

TECHNICAL NOTES

U.S. Department of Agriculture

Natural Resources Conservation Service

TN-PLANT MATERIALS-79

June 2008

The Potential of Mycorrhiza Use in Improving Grass Performance

ABSTRACT

This study evaluated the effects of using different amounts of mycorrhiza inoculation in the growing medium used to propagate different conservation plants. This study used endo net arbuscular mycorrhizal inoculum, *Glomus intraradices*. This study determined that mycorrhizal inoculation using seed coatings did not provide improved plant performance.

INTRODUCTION

The location of this study was at the Lockeford Plant Materials Center and the study was performed from 2002 to 2007. The land uses associated with this study are rangeland and wild land. The vegetative practices associated with this study are 550 range planting and 342 critical area planting. The resource concerns are soil restoration, soil erosion and grazing land conservation. The purpose of the study was to determine if mycorrhiza applied to seed coatings on grass seed improves plant performance.

The status of knowledge is, past greenhouse research at the Lockeford PMC on mycorrhiza (Dyer 2001) has shown that mycorrhiza does improve plant performance; however, there is a need to document mycorrhiza seed coating methods on grass performance in field conditions.

METHODS AND MATERIALS

Experimental Design: Randomized Complete Block Design, three replications

Treatment 1	<u>Raw seed</u> Description: No coating
Treatment 2	<u>Mycorrhiza</u> Description: seed coated with mycorrhiza
Treatment 3	<u>Slow release N</u> Description: Slow release N added to coating
Treatment 4	<u>N and Mycorrhiza</u> Description: Slow release N and mycorrhiza added to coating

Prepared by David A. Dyer, Plant Materials Center Manager and Agronomist, Lockeford, CA. and Sarah Lipelt PMC Student Trainee, Lockeford, CA.; Reviewed by Rita Bickel, State Agronomist, Davis, CA. and Jim Briggs, West Region Plant Materials Specialist, Portland, OR.

CA-79-1

The study evaluated two species, purple needlegrass (*Nassella pulchra*) and ‘Berber’ orchardgrass (*Dactylis glomerata*). The planting was accomplished by broadcasting seed in 20’x20’ plots with 50 pure live seed per square foot. Weed control was performed as needed using broadleaf weed herbicide.

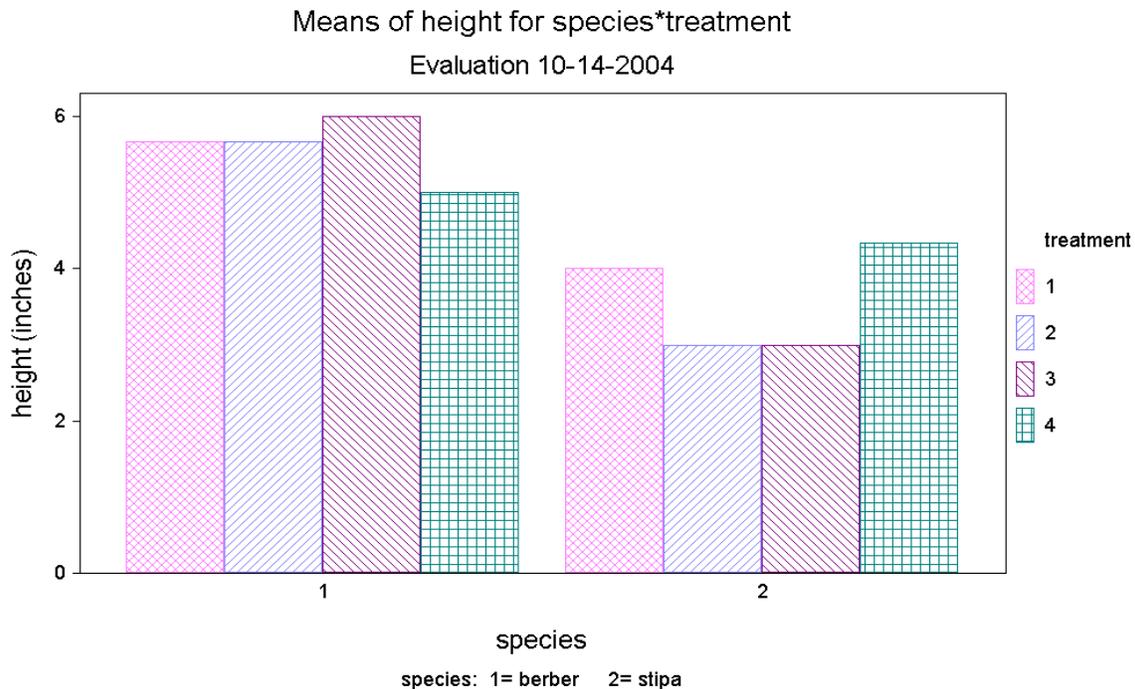
RESULTS AND DISCUSSION

Two species of grass, purple needlegrass (*Nassella pulchra*) and ‘Berber’ orchardgrass (*Dactylis glomerata*), were evaluated on three different dates to find the effects of three mycorrhiza seed treatments and one control.

