



## 1998 Progress Report

**STUDY NUMBER:** 29I143G - Seed Coating / Seeding Rates Study

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### **Introduction:**

There is little information available comparing coated seed, versus non-coated seed, and various seeding rates of commonly used forage species used in the Midwest region. Studies done have been short lived (1 or 2 years) and have looked only at emergence, plants at the end of the seedling year, or plants at the end of the first year following seeding.

Evaluations will be made on emergence, stems at the end of the seeding year, stems at the end of the first through the fourth year following planting. The study will be repeated for five consecutive planting seasons to compensate for changes in yearly weather patterns.

### **Statement of Problem:**

There is a need to compare coated seed to non-coated seed for selected legumes to determine if a significant difference exists. Disagreement of seeding rates between coated versus non-coated legume seed is quite common. The results of this study could improve on the seeding rate recommendations for legume species being tested.

Can seeding rates of selected legumes and forage grasses be reduced to one-half the current rate or increase to one and a half times the current rate and provide similar results in long term stand density. Selected grass/legume species will be monitored for the emergence date, emergence density, and stand density.

### **Objective:**

The objectives of this study is to determine if a significant difference exists between coated versus non-coated seed of selected legume species and determine if the seeding rates of selected legume and forage grasses can be reduced or increased from current rates and provide the same results in stand density.

### **Location:**

Selected field on the Freeman Farm at Lincoln University, Jefferson City, Missouri.

- A. Description: Township 44N, Range 10N, Section 19

- B. MLRA: 115
- C. Soils: Grable silt loam

**Procedure:**

- A. Assembly of Materials:
  - 1. A list of species to be tested was developed and approved by cooperators. (See Table #1)
  - 2. Species that were coated, both coated and uncoated lots, were provided by Seedbiotics and CelPril. Grass seed and other non coated species were provide by USDA-Natural Resources Conservation Service, Plant Materials Center.
  
- B. Planting Plan:
  - 1. Plot Design: Randomized split plot design with four replications. (See Tables #2 and #3) This study is planned to last a total of ten years.
  - 2. Plot size: (See Table #3)
    - a. Length: 20 feet; 20' between reps.
    - b. Width: 15 feet; 21 rows: 30' between blocks
    - c. Redtop and tall fescue between blocks.
  - 3. Seeding Method and Rate: (See Table #4)

The plots will be seeded with a plot seeder. Seeding rates will be .5, 1.0, and 1.5 X those listed in the current Pasture and Hayland Planting Specifications, NRCS MOFOTG, March, 1997.
  - 4. Date of Establishment:

Plots #1 - #13 (Legume Plots)	Planted	5/5/98
Plots #14-#19 (Cool Season Grass Plots)		4/23/98
Plot #20 (Untreated Eastern Gama Plot)		3/26/98
Plot #21 (Treated Eastern Gama Plot)		4/23/98
Plots #22&#23 (Warm Season Grass Plots)		5/5/98
  
- C. Management:
  - 1. Establishment:
    - a. Disk/harrow
    - b. Roll
    - c. Seed
    - d. Roll

2. Fertilization: Soil Samples were sent to a laboratory for analysis of available N, P, K, and pH. No fertility or lime was required.
3. Weed Control:
  - a. Mechanical: During year of establishment, rotary mow as needed to control annual weeds.
  - b. Chemical:
    - (1) Preplant: None or Roundup.
    - (2) Post-emergence: To control broadleaf weeds, apply post-emergence herbicide (2, 4-D) uniformly after grasses are in three leaf stage and before weeds reach a four to six inch height.
4. Crop Residue Management: Burn all plots yearly during dormant period between February 1 and March 15 to remove previous years' residue to facilitate data collection. Other forms of residue management may be considered.

D. Evaluation Measurement:

1. Climatic Data: The data from the nearest weather station will be used to report precipitation and temperatures .
2. Measurements: 1998-2008
  - a. Emergence dates; when 25 plants have emerged.
  - b. Emergence density; conduct emergent density counts by counting the number of plants/foot of row, three counts/plot X number of plots, 3 weeks after planting for legumes, 4 weeks after planting for cool season grasses and 5 weeks after planting for warm season grasses.
  - c. Stem counts; conduct stem counts as same procedure using plants/foot of row, 3 counts/ plot X plots at the end of their first, second, third, fourth, and fifth growing seasons (for the three seeding rates and coated versus non-coated seed).

**Cooperators:**

The following is a listing of cooperators involved with this project: Lincoln University, Jefferson City, Missouri; Seedbiotics, CelPril, and USDA-Natural Resources Conservation Service, Plant Materials Center, Elsberry, Missouri.

