

IMPLICATIONS OF SEEDING RATES AND SEED COATING WITH IMPROVED ALFALFA VARIETIES

Glenn E. Shewmaker, Maggie H. Hopwood, and Ron L. Roemer¹

ABSTRACT

Recommendations for alfalfa seeding rates vary from 8 to 20 lb/acre. The traditional seeding rate for many years has been 12 lb/acre for irrigated alfalfa. Yet that rate was recommended when most of our soils had less erosion, fewer diseases and pests, hay was cut two or three times per season, and the varieties planted were old fall-dormant public varieties. The reasoning for the higher rates is that it 1) provides a level of insurance for a good stand when seedling establishment environments are less than ideal, 2) an increased stem density produces smaller stems resulting in more desirable forage quality, and 3) a denser stand is able to resist weed invasion. Lime based seed coatings were developed to attract water to the seed and to buffer the pH in acid soils near the seed. Adding lime (CaCO₃) to calcareous soils with high pH is not a benefit. A new and patented seed coating uses gypsum as a base with Mo added as a micronutrient to promote nodulization of young seedlings. The new seed coating has improved forage yield and root production in several cases in the arid west. There is little independent and current information on seeding rates or the new seed coating for Idaho conditions. Moreover, producers use new and less fall-dormant varieties, cut more frequently, and face more plant disease and pest problems.

Keywords: Alfalfa, *Medicago sativa*, seeding rate, seed coating, *Mico-Rizo*TM

SEEDING RATE EXPERIMENT

Determining an optimum seeding rate for forage yield and quality will provide forage producers with the information to optimize yield and quality. The objectives of this study were to evaluate stem density, yield, and characterize the forage quality of alfalfa seeded at a series of rates in southern Idaho. Four varieties representing 4 dormancy groups from 2 to 5 were seeded at 1/4 inch depth in 6-inch rows with a press wheel drill at 8, 12, 16, and 20 lb pure live seed/acre.

Table 1. Experimental Design: Four varieties representing 4 dormancy groups from 2 to 5 are seeded at 4 planting rates from 8- 20 lbs-seed/acre with 4 replicates of each treatment.

Seed	Dormancy Rates (lbs/acre)	
Vernal	2	8
Trophy	3	12
Rampage	4	16
Robust	5	20
Number of Treatments	4	4

Stem density per unit area was determined annually. Yield, dry matter concentration, stage of maturity (mean-stage-count), and forage quality were measured at each of three cuttings per year. Acid detergent fiber (ADF), neutral detergent fiber (NDF), and crude protein were determined by near infrared

¹ G. Shewmaker, Univ. of Idaho Twin Falls R&E Center, P.O. Box 1827, Twin Falls, ID 83303-1827. Published In: Proceedings, Western Alfalfa and Forage Conference, 11-12 December 2002, Reno, NV, UC Cooperative Extension, Univ. of California, Davis.

reflectance spectrophotometry (NIRS) with calibration by wet chemistry.

RESULTS-- SEEDING RATE EXPERIMENT

Alfalfa canopy develops rapidly in the first 7 days after cutting in mid summer. The photosynthetic active radiation (PAR) decreases logarithmically with time (see Figure 1) at 2 inches above ground. By the 13th day after cutting not much light is reaching the soil surface at any of the seeding rates.

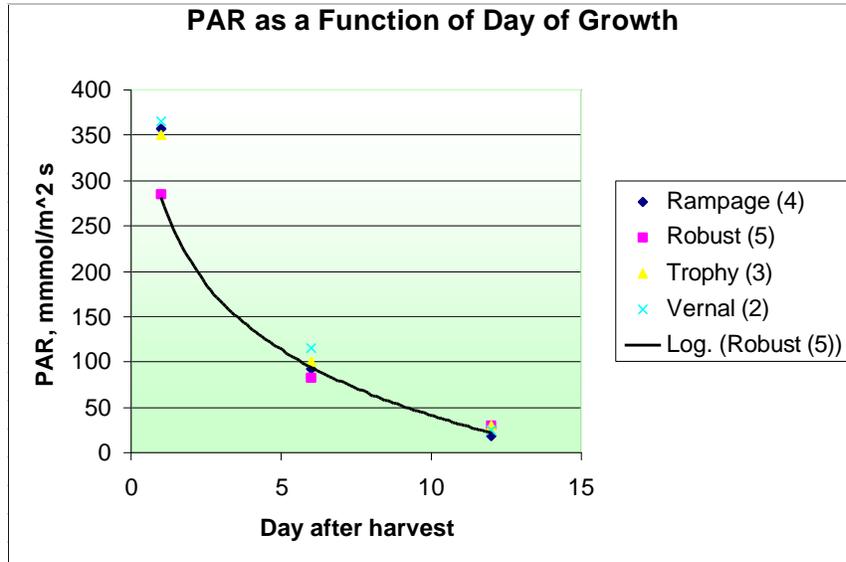


Figure 1. The amount of light measured as photosynthetic active radiation (PAR) penetrating the alfalfa canopy to a 2-inch above ground level as a function of day after harvest. University of Idaho study at the Kimberly R&E Center.