Treatment 1	<u>Raw seed</u> - no coating
Treatment 2	<u>Mycorrhiza</u> - seed coated with mycorrhiza
Treatment 3	<u>Slow release N</u> - slow release N added to coating
Treatment 4	<u>N and Mycorrhiza</u> - slow release N and Mycorrhiza added to coating

Evaluation on October 14, 2004

At the evaluation date, Oct-14-2004, the first evaluation of the plantings, a height measurement was taken. This seedling height showed no great effect by the seed coatings. Treatment 4 produced the best results for *Nassella pulchra*, but it was a difference of only 0.333 greater than Treatment 1. Treatment 3 had the greatest height for ‘Berber’ *Dactylis glomerata* but it was only 0.4 inches greater than Treatments 1 and 2. There was not a large difference between the top height and the following height, which in both cases was Treatment 1.



Note: Species 1 is ‘Berber’ *Dactylis glomerata*. Species 2 is *Nassella pulchra*, which is listed as “stipa” in the graph above.

There was no significant difference between the treatments on seedling height for the first evaluation date. When the height data was compared using an LSD All-Pairwise comparison test, there is not a statistically significant difference between the treatments. Therefore, although there are differences, they are not significant enough to promote one treatment over the other.

LSD All-Pairwise Comparisons Test of height for treatment

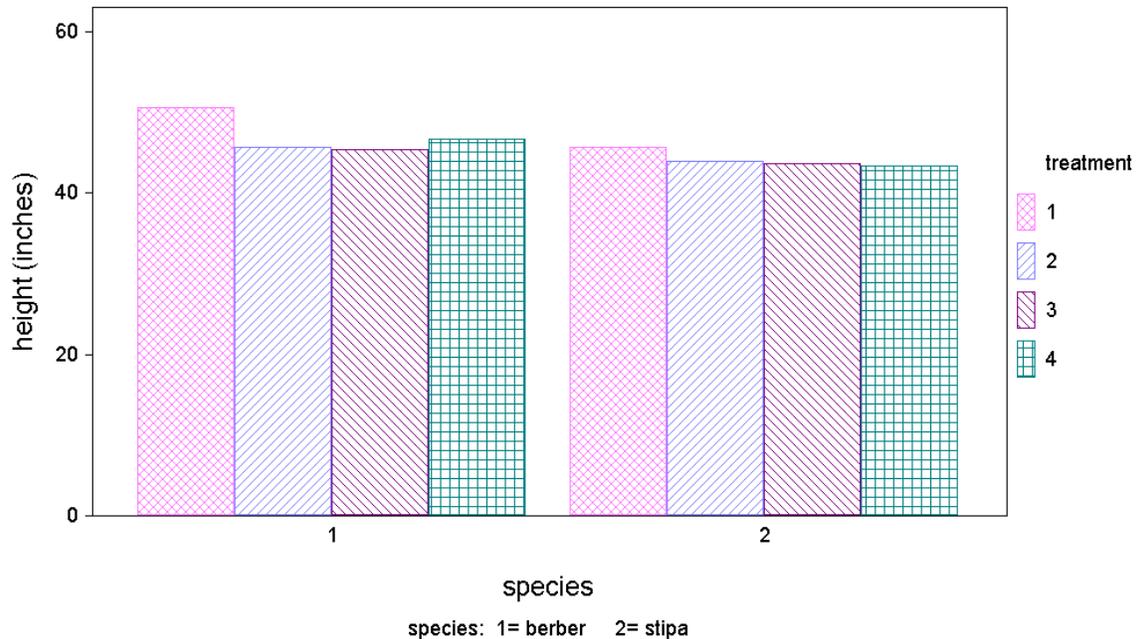
treatment	Mean	Homogeneous Groups
1	4.8333	A
4	4.6667	A
3	4.5000	A
2	4.3333	A

Alpha 0.05 Standard Error for Comparison 0.7836
 Critical T Value 2.1 Critical Value for Comparison 1.6401
 Error term used: Error, 19 DF
 There are no significant pairwise differences among the means.

