



8-06

PROGRESS REPORT

1. **TITLE:** Controlling Jointed Goatgrass with Moldboard Plowing.
2. **PRINCIPAL PERSONNEL:** Robert N. Klein, Gordon E. Hanson, and Gary W. Mahnken, University of Nebraska, 461 West University Drive, North Platte, NE 69101
3. **TIME LINE:** Initiated in 2003; projected completion, summer, 2007; On schedule.
4. **ORIGINAL HYPOTHESIS:** Tillage method will aid in the germination of jointed goatgrass (JGG) during the fallow period or will prevent JGG from germinating by destruction of the JGG cylinder or burying it too deep to germinate.
5. **SUMMARY OF PROGRESS:** Plowing done at the beginning of this study was beneficial to the winter wheat phase of this study despite the extended drought experienced since before its initiation. The initial plowing operation benefited the 2005-2006 winter wheat crop through lower JGG densities and higher grain yield. In the fallow phase of this study, plowing treatments again were among the lowest JGG densities. The treatments, which were burned at the initiation of the study, had JGG densities almost as low as the plowed treatments. The no-till treatment had the highest JGG densities. Although it was applied late, the Beyond™ herbicide application was effective at reducing JGG numbers. In the final winter wheat phase of this study, planted September 22, 2006, JGG density in the growing wheat is highest in no-till and disked plots and lower in burn and plow treatments.
6. **OBJECTIVE:** To determine the usefulness of unconventional weed control methods to aid in the control of JGG in winter wheat. Original objective: To determine if moldboard plowing or burning + moldboard plowing plus Beyond™ will enhance the depletion of jointed goatgrass in the soil seedbank compared with using tandem disking + Beyond™ herbicide, burning + plowing, or no-till + Beyond™.
7. **EXPERIMENTAL DESIGN:** This study is a randomized complete block with five replications was laid out in a fallow area containing wheat stubble and an existing JGG cylinder density of at least 200 cylinders/m². Plots for six JGG control treatments and a no-till treatment were established. The first repetition of this study was initiated in the spring of 2003. The second repetition of this study was initiated in the fall of 2003. JGG was seeded to a density of 1,000 cylinders/m² for a heavy JGG treatment. Treatments included burning, burning plus moldboard plowing, tandem-disk harrowing in the spring, disking in the previous fall, moldboard plowing, and moldboard plowing with heavy JGG

density. A no-till check was also included. The tillage/burning treatments were performed once only in the initial fallow phase. The stubble burning treatment for the first repetition of the study was more effective than for the second repetition as the flame front advance more slowly, generating heat for a longer period. The disk was set to a depth of 2.5 inches and plowing was performed to a depth of 8 inches with complete inversion. The first repetition was in growing wheat this season which was planted on September 22, 2005. JGG density was determined before planting on September 20, 2005; after the wheat had emerged on November 8, 2005; April 4, 2006; before wheat harvest on June 15, 2006; and after wheat harvest on July 13, 2006. This was the final activity on the first repetition. The second repetition was fallow for this season. JGG density was determined August 2 and September 13, 2005; May 18, 2006; and September 19, 2006. Weed control in the fallow was through the application of glyphosate, which coincided with the determination of JGG populations. Winter wheat was planted September 20, 2006. JGG density in the emerged wheat was determined November 9, 2006. Beyond™ herbicide will be applied early in the spring of 2006.

8. **PROGRESS/CONCLUSIONS:** The first repetition of this study was in winter wheat which was planted September 22, 2005. JGG plants were counted in the growing wheat on November 8, 2005 and April 5, 2006. In the growing wheat, the no-till plots had the highest JGG density contrasting to the three plowed treatments having no JGG (Table 1). Beyond™ herbicide was applied May 11, 2006. JGG plants were counted on June 15, 2006 in the matured wheat. Beyond™ herbicide reduced JGG counts; with a significant reduction in the no-till plots. The harvest of these plots occurred June 30, 2006 with the plowed treatments yielding more grain than the rest of the study. The Beyond™ treatment did not affect wheat grain yield. In a JGG count taken on July 13, 2006, two weeks after harvest, the no-till plots with no Beyond™ treatment had higher JGG density than in all other treatments. The second repetition of this study was fallow this season that was planted to winter wheat September 20, 2006. As in the first repetition, the burned and plowed plots were lower in JGG density than the no-till plots. But in contrast, the disked plots in the second repetition had JGG density similar to the no-till plots; whereas in the first repetition the disked plots were more similar to (yet slightly higher than) the plowed and burned plots. In both halves of the study, Beyond™ herbicide was effective in reducing JGG. When this half of the study was initiated, it was not necessary to over-seed the plots (other than the heavy JGG treatment) as a sufficient JGG population already existed. The harvest of winter wheat in the summer of 2007 followed by a post-harvest determination of JGG density will complete this study. Throughout duration of this study, considering both repetitions, the no-till plots have consistently had among the highest JGG densities, quite often significantly more than any other tillage treatments. In contrast, the plowed plots have consistently had among the lowest densities. The plowing operation was successful in moving the JGG joints on or near the soil surface and burying them too deep for germination to occur. The no-till operation however left the joints at the surface, in an environment where only a percentage of the joints germinated when conditions were favorable; with the remainder remaining dormant and ensuring a JGG infestation in the short to long-term future. JGG density in the burned plots were typically equal to (first repetition) or only slightly more dense (second repetition) than populations in the plowed plots. Disking plots resulted in

