seeding rate (lb/acre) Actual - PLS	Yield (ton/acre)	DM (%)	Moist. (%)	Stems/ft ²	Wt./stem (g)
4 – 3.1	1.83	26.0	74.0	91.0	0.43
8 – 6.2	1.71	24.3	75.7	86.1	0.43
12 – 9.4	1.86	27.9	72.1	103.5	0.39
16 – 12.5	2.08	22.1	77.9	76.7	0.55
20 – 15.6	1.76	25.2	74.8	101.1	0.36
24 – 18.7	1.89	23.9	76.1	93.8	0.43
28 – 21.8	1.85	28.0	72.0	88.6	0.45
32 – 25.0	1.76	28.3	71.7	99.4	0.37
Mean	1.84	25.7	74.3	92.8	0.42
PLSD 0.01	NS	NS	NS	NS	NS
PLSD 0.05	NS	NS	NS	14.8	NS
PLSD 0.10	NS	NS	NS	12.3	0.10
CV %	12.5	16.8	5.8	10.9	19.0
Prob. > F	0.4656	0.4106	0.4106	0.0334	0.0712
Harvest date	8/9				

Table 13. Fourth cutting 2000 seeding rate effect on yield and stems/ft² results for ‘Ultra’ alfalfa under a four-cut harvest management regime, planted in August, 1998 at the Central Oregon Agricultural Research Center, Madras, Oregon.

Seeding rate (lb/acre) Actual - PLS	Yield (ton/acre)	DM (%)	Moist. (%)	Stems/ft ²	Wt./stem (g)
4 – 3.1	1.69	22.9	77.1	98.5	0.53
8 – 6.2	1.93	25.3	74.7	72.8	0.56
12 – 9.4	1.94	24.5	75.5	72.4	0.57
16 – 12.5	1.84	22.6	77.4	73.7	0.53
20 – 15.6	1.85	26.6	73.4	73.8	0.52
24 – 18.7	1.88	25.1	74.9	71.8	0.54
28 – 21.8	2.03	25.6	74.4	73.0	0.60
32 – 25.0	1.97	24.0	76.0	77.6	0.53
Mean	1.89	24.6	75.4	72.9	0.55
PLSD 0.01	NS	NS	NS	NS	NS
PLSD 0.05	NS	NS	NS	NS	NS
PLSD 0.10	NS	NS	NS	NS	NS
CV %	9.0	10.5	3.4	13.7	20.2
Prob. > F	0.2364	0.3902	0.3902	0.9662	0.9746
Harvest date	9/27				

2001

First cutting (Table 14): There were no differences in yield, stems/ft², and stem weight between the seeding rates. There was a trend for increasing stems/ft² and decreasing stem weight as seeding rate increased.

Second cutting (Table 15): There were no differences in yield, stems/ft², and stem weight between the seeding rates.

Third cutting (Table 16): There were no differences in yield, stems/ft², and stem weight between the seeding rates. There was a difference between seed rates for stems/ft² in general as seed rates increased.

Fourth cutting (Table 17): There were no differences in yield, stems/ft², and stem weight between the seeding rates. There was a difference between seed rates for stems/ft² in general as seed rates increased. There were inverse differences for stem weight between seed rates, but many rates had the same stem weight.

Table 14. First cutting 2001 seeding rate effect on yield and stems/ft² results for 'Ultra' alfalfa under a four-cut harvest management regime, planted in August, 1998 at the Central Oregon Agricultural Research Center, Madras, Oregon.