Evaluation on June 10, 2005

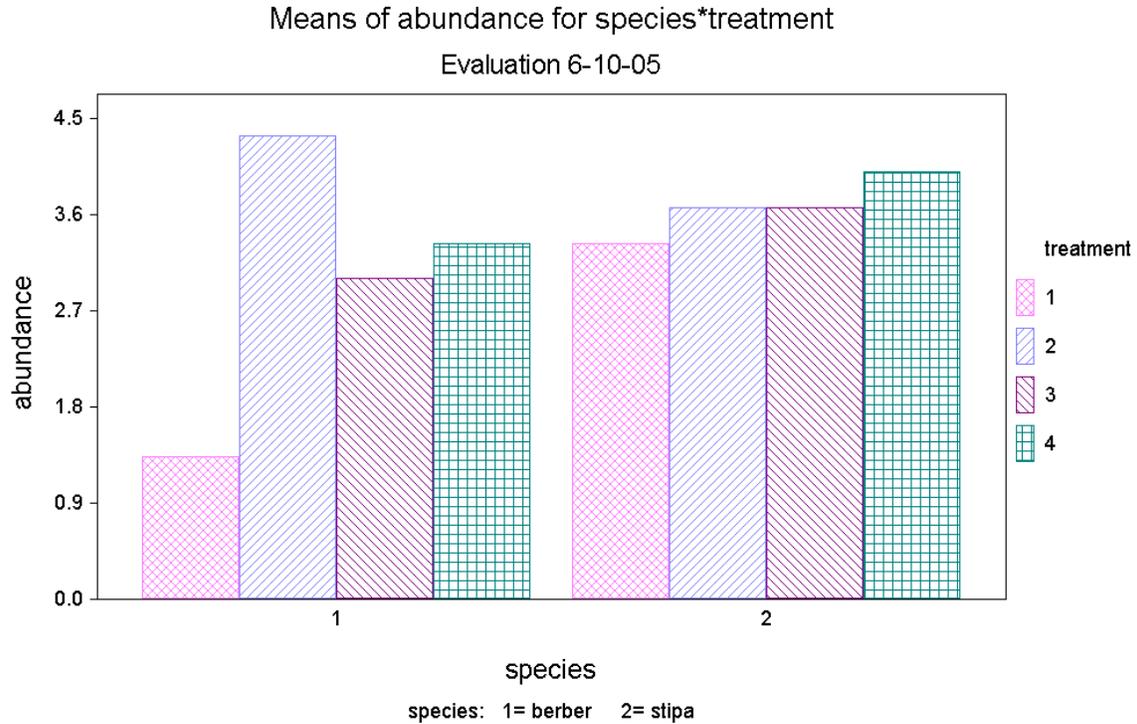
The evaluation of height on June-10-2005 showed that there is no effect on the plant height by the seed coating treatments. For both species, Treatment 1 had the greatest heights, but the difference between all treatment heights was relatively insignificant.

Means of height for species*treatment
 Evaluation 6-10-05



Note: Species 1 is ‘Berber’ *Dactylis glomerata*. Species 2 is *Nassella pulchra*, which is listed as “stipa” in the graph above.

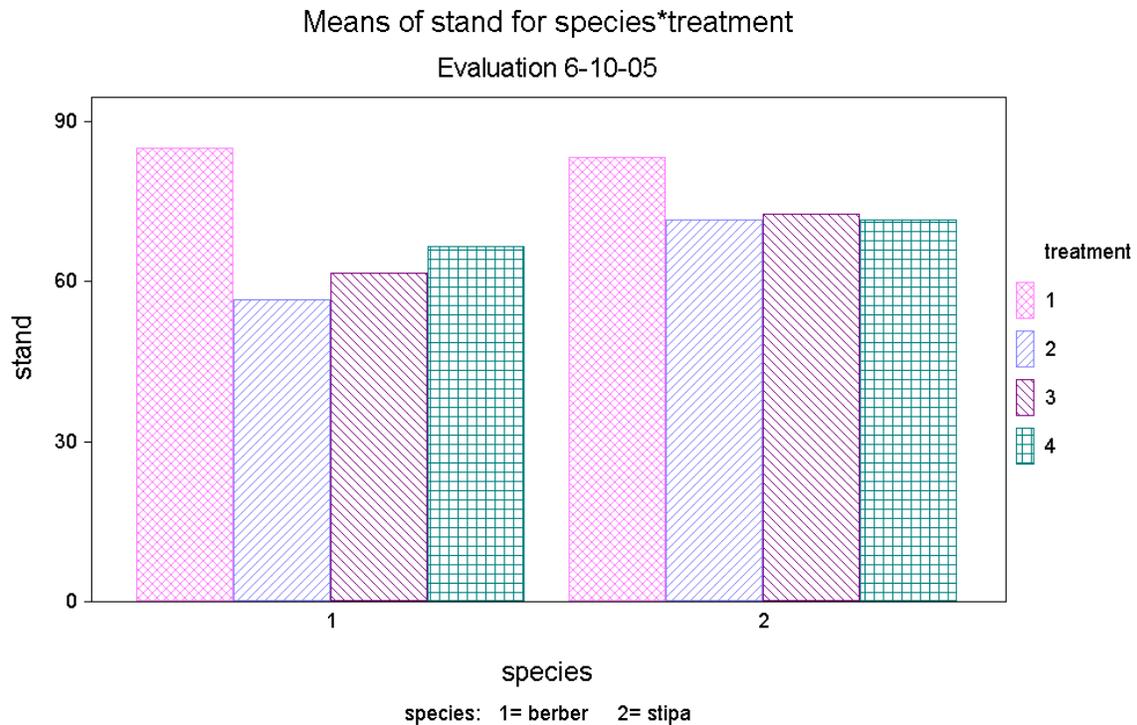
Stand abundance shows that there is effect from the treatments, though it is not in favor of the seed coatings. 'Berber' seed coatings did poorly in comparison to the untreated seed. Though *Nassella pulchra* treatment results were more similar between treatments than 'Berber' *Dactylis glomerata*, still Treatment 1 received the best score.



Abundance rating: 1=good, 9= poor

Note: Species 1 is 'Berber' *Dactylis glomerata*. Species 2 is *Nassella pulchra*, which is listed as "stipa" in the graph above.