JGG densities that were intermediate to the no-till and plowing or sometimes as great as the no-till treatment. The herbicide treatment was effective in reducing JGG density, and reduced downy brome (data not shown) density as well. In 2005 and 2006, JGG densities remained low in the Beyond™ plots throughout the fallow period as well as in the growing wheat.

9. **PUBLICATIONS:** None

10. **TECHNOLOGY TRANSFERS:**

Interactions with scientists and producers:

Annual Review of the National JGG Program; March 12, 2006; Reno NV.

Weed Technology Workshops; February 21, 22, 23, 2006.

Winter Wheat Plot Meetings; June 13, 14, 15, 16, 2006.

Recommendations:

Burning and plowing wheat stubble as an effort to control jointed goatgrass are difficult practices to recommend. Leaving the soil surface exposed to erosion wind and rain and increased evaporation from the bare surface are major hindrances to these practices. However, if performed in strips and small areas and if surrounded by areas of good crop residues burning and plowing are effective weed management practices. Also effective for jointed goatgrass control is the Clearfield™ System. Beyond™ herbicide is effective against winter annual grasses including jointed goatgrass and Clearfield™ winter wheat varieties have been developed that are better suited to our region. The Clearfield™ System can be a good choice for a producer facing a major jointed goatgrass infestation. The producer can get on top of the problem quickly and effectively.

11. **BUDGET:**

Timeline table for dollars requested and received.

Amount	2003	2004	2005	2006	2007
Requested	\$11,000	\$11,000	\$11,000	\$ 8,000	\$ 0
Received	\$11,000	\$ 8,000	\$ 8,000	\$ 8,000	

Table 1. The effect of post-harvest tillage and burning on jointed goatgrass density and winter wheat yield in 2005 and 2006.

Beyond herbicide	----- Jointed goatgrass plant counts -----								----- grain yield -----	
	----- in wheat -----						--- post-harvest ---			
	November 8, 2005		April 4, 2006		June 15, 2006		July 13, 2006			
	no	yes	no	yes	no	yes	no	yes	no	yes
Fallow Treatment	----- no. / m ² -----								----- kg/ha -----	
Burn	3 c	7 c	1 b	3 b	3 bc	2 bc	2 b	2 b	1030 cde	1020 cde
Burn + plow	0 c	0 c	0 b	0 b	0 c	0 c	0 b	0 b	1580 ab	1520 ab
Disk in spring	20 c	33 c	4 b	2 b	17 b	1 bc	6 b	0 b	1050 cde	870 de
Disk in fall	36 c	6 c	4 b	3 b	10 bc	1 bc	7 b	0 b	890 de	750 e
Moldboard plow	0 c	0 c	0 b	0 b	0 c	0 c	0 b	0 b	1320 bc	1460 ab
Moldboard plow – heavy JGG	0 c	0 c	0 b	0 b	0 c	0 c	0 b	0 b	1770 a	1430 b
No-till	188 a	83 b	23 a	18 a	92 a	3 bc	52 a	1 b	1050 cde	1070 cd
L.S.D.($\alpha=0.05$)	42		9		16		10		322	

Table 2. The effect of post-harvest tillage and burning on jointed goatgrass density in a winter wheat-fallow rotation in 2006.

Beyond herbicide	----- Jointed goatgrass plant counts -----					
	----- in fallow -----				----- in growing wheat -----	
	May 18, 2006		September 19, 2006		November 9, 2006	
	no	yes	no	yes	no	yes
Fallow Treatment	----- no. / m ² -----					
Burn	24 de	13 de	0 c	0 c	0 b	0 b
Burn + plow	19 de	4 e	0 c	0 c	0 b	0 b
Disk in spring	129 ab	66 cd	114 a	0 c	8 a	1 b
Disk in fall	66 cd	17 de	57 b	0 c	10 a	0 b
Moldboard plow	40 cde	4 e	0 c	0 c	0 b	0 b
Moldboard plow – heavy JGG	3 e	1 e	0 c	0 c	0 b	0 b
No-till	173 a	87 bc	68 b	0 c	11 a	2 b
L.S.D.($\alpha=0.05$)	53		37		4	