STEEP III RESEARCH PROGESS REPORT - 2002

TITLE: Integrated Management System for Sustained Seed Yield of Kentucky Bluegrass Without Burning.

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FINAL REPORT: Final report of experiment conducted from 1998-2001.

PROJECT OBJECTIVES:

1. To determine variety and location influence on Roundup suppression of bluegrass, seed yield of three no-till crops and subsequent bluegrass seed yield for two years.
2. To relate bluegrass seed yield response to Roundup rate and timing, timing of nitrogen application, and proportion of productive tiller categories.
3. To disseminate information to growers via field representatives, extension educators, field tours, and practical publications and to scientific audiences via publications and presentations.

KEY WORDS: Roundup (glyphosate), chemical suppression, intercrop

STATEMENT OF PROBLEM: Non-thermal bluegrass seed production systems will reduce the consecutive number of bluegrass seed crops from ten or more to about two. More frequent bluegrass establishment, increased potential for soil erosion, and increased annual weeds further decrease economic opportunities for sustained bluegrass seed production. High stand density may be partially responsible for seed yield decline, especially when post-harvest residue is removed mechanically. Stand suppression and thinning with spring applied Roundup may restore seed yield. No-till planting of annual crops in Roundup suppressed bluegrass stands may allow economic return during renovation.

ZONE OF INTEREST: Palouse and Camas Prairie regions of Washington and Idaho.

ABSTRACT OF RESEARCH FINDINGS: In fall 1998, trials were established in fields of 'Rhonde', 'Kenblue', 'Nublue', and 'Palouse' Kentucky bluegrass, to determine whether stand suppression and thinning with Roundup can sustain bluegrass production cycles in high and low residue areas, and to determine if an intercrop of lentil, pea, or oat, seeded into the suppressed sod would benefit this management system. Bluegrass seed yield in 2001 following the 1999 lentil, pea, and oat intercrops was 1.7 to 2.5 times greater than the continuous bluegrass controls of 'Nublue' and 'Rhonde'. There was no difference in 2001 'Rhonde' and 'Nublue' seed yield between residue removal treatments. However, 'Palouse' 2001 seed yield was 1.4 to 3.4 times higher in the burned treatment compared to the non-burned plots. Except for the two earliest application times, 'Palouse' did not recover from Roundup treatment.

RESULTS AND INTERPRETATION: S*ee the 1999, 2000, and 2001 STEEP reports for more detailed information from previous years.* Following harvest in 1998, trials were

established in fields of 'Rhonde', 'Kenblue', 'Nublue', and 'Palouse' Kentucky bluegrass, each with an intercrop experiment and an herbicide experiment, and having high and low post-harvest residue treatments. The low residue treatments were mowed, raked, and baled in the 'Kenblue' and 'Rhonde' fields, and were burned in the 'Nublue' and 'Palouse' fields, while all fields were re-swathed and baled without raking for the high residue treatments. In the intercrop experiment, Roundup was applied at 1 lb ai/A across both residue treatments 2 weeks prior to no-till planting pea, oat, and lentil intercrops. Intercrop planting dates were April 14, 22, 27, and May 6, 1999 for 'Rhonde', 'Kenblue', 'Nublue', and 'Palouse' fields, respectively. In the herbicide experiment, Roundup was applied at 1 lb/A 6, 5, 4, 3, or 2 weeks prior to planting lentil, 1.5 lb/A applied 2 weeks preplant, and split applications of 1.0 + 1.0 lb/A and 0.75 + 0.75 lb/A applied 6 and 2 weeks pre-plant. Both experiments included non-suppressed bluegrass control plots (no Roundup or intercrop). In July 1999, non-suppressed bluegrass plots were swathed. Grass windrows and standing intercrops were harvested to determine seed yield. The 'Kenblue' site was inadvertently plowed up and is no longer part of the study. Following harvest in 1999 and 2000, post harvest residue was removed from the bluegrass plots using the same methods as in fall 1998. In 1999, oat straw was raked from the intercrop plots but pea and lentil straw was allowed to remain. Fertilizer was applied to the plot areas in October 1999 and 2000, at the same time and rate as the remainder of the bluegrass field, except in the nitrogen timing treatments. In Kentucky bluegrass control and lentil intercrop plots of 'Nublue' and 'Palouse', fall fertilizer was applied at 100 (135 lb N/A), 70, and 30% of field rate and followed by spring applications of 0, 30, and 70% field rates, respectively. Spring applications were at early re-growth and early stem elongation. In the fall of 1998 and 1999, 4-inch sod cores were dissected to determine C and F tillers. In the spring of 1999, 2000, and 2001 panicles derived from C and F tillers were determined by growing 4-inch sod cores in the greenhouse. Panicles were collected from a 7 by 14 inch area and counted to determine panicle density in June 1999, 2000, and 2001. Bluegrass was swathed and seed was harvested at maturity in 2000 and 2001.

Objective 1: Seed yield of 'Nublue' and 'Rhonde' in 2001 following the 1999 lentil, pea, and oat intercrops was 1.7 to 2.5 times greater than the continuous bluegrass controls (Table 1). Also, grass seed yield in 2001 was not affected by the intercrop grown in 1999. Residue level did not affect 'Rhonde' or 'Nublue' seed yield in 2001.