## Discussion:

### 1998

Signatures of all cooperators with the study were received by March of 1998. Seed lots were received for accessions to be planted and new seed tests were secured when necessary.

This study was seeded with a cone type plot planter for all species except eastern gamagrass which was planted with a corn planter using soybean feedcups. Due to a planter malfunction, the legume plots were replanted in the YEAR TWO block and the warm season plots are planted partially in the YEAR ONE block and YEAR TWO block(see table #2).

The study consists of two comparisons, coated verses non coated seed, and three different seeding rates.

The comparison of coated verses non-coated seed was done by planting equal bulk rates. For example, if a bag of seed has a test of 95% purity and 90% germination, it is 85.5% pure live seed (PLS). If you want to plant 10# PLS per acre you need to plant 11.7# (10 / .855) BULK. A 50# bag of seed with this test has 95% (47.5#) seed and 5% (2.5#) other (dirt, chaff, weed seed, etc.). The 95% seed has a germination of 90% so the seed portion contains 42.75# Pure Live Seed (PLS) and 4.75# non viable seed.

When seed is coated, the coating generally accounts for 25 to 40 percent of the weight according to the seed industry that coats seed. If the above bag of seed was coated and 30% of the total weight was coating, the composition of the coated and uncoated seed would be as follows:

	coating	pure live seed	non viable seed	other (dirt, etc.)
50# coated seed	15# (30%)	29.9# (59.8%)	3.3#	1.8#
50# uncoated seed	0#	42.75#(85.5%)	4.75#	2.5#

When coating is added to seed, the amount of pure live seed goes down and that weight is replaced by coating. This coating is comprised of compounds that are designed to aid in seed germination and seedling development. Discussion from the seed industry suggests that coated seed is equal to or more beneficial than the loss of pure live seed. In a situation where 10# PLS is recommended, using the above test of 85.5% PLS, a bulk seeding rate of 11.7# of seed is required. To get 10# PLS of the above coated seed you

would need 16.7# . The objective of this part of the study is to determine if 11.7# of the coated seed is equal to or better than 11.7# of the uncoated seed.

This study compared bulk weights of coated and uncoated seed. Using the above rates and seed tests, the comparison is as follows;

Uncoated seed 11.7# Bulk rate containing 10# Pure Live Seed

Compared to

Coated seed 11.7# Bulk Rate containing 7.0# Pure Live Seed and 3.5# coating

The seeding rate part of the study uses a split plot design (see table #3) to compare different rates of all species in the study including both the coated and uncoated seed. Seeding rates were calculated as both pounds per acre and pure live seeds per square foot. Seed size and seeding rates vary considerably between species(see table #4). Pure live seed per square foot is not calculated for coated seed because the exact percentage of coating is not known. It is generally about one third. Measurements of emergence density and cover density were done on a row foot basis rather than square foot because the plots were seeded in rows rather than broadcast. Seeding rates can be converted from pure live seed per square foot (100 sq. ft per plot) to row foot (140 row foot per plot) by using a conversion factor of .714 to determine how many seeds it took in correlation to the emergence and cover density evaluations .

Weed control on the plots became somewhat of a problem by mid season due to wet weather. The ladino seed had an incorrect test so both coated and uncoated plots only had about a third of the intended rate but the ratios stayed the same.

The data from the legume plots indicate most of the coated plots were about the same or slightly better than the uncoated at the lower (.5 full rate) and full seeding rates. The higher seeding rate(1.5 X full rate) had about the same or slightly lower emergence density. It also varied between species. Treated seed of the eastern gamagrass showed a considerable increase over untreated seed.

Differences in the seeding rates was also quite evident in the data but not always as much as expected. The 1.5 seeding rate was not always a whole lot better than the half rate. This indicates the amount of seed may not be the problem of a week stand.

No conclusions can be made from a single year's data so this data will not be analyzed statistically until after the second year and then each year after.