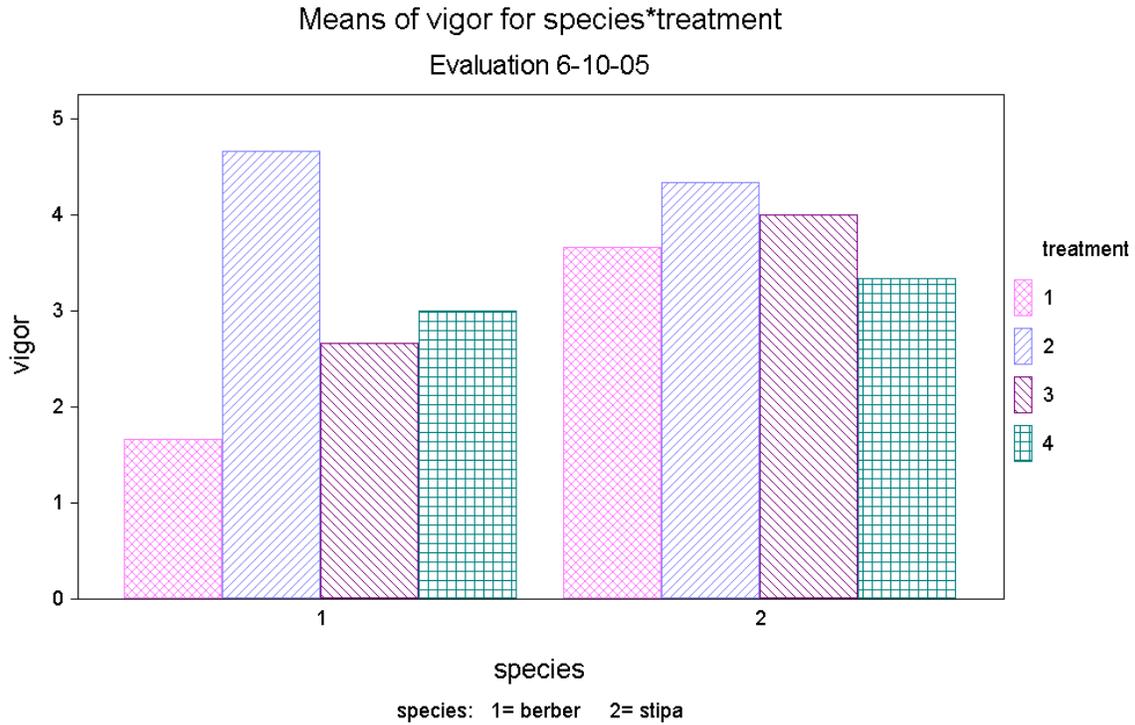
The stand results did not show that there was any positive effect from the seed coating treatments. For both species, Treatment 1, the untreated seed, had the greatest percent stand.



Stand is measured as a percentage

Note: Species 1 is 'Berber' *Dactylis glomerata*. Species 2 is *Nassella pulchra*, which is listed as "stipa" in the graph above.

The vigor results for the June-10-2005 evaluation show that there is little effect from seed coating treatments. For 'Berber' *Dactylis glomerata* treatments, Treatment 1 was the best performer by far. *Nassella pulchra* treatments were closer in results. Treatment 4 was the best score and it was closely followed by Treatment 1. All *Nassella pulchra* ratings were poor. Though Treatment 4 was slightly better than Treatment 1, it was not greatly improved.