Seeding rate (lb/acre) Actual - PLS	Yield (ton/acre)	DM (%)	Moist. (%)	Stems/ft ²	Wt./stem (g)
4 – 3.1	2.48	19.3	80.7	67.2	0.80
8 – 6.2	2.54	19.9	80.1	67.6	0.85
12 – 9.4	2.42	19.7	80.3	83.5	0.60
16 – 12.5	2.69	18.8	81.2	83.2	0.68
20 – 15.6	2.84	22.0	78.0	79.2	0.76
24 – 18.7	2.61	20.7	79.3	86.0	0.63
28 – 21.8	2.75	22.8	77.2	87.6	0.66
32 – 25.0	2.72	22.1	77.9	86.6	0.66
Mean	2.63	20.7	79.3	80.1	0.71
PLSD 0.01	NS	NS	NS	NS	NS
PLSD 0.05	NS	NS	NS	NS	NS
PLSD 0.10	NS	NS	NS	NS	NS
CV %	9.9	13.2	3.4	15.8	22.1
Prob. > F	0.3396	0.3599	0.3599	0.1620	0.3315
Harvest date	5/31				

Table 15. Second cutting 2001 seeding rate effect on yield and stems/ft² results for 'Ultra' alfalfa under a four-cut harvest management regime, planted in August, 1998 at the Central Oregon Agricultural Research Center, Madras, Oregon.

Seeding rate (lb/acre) Actual - PLS	Yield (ton/acre)	DM (%)	Moist. (%)	Stems/ft ²	Wt./stem (g)
4 – 3.1	2.16	18.0	82.0	84.6	0.55
8 – 6.2	2.51	18.4	81.6	82.5	0.66
12 – 9.4	2.31	18.4	81.6	92.4	0.53
16 – 12.5	2.22	19.5	80.5	97.8	0.48
20 – 15.6	2.17	22.0	78.0	93.0	0.50
24 – 18.7	2.18	18.8	81.2	105.2	0.44
28 – 21.8	2.35	19.5	80.5	92.9	0.53
32 – 25.0	2.37	20.1	79.9	100.8	0.49
Mean	2.28	19.3	80.7	93.6	0.52
PLSD 0.01	NS	NS	NS	NS	NS
PLSD 0.05	NS	NS	NS	NS	NS
PLSD 0.10	NS	NS	NS	NS	NS
CV %	8.6	11.8	2.8	14.4	20.4
Prob. > F	0.1956	0.3096	0.3096	0.3097	0.1881
Harvest date	7/11				

Table 16. Third cutting 2001 seeding rate effect on yield and stems/ft² results for ‘Ultra’ alfalfa under a four-cut harvest management regime, planted in August, 1998 at the Central Oregon Agricultural Research Center, Madras, Oregon.

Seeding rate (lb/acre) Actual - PLS	Yield (ton/acre)	DM (%)	Moist. (%)	Stems/ft ²	Wt./stem (g)
4 – 3.1	1.09	23.7	76.3	63.1	0.37
8 – 6.2	1.12	22.7	77.3	74.0	0.33
12 – 9.4	1.14	27.8	72.2	84.2	0.29
16 – 12.5	1.09	23.0	77.0	81.5	0.28
20 – 15.6	1.34	30.2	69.8	82.6	0.34
24 – 18.7	1.25	22.3	77.7	93.0	0.28
28 – 21.8	1.22	26.3	73.7	76.5	0.33
32 – 25.0	1.09	28.0	72.0	85.0	0.27
Mean	1.17	25.5	74.5	80.0	0.31
PLSD 0.01	NS	NS	NS	NS	NS
PLSD 0.05	NS	5.2	5.2	14.7	NS
PLSD 0.10	NS	4.3	4.3	12.10	NS
CV %	13.0	14.0	4.8	12.5	20.7
Prob. > F	0.2132	0.0330	0.0330	0.0186	0.3049
Harvest date	8/13				

Table 17. Fourth cutting 2001 seeding rate effect on yield and stems/ft² results for ‘Ultra’ alfalfa under a four-cut harvest management regime, planted in August, 1998 at the Central Oregon Agricultural Research Center, Madras, Oregon.

