

A: COVER PAGE:

Project Title: **Alternative to Burning for Goatgrass Control**

Submitted To: Agricultural Burning Practices and Research Task Force

Project Contact: Jon Jones, Manager
Whitman Conservation District
805 South Vista Pt. Dr.
Colfax, WA 99111
(509) 397-4636 FAX (509) 397-4953 e-mail: wcd@colfax.com

Project Coordinator: Same

Major Participant: Whitman Conservation District

Cooperators: To be named later.

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approved \$6500 first
year
funding

B. PROPOSAL SUMMARY:

According to records kept by the Whitman County Extension Agent, 37% of all agricultural burning in Whitman County can be attributed to weed control. The major weed of concern is goatgrass. Goatgrass is a relatively new problem that became an economic burden in the mid 1970's; however, it was first discovered in this area growing near the old Rogers field on the Washington State College campus (now the Washington State University campus). Goatgrass is a winter annual closely related to wheat. Because it is so closely related, nearly any agronomic practice conducive to good wheat production, is unfortunately conducive for goatgrass production. The toll goatgrass takes in both yield reduction and terminal dockage is devastating. Farmers simply cannot afford to live with this weed and still maintain fall wheat production.

It has been the general consensus among farmers that because goatgrass and wheat are so closely related, a treatment to kill one will kill the other. Recent studies show, however, that there is a major difference between goatgrass and winter wheat. When left on the surface up to 95% of goatgrass will sprout. When a weed sprouts, the first step to control has taken place. The weed becomes susceptible to control either by mechanical means or by herbicide means. This 95% sprouting is a major difference between goatgrass and wheat – only 33% to 35% of wheat will sprout when left on the surface. Exploitation of this high rate of goatgrass sprouting is a focal point of this project.

The current favored treatment for goatgrass control involves burning stubble following harvest, a light tillage and then keeping the infested land out of fall wheat production for three years. Grower experience indicates this method is only partially satisfactory – there is still enough goatgrass seed to infest subsequent crops unless very careful attention is paid to rotation.

Because the ground is left with no overwinter residue cover during the first year of this treatment is a cause for concern. Not only is air quality adversely affected (by the smoke), but so is water quality (by the runoff).

Growers in the lower rainfall areas of the county often complain they don't have a viable crop rotation they can use to combat goatgrass. However, by using chemfallow, coupled with the introduction of a "new generation" of winter peas, a new opportunity will be available. No-till technology is approaching the point that it, too, becomes a vital component of the study.

By demonstrating how growers can take advantage of the peculiar trait of goatgrass sprouting if left uncovered on the surface, and by showing how a crop rotation combined with pesticide assistance, can bring goatgrass to a manageable level, growers can combat goatgrass without the aid of fire. Burn permits to manage goatgrass will become a thing of the past.

This project will make burning unnecessary and will show a better way to combat the goatgrass problem.

C: PROJECT NARRATIVE:

1. **Background:** The problem is simple. The perception is that air is being polluted by burning. Anything that can be done to reduce the amount of burning will be beneficial. It has been shown that an effective burn in wheat stubble can reduce the amount of viable goatgrass seed by up to 80%. However, no control plots were used in these studies to show what would happen if goatgrass were left undisturbed. Recent studies have proven that up to 95% of goatgrass will sprout if left on the surface, and although the plants are indeed alive, that is the very thing that makes them controllable. This "weakness" of goatgrass coupled with a proper rotation renders goatgrass a controllable weed. This project will demonstrate to the farmer an alternative method of controlling goatgrass .
2. **Related or Current Work in the Area:** Goatgrass control has been the topic of numerous studies. Because the problem is nationwide, and because goatgrass can reduce wheat yield by 30% and dockage by 50%, widespread attention has been given to controlling the weed. This project, however, differs in other projects in that it will control goatgrass by utilizing knowledge of goatgrass's proclivity to sprout if left on the surface, combined with judicious use of herbicide, and introducing innovative crop rotations. A multi-faceted approach to a complicated problem is necessary if useful results are to be obtained.
3. **Objectives:**
 - a. To demonstrate how goatgrass can be controlled without using burning.
 - b. To demonstrate how proper crop rotations, coupled with proper use of herbicides, can be used as a tool for goatgrass control.
 - c. To demonstrate how achieving goatgrass control need not be an economic hardship.
 - d. To educate producers about alternative methods of goatgrass control through newsletters, tours and meetings.
4. **Approach:**
 - ***Demonstrating how goatgrass can be controlled without using burning:*** This will be a three-year study. The first step is to identify at least three growers, in three different rainfall zones (<15", 15-18", and >15") of Whitman County, who have a goatgrass infestation. Plots will be laid out with assistance from the Natural Resources Conservation Service (NRCS) and the United States Department of Agriculture/Agricultural Research Service (USDA/ARS). The producers' own attempts at controlling goatgrass will be compared to this project's methods by doing plant counts during and at the end of each growing season. This research will be coordinated in accordance with proper statistical models through assistance from NRCS and USDA/ARS.