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STUDY 291143G		PLOT LAYOUT		PLOT SIZE 15' X 20'		Table #2	
		----- county road -----		SUB-PLOT SIZE 5' X 20'			
		30'		445'			
	30'	REP 1	LEGUMES	20'	COOL S. G	20'	WARM S. G
		20'					30'
		REP 2	LEGUMES		COOL S. G		WARM S. G
200'		20'	YEAR	ONE			
		REP 3	LEGUMES		COOL S. G		WARM S. G
		20'					
		REP 4	LEGUMES		COOL S. G		WARM S. G
		30'					
		REP 1	LEGUMES		COOL S. G		WARM S. G
		20'					
		REP 2	LEGUMES		COOL S. G		WARM S. G
170'		20'	YEAR	TWO			
		REP 3	LEGUMES		COOL S. G		WARM S. G
		20'					
		REP 4	LEGUMES		COOL S. G		WARM S. G
		30'					
880'		REP 1	LEGUMES		COOL S. G		WARM S. G
	← North	20'					South →
		REP 2	LEGUMES		COOL S. G		WARM S. G
170'		20'	YEAR	THREE			
		REP 3	LEGUMES		COOL S. G		WARM S. G
		20'					
		REP 4	LEGUMES		COOL S. G		WARM S. G
		30'					
		REP 1	LEGUMES		COOL S. G		WARM S. G
		20'					
		REP 2	LEGUMES		COOL S. G		WARM S. G
170'		20'	YEAR	FOUR			
		REP 3	LEGUMES		COOL S. G		WARM S. G
		20'					
		REP 4	LEGUMES		COOL S. G		WARM S. G
		30'					
		REP 1	LEGUMES		COOL S. G		WARM S. G
		20'					
		REP 2	LEGUMES		COOL S. G		WARM S. G
170'		20'	YEAR	FIVE			
		REP 3	LEGUMES		COOL S. G		WARM S. G
		20'					

		<b>REP 4</b> <b>LEGUMES</b>		<b>COOL S.G</b>		<b>WARM S. G</b>	
	30'	* S.G. = SEASON GRASSES					

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**Table #3**

COOL SEASON GRASSES														WARM SEASON GRASSES										
Y E A R # 1																								
R	E	P	#		1																			
P #	16	18	14	17	15	19	23	21	22	20														
S #	2	1	3	2	1	3	1	2	3	2	3	1	3	2	1	3	1	2	3	1	2	3	1	2
R	E	P	#		2																			
P #	16	18	17	14	19	15	21	20	23	22														
S #	3	2	1	1	2	3	3	1	2	1	2	3	3	1	2	3	2	1	3	1	2	3	1	2
R	E	P	#		3																			
P #	16	19	17	18	14	15	20	22	21	23														
S #	2	1	3	3	1	2	2	3	1	1	2	3	2	1	3	2	1	3	2	3	1	1	3	2
R	E	P	#		4																			
P #	19	15	17	18	16	14	20	22	21	23														
S #	3	2	1	2	1	3	2	1	3	3	1	2	3	1	2	1	3	2	2	3	1	1	2	3
P # is Plot Number														Plot Size = 5' x 20'										
S # is SubPlot Number														Subplot Size = 15' x 20'										



Study 29I143G - Seed Coat/Seeding Rates Study				Table #4
Plot	Sub Plot	Forage - Seeds per LB	Sub Plot Seeding	PLS/square foot
Number	Number	- full seeding rate \4	Rates	
1	1	Alfalfa 200,000 seeds/lb	.5 rate	21.6 PLS / Square foot
"	2	Alfalfa 9.4# / ac	1.0 rate	43.2 PLS / Square foot
"	3	Alfalfa	1.5 rate	64.8 PLS / Square foot
2	1	Alfalfa (Cel-coated) \1	.5 rate	\3
"	2	Alfalfa (Cel-coated)	1.0 rate	\3
"	3	Alfalfa (Cel-coated)	1.5 rate	\3
3	1	Alfalfa (S.B.-coated) \2	.5 rate	\3
"	2	Alfalfa (S.B.-coated)	1.0 rate	\3
"	3	Alfalfa (S.B.-coated)	1.5 rate	\3
4	1	Red clover 275,000 seeds/lb	.5 rate	24.0 PLS / Square foot
"	2	Red clover 7.6# / ac	1.0 rate	48.0 PLS / Square foot
"	3	Red clover	1.5 rate	72.0 PLS / Square foot
5	1	Red clover (Cel-coated)	.5 rate	\3
"	2	Red clover (Cel-coated)	1.0 rate	\3
"	3	Red clover (Cel-coated)	1.5 rate	\3
6	1	Red clover (S.B.-coated)	.5 rate	\3
"	2	Red clover (S.B.-coated)	1.0 rate	\3
"	3	Red clover (S.B.-coated)	1.5 rate	\3
7	1	Birdsfoot trefoil 375,000 seeds/lb	.5 rate	26.7 PLS / Square foot
"	2	Birdsfoot trefoil 6.2# / ac	1.0 rate	53.4 PLS / Square foot
"	3	Birdsfoot trefoil	1.5 rate	80.1 PLS / Square foot
8	1	Birdsfoot trefoil (Cel-coated)	.5 rate	\3
"	2	Birdsfoot trefoil (Cel-coated)	1.0 rate	\3
"	3	Birdsfoot trefoil (Cel-coated)	1.5 rate	\3
9	1	Birdsfoot trefoil (S.B.-coated)	.5 rate	\3
"	2	Birdsfoot trefoil (S.B.-coated)	1.0 rate	\3
"	3	Birdsfoot trefoil (S.B.-coated)	1.5 rate	\3
10	1	Ladino clover 871,650 seeds/lb	.5 rate	37.0 PLS / Square foot
"	2	Ladino clover 3.7# PLS/Ac	1.0 rate	74.0 PLS / Square foot
"	3	Ladino clover	1.5 rate	111.1 PLS / Square foot
11	1	Ladino clover (Cel-coated)	.5 rate	\3
"	2	Ladino clover (Cel-coated)	1.0 rate	\3
"	3	Ladino clover (Cel-coated)	1.5 rate	\3
Plot	Sub Plot	Forage - Seeds per LB	Sub Plot Seeding	PLS/square foot
Number	Number	- Full Seeding Rate	Rates	