Seeding Rate Effect on Alfalfa Yield--In preliminary results there is no significant difference in first year of production yields because of seeding rate. Since there is relatively little difference in number of stems per unit of area, we would not expect any yield differences.

Does dormancy rating interact with seeding rate? --So far, no. There has been no detectable statistical interaction between seeding rate and variety. In other words, there is no evidence that we should seed more or less for different fall dormancy ratings.

Were there differences in quality between the varieties?--Yes. There seemed to be some difference in quality and yield between the varieties. However, the differences did not seem to be consistent with a trend in dormancy rating.

Is there higher quality with higher seeding rates, and finer stems?--We have not measured stem size, however, so far there is no response to seeding rate with respect to acid detergent fiber (ADF) or crude protein (CP) concentration.

Table 2. Alfalfa forage yield and quality as affected by a representative variety from a fall dormancy class. First cut was harvested June 6, 2001 and second on July 10, 2001. The trial was seeded at 8, 12, 16, and 20 lbs/acres with a press-wheel drill in 6-inch rows at the Kimberly R&E Center 16-17 May 2000.

Variety	Fall dormancy	Dry matter yield			First cutting quality and stage			Stage MSC (0-9)
		Total	Cutting		CP (%)	ADF (%)	RFV	
			First	Second				
Vernal	2	5.6	3.8	1.9	16.9	37.6	142	3.6
Trophy	3	5.7	3.7	2.0	17.8	35.9	154	3.8
Rampage	4	5.6	3.7	1.9	17.7	36.5	148	3.6
Robust	5	5.6	3.5	2.0	18.2	35.7	152	3.5
LSD (.05)	----	NS	NS	NS	0.49	0.75	5.0	NS
CV %	----	NS	NS	NS	3.9	2.9	4.7	NS

CP = crude protein, ADF = acid detergent fiber, RFV = relative feed value index

Forage quality estimated by Near Infrared Spectroscopy (NIRS)

Stage MSC = mean stage by count method of Kalu-Fick

Do higher seeding rates provide for greater inter-specific competition and consequently greater weed control in the establishment year?--There were no differences in yield between treatments and all treatments were infested with weeds. No herbicides were used, but high seeding rate itself did not reduce weeds.

Are 12 lbs of alfalfa seed enough?--Plant stand data have not been analyzed yet but will be at the end of the trial. It is generally considered adequate to have about 30 plants/ft² at the end of the establishment year, and to winter over 20 plants/ft² for a full stand. Loss of plants during the seeding year is generally considered to be due to inter-specific competition for resources. It appears that adequate stands were established with all seeding rates.

CONCLUSIONS--SEEDING RATE EXPERIMENT

Seeding rate did not affect dry matter yield, or forage quality. We conclude that any seeding rate for alfalfa between 8 and 20 lbs/acre when sown with a press-wheel drill will produce an adequate stand with proper management. Broadcast seeding methods may produce different results and recommendations.

SEED COATING EXPERIMENT

Some areas in Idaho have difficulty establishing alfalfa stands. Seed coating was originally developed to add lime around the seed to buffer low soil pH in acid soils and to attract water to the seed. Other

benefits of coatings were to protect rhizobia inoculant and increase the amount of inoculant on the seed and to add fungicides such as Apron.

A new seed coat has been developed to assist in establishment and rhizobia inoculation of seedling roots. *Mico-Rizo*TM is a gypsum-based seed coating with the micronutrient molybdenum added. This seed coating was patented in 1999 (paten # 5,994,265). The *Mico-Rizo*TM seed coating was evaluated in trials at Kimberly and in Camas Co. Idaho. The first trial was planted 3 September 1999 at the Kimberly R&E Center with 5 x 17.5 foot plots with four replications. Seed were sown at 1/4 inch depth with a press wheel drill in 6-inch rows. Seeding rate for all treatments was 16 lbs/ac, so treatments with the 33% seed coat actually had 33% fewer seed planted. The Kimberly trial included the varieties GA00, Rampage, and ZG9850. The same seed lot was used for the pre-inoculated (PI) treatment and the *Mico-Rizo*TM treatment.