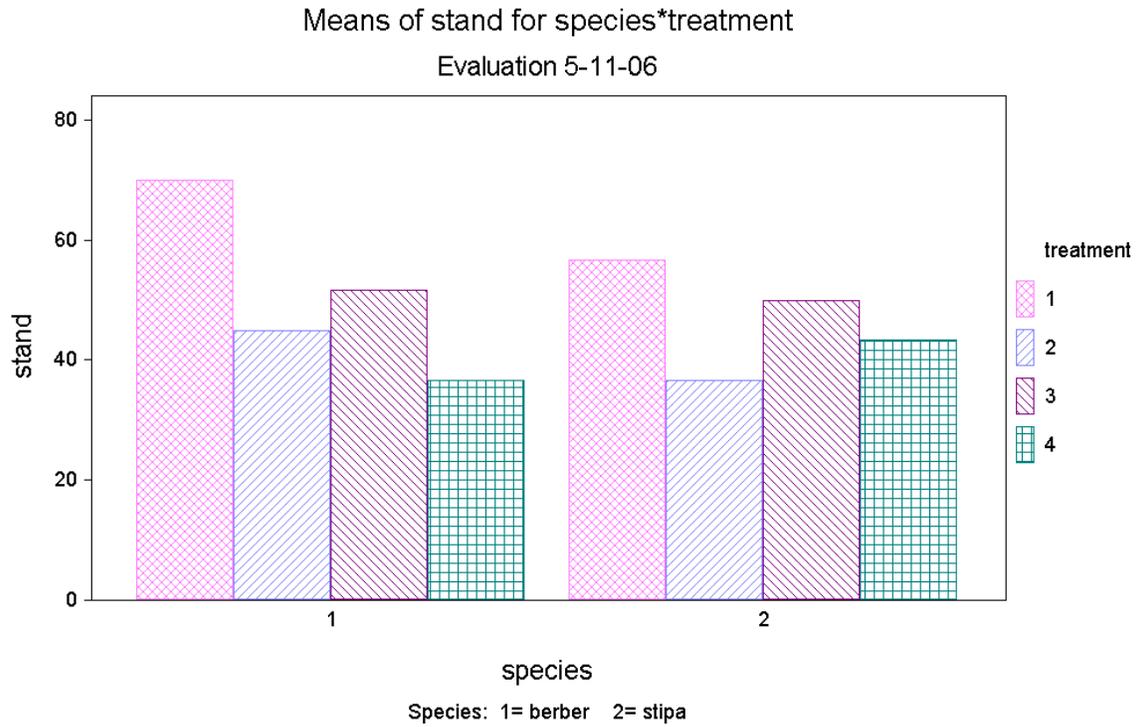


Abundance rating: 1=good, 9= poor

Note: Species 1 is 'Berber' *Dactylis glomerata*. Species 2 is *Nassella pulchra*, which is listed as "stipa" in the graph above.

Evaluation on May 11, 2006

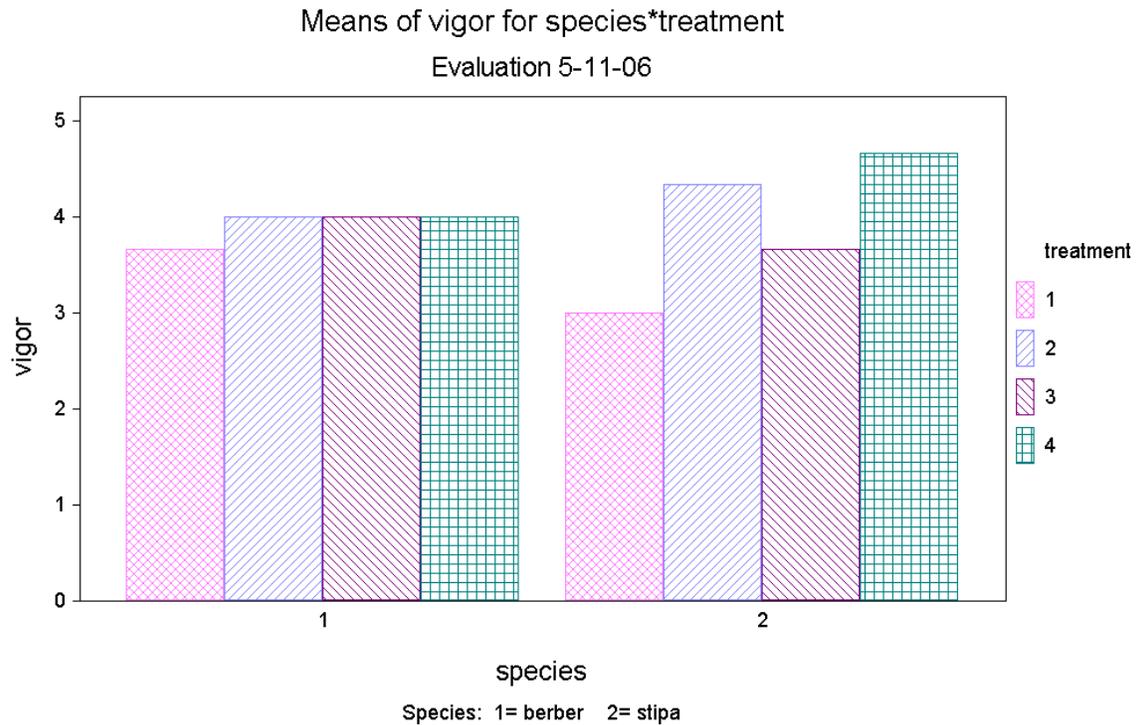
At the final reading, May-11-2006, percent stand was best with Treatment 1 for both species. Of the treated seeds, Treatment 3 was best for both species, but was still lower in stand than the untreated seeds of Treatment 1.



Stand is measured as a percentage

Note: Species 1 is 'Berber' *Dactylis glomerata*. Species 2 is *Nassella pulchra*, which is listed as "stipa" in the graph above.