The project will encompass a three-year study beginning in the harvest of 1998. Following harvest, a skew treader or sweep-type implement will be used to make good seed-soil contact while at the same time leaving goatgrass seed on the surface. Year two will consist of chem-fallow. The grower will be given the option of either planting winter peas or holding the chem fallow through the winter to plant a spring legume. In either case, the grower will be required to apply a y-weed herbicide (either Poast or Assure II) to control goatgrass. Year three will involve holding the pea stubble through the winter to be planted back to a spring cereal – either barley or wheat.

All planting will be done using a minimum disturbance no-till drill, and no other tillage will be permitted other than the first year of mild tillage to insure seed-soil contact.

- ***To demonstrate how proper crop rotations, coupled with proper use of herbicides can be used as a tool for goatgrass control:*** At the completion of the project, results from the plots will be compared to results from the adjacent fields. It will be shown that there will be a measurable difference in leaving goatgrass seed on the surface, rather than by the more conventional methods of burning and burying seed. If, for example, there are initially 100 seeds per square foot and they are reduced by 95% the first year of chem fallow, that leaves only 5 seeds per square foot. The next year of legumes, coupled with chemical control of goatgrass, will leave .25 seeds per square foot, and the third year of no-till spring cereal will reduce that further to .0125 seeds per square foot. One seed per 100 square feet is the anticipated outcome of the project. When these results are compared to more traditional methods of control, they will be a powerful educational tool.
- ***To demonstrate how achieving goatgrass control need not be an economic hardship:*** By providing access to economic information to growers through the use of NRCS and WSU extension economists, the economic viability of this control method will be explained to not only growers taking part in the study, but to any interested grower.
- ***To educate producers about alternative methods of goatgrass control through newsletters, tours and meetings.*** Whitman Conservation District has a tradition of publishing a quarterly newsletter. Information will be disseminated through this resource as well as holding informational meetings and tours. Tours and meetings will coincide with Palouse-Rock Lake's alternative cropping proposal funded by the same source. Whitman Conservation District intends to coordinate our efforts closely with Palouse-Rock Lake's efforts. Through this synergism, it is anticipated both projects will be strengthened.

5. Anticipated Schedule for Achieving Objectives: The first year of the three-year project will begin in the fall of 1998. The project will end in the fall of 2001. The project is designed so that results will be useful even if the project is not carried through the end. Therefore, **if funding sources become non-existent, each year's results will stand alone and will yield useful information.**

C. BUDGET:

Fall 1998:

Equipment Rental (skew treader, sweep, chaff spreaders)	\$ 500
District administration/overhead/meetings/newsletters	1,000
Technician (for seed count)	<u>1,000</u>
Fall 1998 totals	\$ 2,500

Year 1:

Sprayer rental/custom application	\$ 500
Herbicides for chem fallow	1,500
District administration/overhead/meetings/newletters	1,000
Technican (for seed count)	1,000
Year 1 totals	\$4,000

Year 2:

No-till drill rental/custom seeding	\$ 1,000
Winter pea seed	300
Herbicide for legume	500
Custom application for legumes	1,000
District administration/overhead/meetings/newsletters	1,000
Technican (for seed count)	<u>1,000</u>
Year 2 totals	\$4,800

Year 3:

No-till drill rental/custom seeding for spring cereals	\$1,000
Technican (for seed count)	1,000
District administration/overhead/meetings/newsletters	<u>1,000</u>
Year 3 totals	\$3,000

PROJECT GRAND TOTAL \$14,300

Department of Ecology
C000037

Final Report

**Whitman Conservation District
Alternative to Burning for Jointed Goat Grass Control**

Goat grass is considered a relatively new problem in the County even though it became a burden in the mid-1970s. Jointed goat grass is a winter annual weed closely related to wheat making most agronomic practices conducive to good wheat production also conducive for good goat grass production, affecting both crop yield and terminal dockage.