Seeding rate (lb/acre) Actual - PLS	Yield (ton/acre)	DM (%)	Moist. (%)	Stems/ft ²	Wt./stem (g)
4 – 3.1	1.66	22.6	77.4	61.1	0.56
8 – 6.2	1.81	22.8	77.2	62.4	0.60
12 – 9.4	1.87	24.2	75.8	71.7	0.56
16 – 12.5	1.80	22.4	77.6	74.3	0.51
20 – 15.6	1.71	22.8	77.2	72.9	0.49
24 – 18.7	1.78	22.7	77.3	81.0	0.46
28 – 21.8	1.78	22.7	77.3	76.0	0.50
32 – 25.0	1.78	23.5	76.5	80.4	0.46
Mean	1.77	23.0	77.0	72.5	0.52
PLSD 0.01	NS	NS	NS	NS	NS
PLSD 0.05	NS	NS	NS	12.3	NS
PLSD 0.10	NS	NS	NS	10.2	0.08
CV %	5.7	5.0	1.5	11.6	13.3
Prob. > F	0.1852	0.3844	0.3844	0.0204	0.0732
Harvest date	10/15				

2002

First cutting (Table 18): There were differences in yield, dry matter, moisture, and stem weight. The low seed rate yield was significantly lower than the 8-, 12-, 20-, and 32-lb/acre rate. The 8-, 16-, 24-, and 28-lb/acre rate yielded the same. While there were differences between some of the seed rates in stem weight; the effect of increasing seed rates was unclear.

Second cutting (Table 19): The 4-lb/acre seed rate yielded significantly less than the rest of the seeding rates. The 8-lb/acre rate yielded significantly less than the 32-lb rate. The 12- to 32-lb/acre rate yielded the same. There were no differences for stem number and stem weight.

Third cutting (Table 20): The 4-lb/acre rate yielded significantly less than the 8- to 32-lb/acre rate with the exception of the 16-lb rate. There were no differences for stem number or stem weight, although in general stem numbers were greater with increased seed rates.

Fourth cutting (Table 21): There were no differences in yield, stem number, or stem weight. There was a trend for increasing stem numbers with increased seed rates.

Table 18. First cutting 2002 seeding rate effect on yield and stems/ft² results for ‘Ultra’ alfalfa under a four-cut harvest management regime, planted in August, 1998 at the Central Oregon Agricultural Research Center, Madras, Oregon.

Seeding rate (lb/acre) Actual - PLS	Yield (ton/acre)	DM (%)	Moist. (%)	Stems/ft ²	Wt./stem (g)
4 – 3.1	2.27	19.2	80.8	77.2	0.61
8 – 6.2	2.56	20.0	80.0	66.0	0.83
12 – 9.4	2.70	19.7	80.3	75.6	0.75
16 – 12.5	2.43	19.7	80.3	81.7	0.62
20 – 15.6	2.89	20.0	80.0	72.4	0.83
24 – 18.7	2.41	20.8	79.2	87.4	0.59
28 – 21.8	2.50	21.3	78.7	79.7	0.66
32 – 25.0	2.89	22.4	77.6	79.1	0.78
Mean	2.58	20.4	79.6	77.4	0.71
PLSD 0.01	0.44	2.1	2.1	NS	NS
PLSD 0.05	0.32	1.6	1.6	NS	0.17
PLSD 0.10	0.27	1.3	1.3	NS	0.14
CV %	8.4	5.2	1.3	13.1	16.6
Prob. > F	0.0042	0.0075	0.0075	0.1959	0.0307
Harvest date	6/3				

Table 19. Second cutting 2002 seeding rate effect on yield and stems/ft² results for 'Ultra' alfalfa under a four-cut harvest management regime, planted in August, 1998 at the Central Oregon Agricultural Research Center, Madras, Oregon.

Seeding rate (lb/acre) Actual - PLS	Yield (ton/acre)	DM (%)	Moist. (%)	Stems/ft ²	Wt./stem (g)
4 – 3.1	1.50	15.6	84.4	87.3	0.37
8 – 6.2	1.60	15.6	84.4	90.9	0.38
12 – 9.4	1.67	15.4	84.6	91.8	0.39
16 – 12.5	1.66	15.7	84.3	80.3	0.46
20 – 15.6	1.63	15.2	84.8	98.6	0.35
24 – 18.7	1.66	15.6	84.4	105.0	0.33
28 – 21.8	1.65	15.7	84.3	100.9	0.34
32 – 25.0	1.69	15.5	84.5	107.4	0.33
Mean	1.63	15.5	84.5	95.3	0.37
PLSD 0.01	NS	NS	NS	NS	NS
PLSD 0.05	0.10	NS	NS	NS	NS
PLSD 0.10	0.08	NS	NS	NS	NS
CV %	4.1	3.3	0.6	15.9	21.0
Prob. > F	0.0128	0.8306	0.8306	0.2228	0.3865
Harvest date	7/3				