The second trial was planted at Kimberly 4-5 May 2000 with the same protocol as the first trial. The third trial was planted in Camas County, Idaho on 26 May 2000.

RESULTS--SEED COATING EXPERIMENT

In most cases there has been an advantage in seedling development with the *Mico-Rizo*TM treatment. Whole plant (roots + crowns + shoots) and forage yields are higher with the *Mico-Rizo*TM seed coat. Although we didn't measure nodulization, it appeared that greater effective nodulization was the primary cause for improvement in production for the *Mico-Rizo*TM treatment. In these preliminary results, there were no significant effects of seed coating on forage quality.

First Trial--Whole plant production was higher for the *Mico-Rizo*TM treatment than for the PI seed treatment in April 2000 from the 3 September 1999 planting (Figure 2).

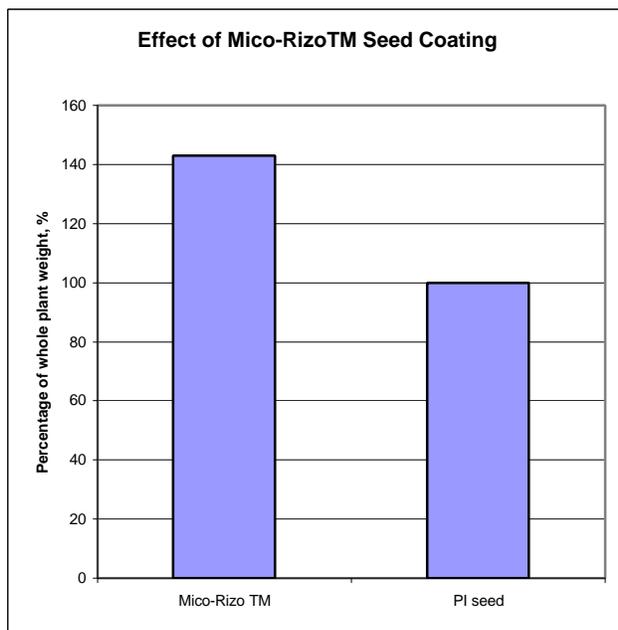


Figure 2. *Mico-Rizo*TM seed coat versus pre-inoculated seed (PI seed) effects on whole plant (leaves, stems, and roots) dry matter yield on April 6, 2000. Plots were seeded 3 September 1999. Dry matter yields for Rampage and ZG9850 sown with seed coated with *Mico-Rizo*TM were greater ($P=0.05$) than for the same seed lots with just pre-inoculation.

Second Trial--First year results from the second trial at Kimberly are shown in Figure 3. Rampage + *Mico-Rizo*TM and ZG9850 + *Mico-Rizo*TM treatments yielded more forage dry matter at the 15 October 2000 cutting than the PI seed of each. The treatment was not significant for GA00.

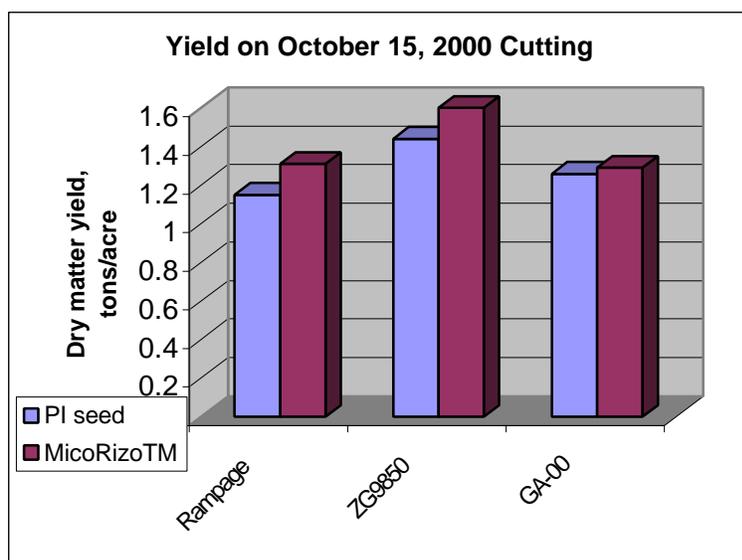


Figure 3. Mico-Rizo™ seed coat versus pre-inoculated seed (PI seed) effects on dry matter yield on October 15, 2000 cutting. Plots were seeded September 1999. Dry matter yields for Rampage and ZG9850 sown with seed coated with Mico-Rizo™ were greater (P=0.05) than for the same seed lots with just pre-inoculation.