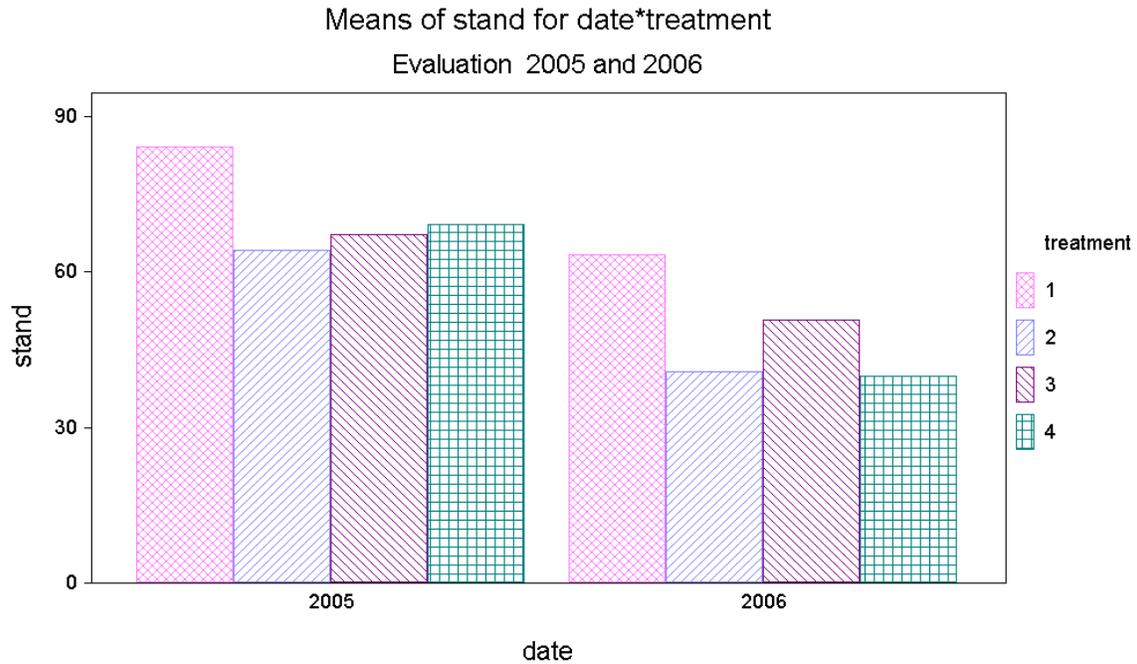
Vigor still showed little effect from treated seeds at the time of the final evaluation, May-11-2006. 'Berber' *Dactylis glomerata* seeds were all the same except for Treatment 1, which was more vigorous. *Nassella pulchra* seed was best for vigor with Treatment 1, with the other treatments performing poorly in comparison.



Abundance rating: 1=good, 9= poor

Note: Species 1 is 'Berber' *Dactylis glomerata*. Species 2 is *Nassella pulchra*, which is listed as "stipa" in the graph above.

When a comparison is done between the two evaluation dates, June-10-2005 and May-11-2006, the lack of effects of the seed coating treatment is apparent. Stand percent evaluation for the two years still shows that Treatment 1, no coating, has the greatest results.

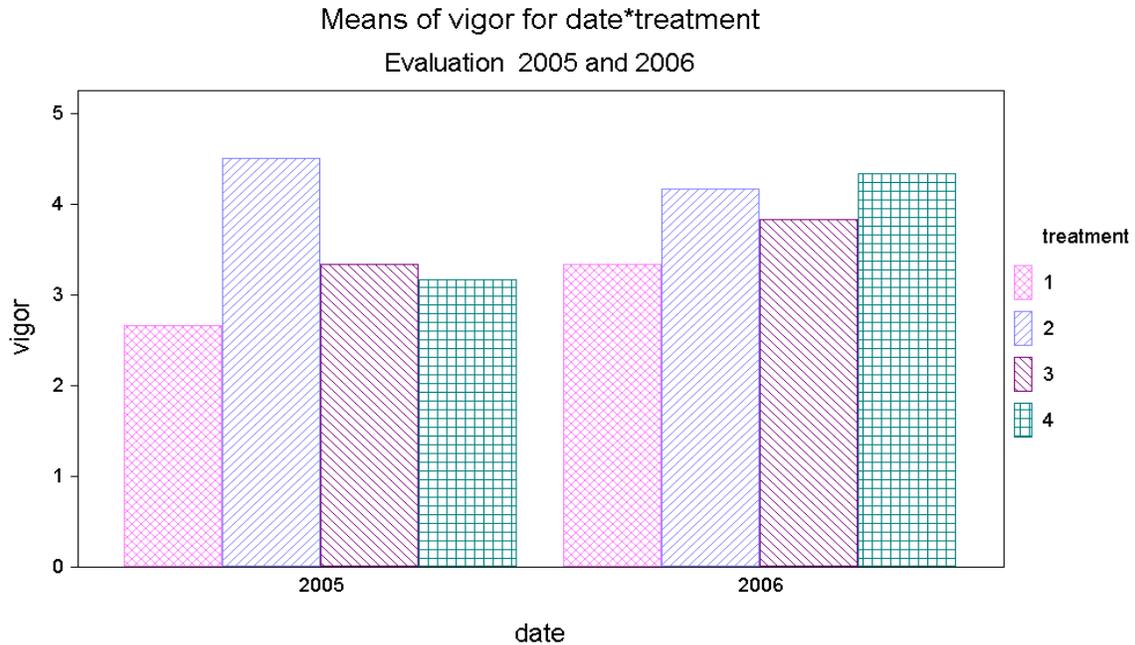


Note: species data is combined for each evaluation date

Stand is measured as a percentage

Note: Species 1 is 'Berber' *Dactylis glomerata*. Species 2 is *Nassella pulchra*, which is listed as "stipa" in the graph above.

Vigor comparison for years 2005 and 2006 gives the same results: Treatment 1 has the best effect for both evaluation years. Mycorrhiza seed coating and nitrogen seed coating have no positive effect on the vigor.