One difference between jointed goat grass and wheat is the undisturbed seed sprouting percentages. Recent studies have shown that when goat grass is left on the surface up to 95% of it will germinate, with wheat only 33% - 35% germinate. Exploitation of this high rate of goat grass emergence is the focal point of this project, coupled with proper herbicide, crop rotation, and tillage practices.

As the news stories have shown, the public has developed the perception that agricultural burning is polluting the air and any method of reducing agricultural burning will be beneficial. According to records kept by the Whitman County Extension Agent, 37% of all agricultural burning in Whitman County can be attributed to weed control, with the major concern being Jointed Goat Grass. The infested field is typically burned after harvest, followed by a light tillage practice and then kept out of fall wheat production for three years. This method has proven to be only partially satisfactory due to there still being enough goat grass seed in the soil to infest subsequent wheat crops (an effective burn reduces the amount of viable goat grass seed by up to 80%). By demonstrating the advantage of leaving seeds on the surface, and using crop rotation with herbicides, the producer can be shown that goat grass can be brought to a manageable level without the aid of fire.

The intent of this project was to be set-up as a three-year study with three producers (currently combating a goat grass problem), in three different rainfall zones, in cooperation and with assistance from NRCS and USDA/ARS. The crops were to be seeded using a minimum disturbance no-till drill; utilizing crop rotations of winter peas and/or chemfallow with a spring legume; and a y-weed herbicide (either Poast or Assure II) to assist in controlling the goat grass.

Two producers combating a goat grass problem agreed to be involved in this project. Mr Faires, Colfax was located in 21-22" rainfall zone and farmed conventionally. The second, Mr Sunwold, was located in the 14-15" rainfall zone also farmed conventionally. A third participant had been sought throughout the life of the grant unsuccessfully.

Colfax – Mr Faires

This location began with the plot being laid out in the spring of 1999. An application of roundup was applied followed by spring Afla peas, Majorette variety, being seeded late due to drill availability. A Krause 5250 no-till drill, light-duty with double-disc openers slightly off set to assist in cutting the residue was used throughout this project as a low disturbance drill. The peas were being seeded into wheat stubble with a residue level that equaled approximately 118-bushel wheat. The plot was sprayed with Assure II approximately four weeks after seeding. The site was checked at the end of June with the peas being in the eight – ten node stage and blooming. Goat grass counts were taken in the field, showing low emergence.

The plot was harvested with a standing yield of 990-lbs/ac. This variety of pea shatters easier than conventional peas with approximately 830-lbs/ac being on the ground due to weather and harvesting. The plot had been periodically checked for goat grass with there being no sign of the weed.

The grant technician, Dan Nelson, was trained by the original grant manager, Jon Jones to perform properly the soil probes and goat grass counts. Dan worked both with and independently of Jon when conducting his tests. Training consisted of proper use of the soil probe, goat grass identification and count, hoop count, and soil mixture for greenhouse emergence testing. The soil probe being used is a 2" square tube driven 8" deep, which is the maximum tillage depth. The plot was divided into three segments and within each segment ten soil probes were taken. This became the standard for soil probe plot testing.

Next in the crop rotation was spring barley (Baroness). This was seeded at a rate of 85-lbs/ac of seed in the spring of 2000 following a treatment of 1-qt/ac glyphosate (thirty days prior). Due to the availability of the Krause drill, this was again seeded late. The fertilizer, 40-lbs/ac nitrogen, 20-lbs/ac sulfur, and 14-lbs/ac phosphate were simultaneously applied through a deep banding attachment. The heavy wheat residue from two seasons ago was decayed and there was very little pea residue. The drill had little difficulty penetrating and placing the seed at the desired depth. In some areas where the chaff rows were thick, seed placement was poor.

The barley yield was 5,587-lbs/ac with an appearance of heavy residue, but was actually fragile to the touch and crumbled easily when disturbed. This plot was sprayed with 1.5-qt/ac for broadleaf. At harvest, soil probes were again completed.