Objective 2: Compared to the continuous bluegrass control, 'Rhonde' 2001 seed yield was 1.3 to 2.2 times greater in all Roundup treated plots except for the earliest application timing (Table 2). 'Nublue' 2001 seed yield was 1.8 and 2 times greater at the split-application timings (1,1 and 0.75, 0.75) of Roundup and the single application 3 weeks before planting intercrops compared to the non-suppressed bluegrass control. 'Rhonde' and 'Nublue' 2001 seed yield did not differ between residue removal treatments. Except for the earliest timings (6 and 5 weeks before seeding the lentil intercrop), stands of 'Palouse' did not recover from the 1999 Roundup treatment. 'Palouse' 2001 seed yield was 1.4 times greater at the earliest herbicide timing (6 weeks prior to seeding) compared to the 5 weeks prior to seeding and in continuous bluegrass control treatments. Seed yield was 27 % greater in the low residue treatment compared to the high residue treatment. Nitrogen timing did not affect 'Nublue' and 'Palouse' 2001 seed yields (Table 3). Also, there was no difference in 2001 'Nublue'

seed yield between residue removal treatments, however 'Palouse' 2001 seed yield was 70% greater in the low residue treatment compared to the high residue treatment. 'Nublue' 2001 seed yield following the 1999 lentil intercrop was 2.1 times greater than the continuous bluegrass control. Weight of harvested bluegrass seed in 'Nublue', 'Rhonde', and 'Palouse' averaged 37, 30, and 33 mg/100 seed, respectively, and was not affected by the previous intercrop, residue level or herbicide treatment.

Objective 3: Fairfield plots were shown to the Spokane Co. Crop Improvement Assoc. during June 1999 and 2000. The Nezperce plots were included in the Lewis County field tour during June 1999 and 2000.

INTERACTION WITH OTHER SCIENTISTS CONDUCTING RELATED ACTIVIES: No other scientists are conducting related research.

PUBLICATIONS, REPORTS, AND PRESENTATIONS:

Thill, D.C. and J. Reed. 2001. Integrated management system for sustained seed yield of Kentucky bluegrass without burning. 2001 GSGSSA Annual Report. Pg. 35-38.

Thill, D.C.and J. Reed. 2001. Integrated management system for sustained seed yield of Kentucky bluegrass without burning. 2000. STEEP Annual Report. Pg. 78-83; and 2001 Washington DOE annual report.

Table 1. The effects of intercrops and residue removal methods on Kentucky bluegrass (KBG) seed yield in 2000 and 2001. Values for intercrops are means of two residue levels, while values for residue levels are means of the four intercrops.

	Rhonde		Nublue	
Crop	2000 yield	2001 yield	2000 yield	2001 yield
	lb/A	lb/A	lb/A	lb/A
KBG	119	138	215	91
Lentil	240	342	427	169
Pea	186	303	501	170
Oat	139	313	364	156
$LSD_{0.05}$	51	57	61	46
Low residue	175	272	481	152
High residue	167	276	309	140
$LSD_{0.05}$	NS	NS	142	NS

Table 2. The effects of Roundup application time (applied in spring 1999) and rate, and residue removal methods on Kentucky bluegrass seed yield in 2000 and 2001. Values for herbicide treatments are pooled over residue levels. Values for residue levels are pooled over Roundup rates.

Herbicide treatment		Rhonde		Nublue		Palouse	
Roundup rate	Appl. time	2000 yield	2001 yield	2000 yield	2001 yield	2000 yield	2001 yield
lb/A	weeks[a]	lb/A	lb/A	lb/A	lb/A	lb/A	lb/A
0	0	114	169	184	128	159	233
1	6	152	226	347	179	219	325
1	5	198	299	423	118	143	234
1	4	138	350	366	141	--	--
1	3	172	306	459	189	--	--
1	2	195	335	460	139	--	--
1.5	2	136	336	436	146	--	--
1, 1	6, 2	156	336	478	238	--	--
0.75, 0.75	6, 2	191	376	442	214	--	--
$LSD_{0.05}$		65	82	66	62	52	54
Low residue		164	308	477	173	144	297
High residue		149	298	288	160	146	215
$LSD_{0.05}$		NS	NS	56	NS	NS	42

[a] Application time is weeks prior to planting the lentil intercrop.

Table 3. The effects of nitrogen application time, residue level, and intercrop-type on Kentucky bluegrass seed yield in 2000 and 2001. Values are pooled means.

Nitrogen timing			Nublue		Palouse	
Fall	Early spring	Late spring	2000 yield	2001 yield	2000 yield	2001 yield
	lb/A		lb/A	lb/A	lb/A	lb/A
100	0	0	321	114	182	239
70	30	0	290	123	165	243
70	0	30	303	124	140	208
30	0	70	244	110	139	174
	$LSD_{0.05}$		NS	NS	NS	NS
	Residue					
	Low		369	120	244	333
	High		210	115	69	99
	$LSD_{0.05}$		90	NS	47	51
	Intercrop					
	KBG		162	76	--	--
	Lentil		417	163	--	--
	$LSD_{0.05}$		45	42	--	--

[a] Palouse data is only for continuous bluegrass plots.