Table 20. Third cutting 2002 seeding rate effect on yield and stems/ft² results for 'Ultra' alfalfa under a four-cut harvest management regime, planted in August, 1998 at the Central Oregon Agricultural Research Center, Madras, Oregon.

Seeding rate (lb/acre) Actual - PLS	Yield (ton/acre)	DM (%)	Moist. (%)	Stems/ft ²	Wt./stem (g)
4 – 3.1	1.50	21.5	78.5	75.7	0.45
8 – 6.2	1.68	21.7	78.3	73.3	0.54
12 – 9.4	1.81	24.7	75.3	76.2	0.50
16 – 12.5	1.58	20.8	79.2	79.9	0.42
20 – 15.6	1.75	22.0	78.0	77.5	0.47
24 – 18.7	1.74	20.2	79.8	94.4	0.39
28 – 21.8	1.80	21.3	78.7	86.6	0.43
32 – 25.0	1.84	24.8	75.2	83.7	0.46
Mean	1.71	22.1	77.9	80.9	0.46
PLSD 0.01	0.24	NS	NS	NS	NS
PLSD 0.05	0.17	NS	NS	NS	NS
PLSD 0.10	0.14	NS	NS	NS	NS
CV %	6.9	11.5	3.3	20.8	22.2
Prob. > F	0.0067	0.1415	0.1415	0.6806	0.5778
Harvest date	8/7				

Table 21. Fourth cutting 2002 seeding rate effect on yield and stems/ft² results for ‘Ultra’ alfalfa under a four-cut harvest management regime, planted in August, 1998 at the Central Oregon Agricultural Research Center, Madras, Oregon.

Seeding rate (lb/acre) Actual - PLS	Yield (ton/acre)	DM (%)	Moist. (%)	Stems/ft ²	Wt./stem (g)
4 – 3.1	1.70	23.8	76.2	72.1	0.53
8 – 6.2	1.81	24.1	75.9	74.8	0.54
12 – 9.4	1.66	25.5	74.5	73.7	0.47
16 – 12.5	1.67	23.1	76.9	72.1	0.50
20 – 15.6	1.75	23.9	76.1	75.0	0.49
24 – 18.7	1.97	23.7	76.3	92.3	0.45
28 – 21.8	1.79	24.0	76.0	84.0	0.45
32 – 25.0	1.78	24.0	76.0	80.6	0.46
Mean	1.77	24.0	76.0	78.1	0.49
PLSD 0.01	NS	NS	NS	NS	NS
PLSD 0.05	NS	NS	NS	NS	NS
PLSD 0.10	NS	NS	NS	NS	NS
CV %	8.5	5.8	1.8	17.4	22.9
Prob. > F	0.1269	0.5034	0.5034	0.4007	0.8878
Harvest date	10/8				

2003

First cutting (Table 22): There were no differences for yield, stem number, or stem weight. There were fewer stems on this cutting than previous cuttings and the stem weights were much greater in general.

Second cutting (Table 23): There were no differences in yield, stem number, or stem weight. There was a slight increase in stem numbers with increased seed rates.

Third cutting (Table 24): The 4-lb/acre rate yielded significantly less than the rest of the seed rates, with the exception of the 16- and 24-lb/acre rates. There were significant differences in stem numbers, up to the 12 lb/acre seed rate. There were no differences in stem numbers from the 12- to 32-lb/acre rates, but the 8-lb rate, was not different from the 16- and 24- to 28-lb/acre rate. There were no differences in stem weight, although there was a trend for the two lowest seed rates to have heavier stem weight.