Note: species data is combined for each evaluation date
Abundance rating: 1=good, 9= poor

Analysis of variance tables for stand and vigor for the 2005-2006 comparison:
Analysis of Variance Table for stand

<u>Source</u>	<u>DF</u>	<u>SS</u>	<u>MS</u>	<u>F</u>	<u>P</u>
date	1	6030.1	6030.08	10.01	0.0030
treatment	3	3307.8	1102.58	1.83	0.1572
date*treatment	3	257.7	85.92	0.14	0.9338
Error	40	24098.3	602.46		
Total	47	33693.9			

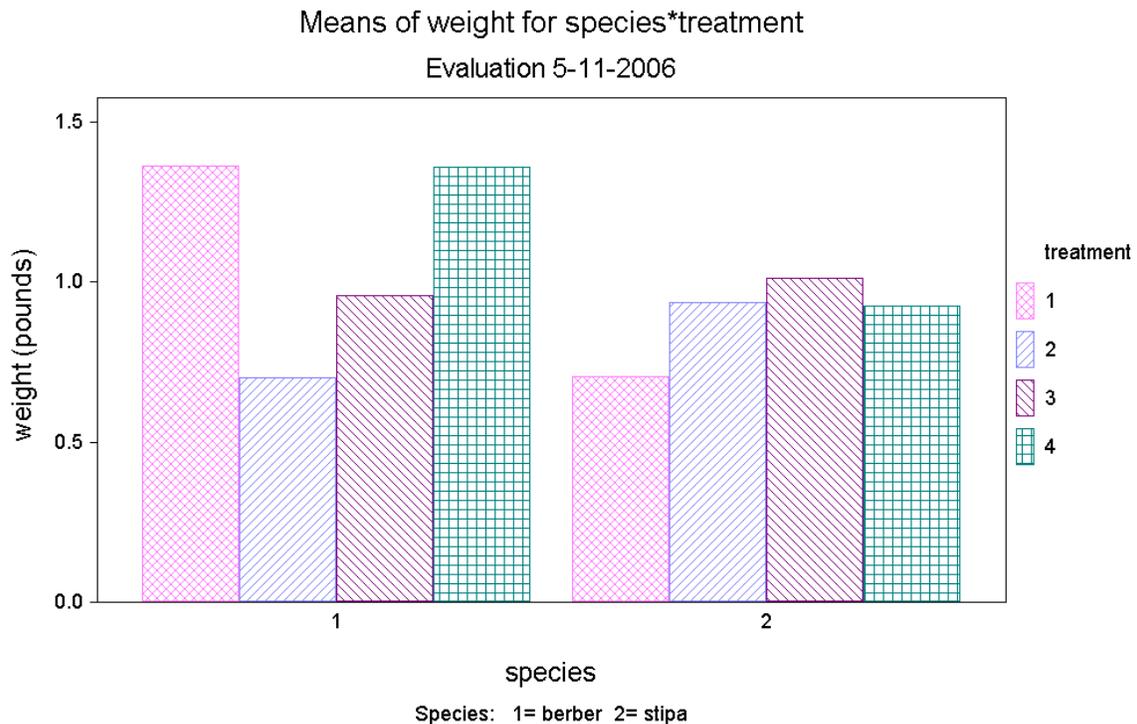
Grand Mean 59.958 CV 40.94

Analysis of Variance Table for vigor

<u>Source</u>	<u>DF</u>	<u>SS</u>	<u>MS</u>	<u>F</u>	<u>P</u>
date	1	3.000	3.00000	0.79	0.3785
treatment	3	10.833	3.61111	0.95	0.4236
date*treatment	3	3.500	1.16667	0.31	0.8192
Error	40	151.333	3.78333		
Total	47	168.667			

Grand Mean 3.6667 CV 53.05

A clipping of 7.5 sq. ft. was taken of each species on May-11-2006. These results showed some positive effect from the seed coatings. For *Nassella pulchra*, Treatment 3, slow release N coating, had the greatest average weights; Treatment 1 had the lowest average weights. ‘Berber’ *Dactylis glomerata* seed with Treatment 1 had a slightly greater mean, 1.3633 lbs.; Treatment 4 was close with a mean of 1.3600 lbs. There was no statistically significant difference between the treatment results for plant weight. Though the graph visually depicts a great difference between the treatment results for weight as of May-11-2006, there is not a great difference. All treatment weights were well within a pound of each other. For *Nassella pulchra*, all treatments were close, within a half pound.



Note: Species 1 is ‘Berber’ *Dactylis glomerata*. Species 2 is *Nassella pulchra*, which is listed as “stipa” in the graph above.

When a LSD All-pairwise comparison test is used, it can be seen that the differences in weight are insignificant. Therefore, weight cannot be used as an argument in support of the use of the seed coatings.

LSD All-Pairwise Comparisons Test of weight for species*treatment

<u>species</u>	<u>treatment</u>	<u>Mean</u>	<u>Homogeneous Groups</u>
1	1	1.3633	A
1	4	1.3600	A
2	3	1.0133	A
1	3	0.9567	A
2	2	0.9367	A
2	4	0.9267	A
2	1	0.7033	A
1	2	0.7000	A

Alpha 0.05 Standard Error for Comparison 0.3959
Critical T Value 2.1 Critical Value for Comparison 0.8392
Error term used: Error, 16 DF
There are no significant pair-wise differences among the means.

