Using Phosphorus, Ammonium-nitrogen and Strip-kill to Increase Tall Fescue Seed Production in Missouri

Missouri Fertilizer and Lime Council

2006 First Year Report

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Objective: To determine if tall fescue seed production in Missouri can be increased by late summer phosphorus (P) and ammonium (NH_4^+) applications in a strip-kill management system. In several plant species, a fall NH_4^+ application increased production of the hormone, cytokinin, by root tips, and this hormone triggered reproductive growth that culminated in greater seed production (Marschner 1995). The this project is important in that Missouri has 13 million acres of tall fescue pastures, and leads the nation in common tall fescue seed production, however, our seed yields are much lower than those in Oregon, for example. In earlier experiments, we dug tall fescue roots from established pasture monthly from October to April, and found an extremely thick root mass. The mass of roots was so thick that the plant almost looked "root-bound" and pastures needed to be aerated, like lawns, in the fall. Stripkill could be used to renovate the dense root system and restore the new growth. Our stripkill method worked for increasing forage production and our preliminary results indicate that stripkill also improves seed production.

Procedure: During the summer of 2006, a PhD student, Will McClain, built a sprayer that will spray Roundup® approximately 7.5" wide strips and leave 7.5" for seed production. The sprayer had a 10' boom and eight 4002 Tarjet nozzles placed 15" apart. During mid-September 2006, tall fescue (K31, endophyte infected) pastures at the SW Center near Mt. Vernon and at the Bradford Agronomy Research Center near Columbia were selected and forage was removed to a height of 4". Soil samples were collected and tested for P, Mg, Ca and K concentrations. Plots were flagged at 10'x 20' (SWC) and 10' x 25' (ARC) with 5' alleys (see Figs. 1 & 2 for the plots maps from SWC and ARC, respectively). Ten days after forage removal, Roundup® was applied in 7.5" strips leaving 7.5" of live tall fescue on stripkill plots. A Roundup® concentration of 1.6 oz/gal of water with 0.5 oz of crop oil/gal and 1.2 oz/gal of a blue tracking dye were used for the strip-kill process (Fig. 3). The total volume of application was 31 gal/acre. One half of the plot area was <u>not</u> treated with Roundup® and these plots will be used for conventional tall fescue seed production (controls). On September 20 (SW Center) and September 25 (ARC), plots were treated with 0 or 100 lbs P/acre from triple super phosphate (0-46-0) and 0 or 100 lbs of N/acre as

either ammonium beads (N-guard) from Specialty Fertilizer Products, urea or ammonium nitrate. Therefore, the experimental design consisted of 8 fertilizer treatment combinations, 2 management treatments (stripkill/none), 6 replications, and 2 sites for a total of 192 plots.

2006 Results: A sprayer designed to kill 7.5" strips in 10' wide plots of tall fescue was built and worked well. The tracking dye worked to clearly show the size of the treated strips and the area covered (Fig. 3). The killed strips (Fig. 4) look good at both locations.

Second year schedule: Once the seed is mature (early to mid-June 2007), it will be harvested with a plot combine, and yields and specific seed weight will be determined for each plot. The same plots will be used in 2007-08 without further Roundup® treatments. Based on our preliminary work, stripkill plots can be used for two years. By mid-September 2007, nitrogen will be applied as in 2006, and 50 lbs/acre of P will be applied to P-treated plots. In June 2008, the final seed harvest will be completed and the two years of data will be prepared for publication and distribution.

Budget:

Category	Year 2
Salary	
Research Assistant (25%)	$8,500
Benefits	2,125
Supplies (fertilizer, Roundup®, nozzles, gas)	1,000
Travel to Mt. Vernon	750
Total	$12,375

Figure 1. Stripkill study plot map at Mt. Vernon 2006

S 1P 3N 101	C 0P 0N 102	S 1P 1N 103	S 0P 3N 104	S 0P 2N 105	C 1P 0N 106	S 0P 1N 107	C 0P 2N 108	C 1P 3N 109	C 0P 1N 110	S 0P 0N 111	C 1P 1N 112	S 1P 0N 113	C 1P 2N 114	C 0P 3N 115	S 1P 2N 116
S 1P 0N 201	C 0P 2N 202	S 0P 0N 203	C 1P 1N 204	C 0P 3N 205	S 0P 3N 206	C 1P 0N 207	S 0P 1N 208	S 1P 3N 209	C 1P 3N 210	C 0P 1N 211	S 1P 1N 212	C 1P 2N 213	S 0P 2N 214	S 1P 2N 215	C 0P 0N 216
S 1P 2N 301	S 0P 1N 302	S 0P 2N 303	S 0P 0N 304	S 1P 3N 305	C 0P 3N 306	C 1P 2N 307	S 0P 3N 308	C 1P 3N 309	C 0P 2N 310	C 0P 0N 311	C 1P 0N 312	C 1P 1N 313	S 1P 1N 314	S 1P 0N 315	C 0P 1N 316
S 0P 2N 401	C 0P 3N 402	C 1P 1N 403	C 0P 0N 404	C 0P 1N 405	S 0P 3N 406	S 0P 1N 407	C 0P 2N 408	S 1P 1N 409	C 1P 0N 410	S 0P 0N 411	C 1P 3N 412	S 1P 2N 413	S 1P 3N 414	S 1P 0N 415	C 1P 2N 416
S 0P 0N 501	S 0P 1N 502	S 1P 1N 503	S 0P 2N 504	S 0P 3N 505	C 1P 2N 506	C 0P 1N 507	C 1P 0N 508	C 1P 3N 509	C 0P 2N 510	S 1P 3N 511	C 0P 3N 512	C 1P 1N 513	S 1P 0N 514	C 0P 0N 515	S 1P 2N 516
S 1P 3N 601	S 0P 0N 602	C 1P 1N 603	C 0P 3N 604	C 0P 2N 605	S 1P 2N 606	S 0P 2N 607	S 0P 1N 608	C 1P 3N 609	C 0P 1N 610	S 0P 3N 611	C 0P 0N 612	S 1P 1N 613	C 1P 0N 614	C 1P 2N 615	S 1P 0N 616