Fourth cutting (Table 25): There were no differences in yield, stem numbers, or stem weight between the seeding rates.

Table 22. First cutting 2003 seeding rate effect on yield and stems/ft² results for 'Ultra' alfalfa under a four-cut harvest management regime, planted in August, 1998 at the Central Oregon Agricultural Research Center, Madras, Oregon.

Seeding rate (lb/acre) Actual - PLS	Yield (ton/acre)	DM (%)	Moist. (%)	Stems/ft ²	Wt./stem (g)
4 – 3.1	2.51	23.0	77.0	55.3	1.01
8 – 6.2	2.64	21.4	78.6	52.5	1.05
12 – 9.4	2.93	21.2	78.8	55.8	1.12
16 – 12.5	2.54	21.2	78.8	51.9	1.05
20 – 15.6	2.80	21.5	78.5	61.3	1.00
24 – 18.7	2.62	21.7	78.3	60.7	0.90
28 – 21.8	2.95	22.4	77.6	54.9	1.17
32 – 25.0	2.94	21.4	78.6	71.0	0.87
Mean	2.74	21.7	78.3	57.9	1.02
PLSD 0.01	NS	NS	NS	NS	NS
PLSD 0.05	NS	NS	NS	NS	NS
PLSD 0.10	NS	NS	NS	NS	NS
CV %	12.0	5.4	1.5	20.1	24.6
Prob. > F	0.3143	0.2986	0.2986	0.3677	0.6987
Harvest date	6/5				

Table 23. Second cutting 2003 seeding rate effect on yield and stems/ft² results for 'Ultra' alfalfa under a four-cut harvest management regime, planted in August, 1998 at the Central Oregon Agricultural Research Center, Madras, Oregon.

Seeding rate (lb/acre) Actual - PLS	Yield (ton/acre)	DM (%)	Moist. (%)	Stems/ft ²	Wt./stem (g)
4 – 3.1	1.77	17.7	82.3	60.8	0.61
8 – 6.2	1.88	17.7	82.3	65.7	0.60
12 – 9.4	1.99	17.3	82.7	67.5	0.62
16 – 12.5	1.70	16.9	83.1	63.2	0.57
20 – 15.6	1.86	17.5	82.5	65.9	0.59
24 – 18.7	1.86	17.1	82.9	73.2	0.57
28 – 21.8	1.86	17.3	82.7	72.0	0.54
32 – 25.0	1.96	17.4	82.6	72.1	0.57
Mean	1.86	17.4	82.6	67.6	0.58
PLSD 0.01	NS	NS	NS	NS	NS
PLSD 0.05	NS	NS	NS	NS	NS
PLSD 0.10	NS	NS	NS	NS	NS
CV %	9.8	5.7	1.2	16.6	18.0
Prob. > F	0.4194	0.9474	0.9474	0.7123	0.9708
Harvest date	7/9				

Table 24. Third cutting 2003 seeding rate effect on yield and stems/ft² results for ‘Ultra’ alfalfa under a four-cut harvest management regime, planted in August, 1998 at the Central Oregon Agricultural Research Center, Madras, Oregon.

Seeding rate (lb/acre) Actual - PLS	Yield (ton/acre)	DM (%)	Moist. (%)	Stems/ft ²	Wt./stem (g)
4 – 3.1	2.09	29.8	70.2	54.9	0.82
8 – 6.2	2.33	29.4	70.6	60.7	0.80
12 – 9.4	2.44	29.1	70.9	76.8	0.67
16 – 12.5	2.26	29.1	70.9	68.1	0.69
20 – 15.6	2.32	28.7	71.3	79.1	0.61
24 – 18.7	2.20	28.2	71.8	70.1	0.66
28 – 21.8	2.32	29.1	70.9	72.3	0.68
32 – 25.0	2.46	28.7	71.3	74.6	0.70
Mean	2.30	29.0	71.0	69.6	0.70
PLSD 0.01	NS	NS	NS	NS	NS
PLSD 0.05	NS	NS	NS	NS	NS
PLSD 0.10	0.19	NS	NS	13.0	NS
CV %	6.9	3.5	1.4	15.3	14.6
Prob. > F	0.0723	0.5515	0.5115	0.0592	0.1132
Harvest date	8/13				

Table 25. Fourth cutting 2003 seeding rate effect on yield and stems/ft² results for ‘Ultra’ alfalfa under a four-cut harvest management regime, planted in August, 1998 at the Central Oregon Agricultural Research Center, Madras, Oregon.