\1 CelPrill coated

\2 Seed Biotics coated

\3 See explanation in Discussion section, 1998

\4 rates according to NRCS MOFOTG March 1997

<b>12</b>	1	Ladino clover (S.B.-coated)	.5 rate	\3
"	2	Ladino clover (S.B.-coated)	1.0 rate	\3
"	3	Ladino Clover (S.B.-coated)	1.5 rate	\3
<b>13</b>	1	Lespedeza (annual)	.5 rate	22.6 PLS / Square foot
"	2	Lespedeza (annual) 9.5# PLS / A	1.0 rate	45.3 PLS / Square foot
"	3	Lespedeza (annual)	1.5 rate	67.9 PLS / Square foot
<b>14</b>	1	Tall fescue (end. inf.) 227,000 see	.5 rate	31.3 PLS / Square foot
"	2	Tall fescue (end. inf) 12.0# PLS /	1.0 rate	62.5 PLS / Square foot
"	3	Tall fescue (endophyte infested)	1.5 rate	93.8 PLS / Square foot
<b>15</b>	1	Tall fescue (endophyte free)	.5 rate	31.3 PLS / Square foot
"	2	Tall fescue (endophyte free)	1.0 rate	62.5 PLS / Square foot
"	3	Tall fescue (endophyte free)	1.5 rate	93.8 PLS / Square foot
<b>16</b>	1	Orchardgrass 654,000 seeds	.5 rate	39.0 PLS / Square foot
"	2	Orchardgrass 5.2# PLS / Ac	1.0 rate	78.1 PLS / Square foot
"	3	Orchardgrass	1.5 rate	117.1 PLS / Square foot
<b>17</b>	1	Smooth bromegrass 136,000 se	.5 rate	15.6 PLS / Square foot
"	2	Smooth bromegrass 10.0# PLS	1.0 rate	31.2 PLS / Square foot
"	3	Smooth bromegrass	1.5 rate	46.8 PLS / Square foot
<b>18</b>	1	Timothy 1,300,000 seeds	.5 rate	58.2 PLS / Square foot
"	2	Timothy 3.9# PLS / Ac	1.0 rate	116.4 PLS / Square foot
"	3	Timothy	1.5 rate	174.6 PLS / Square foot
<b>19</b>	1	Canada wildrye 115,000 seec	.5 rate	13.2 PLS / Square foot
"	2	Canada wildrye 10.0# PLS /	1.0 rate	26.4 PLS / Square foot
"	3	Canada wildrye	1.5 rate	39.6 PLS / Square foot
<b>20</b>	1	Eastern gamagrass (n. tr) 7,500 s	.5 rate	0.9 PLS / Square foot
"	2	Eastern gamagrass (n. tr) 10.0# F	1.0 rate	1.7 PLS / Square foot
"	3	Eastern gamagrass (nontreated)	1.5 rate	2.6 PLS / Square foot
<b>21</b>	1	Eastern gamagrass (treated)	.5 rate	0.9 PLS / Square foot
"	2	Eastern gamagrass (treated)	1.0 rate	1.7 PLS / Square foot
"	3	Eastern gamagrass (treated)	1.5 rate	2.6 PLS / Square foot
<b>22</b>	1	Switchgrass 389,000 seeds/lb	.5 rate	26.3 PLS / Square foot
"	2	Switchgrass 5.9# PLS / Ac	1.0 rate	52.7 PLS / Square foot
"	3	Switchgrass	1.5 rate	79.0 PLS / Square foot
<b>23</b>	1	Caucasian bluestem	.5 rate	38.1 PLS / Square foot
"	2	Caucasian bluestem 3.1# PLS /	1.0 rate	76.3 PLS / Square foot
"	3	Caucasian bluestem	1.5 rate	114.4 PLS / Square foot

\1 CelPril coated

\2 Seed Biotics coated

\3 See explanation in Discussion section,1998

\4 rates according to NRCS MOFOTG March 1997