145’

235’

Plots are 10’ x 20’ with 5’ alleys all around. 6 replicate blocks.
The entire area is 235’ x 145’ or 34075 ft^2 (0.782 acres).The diagonal is 276.13’ from corner to corner.

P	**0= none**
	1= 100lb P/acre
N	**0= none**
	1= 100lb N beads/acre
	2= 100lb NH_4NO_3/acre
	3= 100lb Urea/acre

Figure 2. Stripkill study plot map at Bradford (ARS) 2006

S 0 P 0 N 101	C 0 P 0 N 102	C 0 P 3 N 103	C 1 P 3 N 104	C 1 P 0 N 105	C 1 P 1 N 106	S 1 P 3 N 107	S 1 P 2 N 108	S 0 P 3 N 109	C 1 P 2 N 110	C 0 P 2 N 111	S 0 P 2 N 112	C 0 P 1 N 113	S 0 P 1 N 114	S 1 P 1 N 115	S 1 P 0 N 116
S 0 P 2 N 201	C 0 P 1 N 202	C 0 P 2 N 203	C 1 P 1 N 204	C 1 P 2 N 205	S 1 P 3 N 206	S 0 P 0 N 207	S 1 P 0 N 208	C 0 P 3 N 209	C 1 P 3 N 210	C 1 P 0 N 211	S 1 P 2 N 212	S 1 P 1 N 213	S 0 P 1 N 214	S 0 P 3 N 215	C 0 P 0 N 216
C 0 P 1 N 301	S 1 P 3 N 302	C 1 P 2 N 303	C 1 P 3 N 304	S 0 P 1 N 305	C 0 P 0 N 306	C 1 P 1 N 307	S 1 P 2 N 308	C 1 P 0 N 309	S 0 P 2 N 310	S 1 P 0 N 311	S 0 P 3 N 312	S 0 P 0 N 313	C 0 P 3 N 314	S 1 P 1 N 315	C 0 P 2 N 316
C 0 P 3 N 401	C 1 P 0 N 402	C 0 P 0 N 403	C 0 P 1 N 404	S 0 P 1 N 405	S 1 P 2 N 406	S 1 P 1 N 407	C 1 P 2 N 408	C 1 P 3 N 409	C 0 P 2 N 410	S 0 P 2 N 411	S 0 P 0 N 412	S 0 P 3 N 413	C 1 P 1 N 414	S 1 P 3 N 415	S 1 P 0 N 416
S 1 P 0 N 501	C 0 P 3 N 502	C 0 P 0 N 503	C 1 P 2 N 504	S 1 P 2 N 505	S 0 P 0 N 506	C 0 P 2 N 507	S 1 P 1 N 508	S 0 P 2 N 509	C 1 P 0 N 510	C 0 P 1 N 511	S 0 P 1 N 512	S 0 P 3 N 513	C 1 P 3 N 514	C 1 P 1 N 515	S 1 P 3 N 516
S 0 P 1 N 601	S 0 P 3 N 602	S 0 P 0 N 603	S 1 P 0 N 604	C 1 P 2 N 605	S 1 P 1 N 606	C 1 P 0 N 607	C 0 P 3 N 608	C 0 P 1 N 609	C 0 P 2 N 610	C 1 P 3 N 611	S 1 P 3 N 612	C 0 P 0 N 613	S 1 P 2 N 614	S 0 P 2 N 615	C 1 P 1 N 616

175’

235’

Plots are 10’ x 25’ with 5’ alleys all around. 6 replicate blocks.
The entire area is 235’ x 175’ or 41125 ft^2 (0.94 acres). The diagonal is 293’ from corner to corner.

P	**0= none**
	1= 100lb P/acre
N	**0= none**
	1= 100lb N beads/acre
	2= 100lb NH_4NO_3/acre
	3= 100lb Urea/acre

Figure 3. Spraying strips of tall fescue in fall 2006.

Figure 4. Killed strips of tall fescue in late fall 2006.