Seeding rate (lb/acre) Actual - PLS	Yield (ton/acre)	DM (%)	Moist. (%)	Stems/ft ²	Wt./stem (g)
4 – 3.1	1.66	22.9	77.1	53.2	0.70
8 – 6.2	1.75	22.2	77.8	54.1	0.77
12 – 9.4	1.78	22.2	77.8	64.9	0.62
16 – 12.5	1.70	22.7	77.3	65.9	0.58
20 – 15.6	1.76	22.2	77.8	62.6	0.59
24 – 18.7	1.83	22.7	77.3	63.5	0.60
28 – 21.8	1.78	22.5	77.5	56.9	0.66
32 – 25.0	1.78	22.3	77.7	63.6	0.60
Mean	1.76	22.5	77.5	60.6	0.64
PLSD 0.01	NS	NS	NS	NS	NS
PLSD 0.05	NS	NS	NS	NS	NS
PLSD 0.10	NS	NS	NS	NS	NS
CV %	8.6	2.9	0.8	23.3	31.2
Prob. > F	0.8234	0.6131	0.6131	0.8149	0.8914
Harvest date	10/20				

Discussion

Only the first year (cut 1) and fourth year (cuts 1, 2, and 3) showed any differences for yield between the seeding rates. The 5-year cumulative yield ranged from the 4-lb (3.1 lb/acre PLS) rate of 38.33 ton/acre to the 32-lb/acre (25.0 lb/acre PLS) rate of 42.65 ton/acre. Yield from the 4-lb/acre seed rate was significantly lower than yields from the other seeding rates. There were no statistical cumulative yield differences between the 8- to 32-lb/acre seed rates for the 5 years.

During the first 3 years of the trial there were differences in stem numbers, but years 4 and 5 showed no differences for the total average stems/ft². There were, however, trends for higher numbers of stems/ft² with the increased seeding rates in the last 2 years. There were stems/ft² differences into the fourth year of the trial.

There were stem weight differences up until the last cutting of the fourth year and first cutting of the fifth year of the trial. The alfalfa plant was able to compensate for reduced stems/ft² by increasing stem weight.

There appears to be a lot of room to maneuver with lowering seeding rates of alfalfa. One problem with lowering seeding rates is getting even distribution through a drill. This can be accomplished by mixing a carrier with the seed, like fine cracked corn. The lower two seeding rates, of 4 and 8 lb/acre, did not flow evenly out of the small plot drill. We believe that had the lower seeding rates been mixed with fine cracked corn, there may have been fewer yield differences between the seeding rates. With a carrier, the two low seed rate treatment plots would have been more evenly planted. The drill tended to plant heavier at the beginning of the plot to less seed at the end of the plot, sometimes with very little seed at all at the end of the 4-lb/acre rate plot. We believe that if using regular grain drills, a carrier would need to be used, depending upon rate or other seed mixed in the drill.

If fine-stemmed alfalfa is important for marketing, then an appropriate higher seeding rate may need to be used. This study did not measure stem diameter. Seed rates are typically amortized over the life of the stand.

Ultimately, producers will need to make their own individual seeding rate decision based on their own situation, quality of seed bed prep, planting method (drilled, broadcast, or no-till planted), cost of variety seed, use of nurse crop, and market potential. This four-cut harvest trial shows that reducing seeding rates will not sacrifice yield and could lower seed costs.

References

Murphy, W.M., Johnson, M.J., and R.V. Frakes. 1976. Agricultural Experiment Station Oregon State University Special Report 460