Second year results from the second trial at Kimberly are shown in Table 3. Rampage + *Mico-Rizo*™ and ZG9850 + *Mico-Rizo*™ treatments yielded 0.2 tons/acre more forage dry matter at the 15 October 2000 cutting than the PI seed. The treatments were not significant for GA00 and ZG9850 for total dry matter yield. Forage quality of first cutting was not affected by treatment.

Table 3. Alfalfa forage yield and quality (first cut only) as affected by *Mico-Rizo*™ seed coating (patent # 5,994,265). Harvesting dates: First on 30-31 May; second on 27 June, third on 26 July, and fourth on 14 September 2001. The trial was seeded at 16 lbs/acres with a press-wheel drill in 6-inch rows at the Kimberly R&E Center, Idaho 4-5 May 2000.

Entry	Alfalfa dry matter yield					Forage quality		
	Total	Cutting				First cutting 30-31 May 2001		
		First	Second	Third	Fourth	CP	ADF	RFV
	----- (ton/acre) -----					(%)	(%)	index
GA00	10.3	4.7	1.6	2.0	2.0	19.9	35.5	150
Rampage	9.9	4.6	1.6	1.9	1.8	20.3	35.3	150
ZG 9850	10.5	4.6	1.8	2.0	2.1	20.0	35.6	150
PI mean	10.2							
GA00 + <i>Mico-Rizo</i> ™	10.3	4.8	1.6	2.0	1.9	20.1	35.8	148
Rampage + <i>Mico-Rizo</i> ™	10.6	4.9	1.5	2.1	2.2	20.3	35.3	151
ZG 9850 + <i>Mico-Rizo</i> ™	10.3	4.6	1.6	2.0	2.0	20.0	35.4	153
<i>Mico-Rizo</i> ™ mean	10.4							

CP = crude protein, ADF = acid detergent fiber, RFV = relative feed value index
 Forage quality estimated by Near Infrared Spectroscopy (NIRS)

Third Trial--Results from the third trial (Camas County) are shown in Table 4. The *Mico-Rizo*™ seed coating significantly improved forage yield for both varieties in first cutting. There appears to be no

effect on forage quality due to seed coating.

Table 4. Alfalfa forage yield and quality as affected by *Mico-Rizo*™ seed coating (patent # 5,994,265). First cut was harvested 6 July 2001 and second on 29 August 2001. The trial was seeded at 16 lbs/acres with a press-wheel drill in 6-inch rows in Camas County Idaho 26 May 2000.

Entry	Dry matter yield			Forage quality					
	Cutting			First Cutting July 6			Second Cutting August 29		
	Total	First	Second	CP	ADF	RFV	CP	ADF	RFV
	---- (ton/acre) ----			(%)	(%)	index	(%)	(%)	index
Rampage	3.1	1.7	1.4	15.6	39.2	138	18.0	35.8	151
Rampage + <i>Mico-Rizo</i> ™	3.4	1.9	1.5	15.7	39.1	142	16.8	37.2	145
ZG9840	3.1	1.7	1.4	16.4	38.5	146	17.7	35.8	155
ZG9840 + <i>Mico-Rizo</i> ™	3.3	1.9	1.4	16.3	38.1	147	17.3	36.8	145
Mean	3.3	1.8	1.4	16.1	38.6	145	17.3	36.6	148
CV %	17.4	22.9	21.1	4.8	3.1	5.5	5.2	2.5	6.6

CP = crude protein, ADF = acid detergent fiber, RFV = relative feed value index
 Forage quality estimated by Near Infrared Spectroscopy (NIRS)

CONCLUSIONS-- SEED COATING EXPERIMENT

In most cases in three trials at the University of Idaho there has been an advantage in seedling development with the *Mico-Rizo*™ treatment. Whole plant (roots + crowns + shoots) and forage yields are higher with the *Mico-Rizo*™ seed coat. Although we didn't measure nodulization, it appeared that greater effective nodulization was the primary cause for improvement in production for the *Mico-Rizo*™ treatment. In these preliminary results, there were no significant effects of seed coating on forage quality. Moreover, university trials in Utah, Wyoming, and Oregon have generally shown a benefit of *Mico-Rizo*™ seed coating, even with a reduced seeding rate with the 33% by weight coating. Strip trials in several areas in Idaho on different soils show striking results sometimes. The *Mico-Rizo*™ seed coat has given striking visual results in environments that are hard to establish good stands of alfalfa.

For more information on the *Mico-Rizo*™ seed coating (patent # 5,994,265), contact Mike Reed, Gooding Seed Co., 103 Main St., Gooding, ID 83330, phone: 208-934-8441.