CONCLUSION

Treatment 1 had the best results for the majority of the evaluations. There appeared to be no positive result from the seed coating treatments. Though for certain evaluations there were seed coating treatments that performed better than the uncoated seed Treatment 1, the performances were not significantly better and cannot be used in support of the seed coating treatments.

REFERENCES CITED

- Dyer, D.A. ; Technical Note 62, Soil quality improvement using mycorrhiza inoculation and its effects on the propagation of California native plants.
- Biermann, B. J.; Linderman, R. G. 1983. Effect of container plant growth medium and fertilizer phosphorus on establishment and host growth response to vesicular arbuscular mycorrhizae. *Journal of the American Society of Horticultural Science* 108 (6):962-971
- Danielson, R. M.; Visser, S.; Parkinson, D. 1983. Microbial activity and mycorrhizal potential of four overburden types used in the reclamation of extracted oil sands. *Canadian Journal of Soil Science* 63 (2): 363-375
- Graham, J. H., and Timmer, L. W. 1985. Rock phosphate as a source of phosphorus for vesicular arbuscular mycorrhizal development and growth of citrus in a soilless medium. *Journal of the American Society for Horticultural Science*. 110 (4):489-492.
- Powell, C. L.; Santhanakrishnan, P. 1986. Effect of mycorrhizal inoculation and phosphorus fertilizer on the growth of hardwood cuttings of kiwifruit (*Actinidia deliciosa* cv. Hayward) in containers. *New Zealand Journal of Agricultural Research* 29 (2): 263-267

Table 1. Evaluation of plants by Treatments.

Evaluation on October-14-2004

Variety	Treatment	Height (in)
'Berber'	2	5
'Berber'	1	6
'Berber'	4	4
'Berber'	3	5
'Berber'	1	6
'Berber'	4	6
'Berber'	3	6
'Berber'	2	7
'Berber'	4	5
'Berber'	2	5
'Berber'	3	7
'Berber'	1	5
<i>Nassella</i>	2	4
<i>Nassella</i>	1	5
<i>Nassella</i>	4	7
<i>Nassella</i>	3	5
<i>Nassella</i>	1	4
<i>Nassella</i>	4	2
<i>Nassella</i>	3	2
<i>Nassella</i>	2	3
<i>Nassella</i>	4	4
<i>Nassella</i>	2	2
<i>Nassella</i>	3	2
<i>Nassella</i>	1	3

Evaluation on June-10-2005

Variety	Treatment	Height (in)	% Stand	Abundance**	Vigor*
'Berber'	2	5	100	1	1
'Berber'	1	6	95	2	1
'Berber'	4	4	80	3	2
'Berber'	3	5	85	2	2
'Berber'	1	6	80	1	2
'Berber'	4	6	90	1	1
'Berber'	3	6	50	5	4
'Berber'	2	7	40	5	6
'Berber'	4	5	30	6	6
'Berber'	2	5	30	7	7
'Berber'	3	7	50	2	2
'Berber'	1	5	80	1	2
<i>Nassella</i>	2	4	95	2	2
<i>Nassella</i>	1	5	100	1	1
<i>Nassella</i>	4	7	85	2	2
<i>Nassella</i>	3	5	98	1	1
<i>Nassella</i>	1	4	70	4	4
<i>Nassella</i>	4	2	90	3	2
<i>Nassella</i>	3	2	60	4	4
<i>Nassella</i>	2	3	70	3	4
<i>Nassella</i>	4	4	40	7	7
<i>Nassella</i>	2	2	50	6	7
<i>Nassella</i>	3	2	60	6	7
<i>Nassella</i>	1	3	80	5	6

*Vigor Ratings: 1= Excellent, 9= Poor

** Abundance Ratings: 1=Excellent, 9= Poor

Evaluation on May-11-2006

Variety	Treatment	% Cover	Vigor*	Plant Wt.
'Berber'	2	90	2	0.97
'Berber'	1	90	3	2.12
'Berber'	4	50	2	1.94
'Berber'	3	85	4	1.32
'Berber'	1	60	6	0.83
'Berber'	4	50	5	0.94
'Berber'	3	40	5	0.33
'Berber'	2	20	6	0.56
'Berber'	4	10	5	1.2
'Berber'	2	25	4	0.57
'Berber'	3	30	3	1.22
'Berber'	1	60	2	1.14
<i>Nassella</i>	2	80	3	1.02
<i>Nassella</i>	1	60	2	1.34
<i>Nassella</i>	4	80	3	1.4
<i>Nassella</i>	3	70	2	1.56
<i>Nassella</i>	1	50	3	0.3
<i>Nassella</i>	4	40	5	0.5
<i>Nassella</i>	3	60	4	0.7
<i>Nassella</i>	2	20	5	0.65
<i>Nassella</i>	4	10	6	0.88
<i>Nassella</i>	2	10	5	1.14
<i>Nassella</i>	3	20	5	0.78
<i>Nassella</i>	1	60	4	0.47

*Vigor Ratings: 1= Excellent, 9= Poor

Plant weight is in pounds.