The plot was seeded to fall wheat (Madison) and treated with 1-qt/ac glyphosate prior to seeding. 90-lbs/ac nitrogen with 16-20 dry starter fertilizer was used.

The overall stand of fall wheat looks good, but volunteer barley exists in the plot with the adjoining field also showing a good stand, but isn't showing any signs of volunteer. During discussion with NRCS staff, it was felt that rotation played a part. It appears as though the drill did an adequate job on seed placement. The operator sprayed for broadleaf weeds at a rate comparable to the adjoining field.

In April 2001, soil probes were taken along with hoop counts being replicated from the beginning of the project. The goat grass germination will be counted through the month of May. Due to grant expiration, no final yield count or field weed counts will be completed.

Lacrosse – Mr Sunwold and Mr Guske

This location also began with the plot being laid out in the spring of 1999. Following suit, an application of roundup was applied followed by spring Afla peas, Majorette variety, being seeded late due to drill availability. A Krause 5250 no-till drill, light-duty with double-disc openers slightly offset to assist in cutting the residue was used as a low disturbance drill. The peas were being seeded into wheat stubble with a residue level that equaled approximately 80-bushel wheat. The plot was sprayed with Assure II approximately four weeks after seeding. The plot was checked at the end of June with the peas being in the eight – ten node stage and blooming. Goat grass counts were taken in the field, showing low emergence.

During a routine check of the plot, it was discovered that the landowner had disked the site up. Due to the soil disturbance, it was decided to abandon this location.

In the spring of 2000, Mr Guske volunteered to participate in the project with his location also being in the 14-15" rainfall zone. Soil probes were completed to get a baseline at this location and the plot was seeded to an Afilia pea (Eiffel variety). In this area, peas are considered a test crop due to the lower soil moisture. The peas were seeded in wheat stubble with a residue level that equaled approximately 83 - 95- bushel wheat when overwinter, chaff and awn reduction are taken into account. The crop was sprayed with a mixture containing 12-oz/ac Assure II, 1-pt/ac crop oil and 1-pt/ac Basagran, leaving the peas looking healthy and relatively weed free.

During a routine check of the plot, it was discovered that the peas had become infested with green aphids, a common pest to peas. Ground spray presents some health risks to the operator, and due to the relatively small size of the plot, spray pilots were unable to assist. The landowner and grant manager opted to not treat for aphids realizing a reduction in yield. Soil probes were taken in the standard manner performed throughout this project and taken to the WSU green house for emergence testing.

In the summer of 2000, this crop turned unharvestable due to the infestation and the hot weather; it was swathed and baled, with Russian thistle presenting a major weed problem. Inspections of the plot during the growing season revealed no goat grass in the peas.

Soil probes were taken in the fall and germinated for emergence testing; and 1-qt/ac glyposate was applied with no tillage being done. It was noted that there was an excellent kill of all plants in the plot.

Spring wheat was seeded and is currently showing signs of stress due to droughty conditions and early high temperatures. Adjacent crops are comparable with signs of stress. There was slightly more Russian thistle pressure in the plot due to inadequate weed control from previous years. The operator sprayed for broadleaf weeds at a rate comparable to the adjoining field.

In April 2001, soil probes were taken along with hoop counts, a replication from the beginning of the project. The goat grass germination will be counted through the month of May. Due to grant expiration, no final yield count or field weed counts will be completed.

Along with the plot research and germination testing, a demonstration of goat grass sprouting was also conducted. One hundred seeds were planted at a depth of 1/2" and one hundred seeds were left on the surface. The tests were watered and kept at a constant temperature. Ninety-five germinated from the one hundred planted at 1/2" depth while only eighty-seven germinated from the one hundred left on the surface.

Throughout the life of the grant, focus was on goat grass reduction within the plots. A visual inspection of adjacent fields show some minor infestations, to where the plots do not, revealing that the fall chemical treatments were successful with no escapes being apparent.

Erosion was not a focal point of this project, but due to the use of minimum disturbance seeding and high residue management, erosion control was excellent.

Soil quality is always a concern. There was no baseline data collected with regard to soil quality in this project. It is generally known that changes in soil quality occur slowly, taking up to five years for noticeable gains. Due to grant expiration taking place within a three-year period and no baseline data being collected in the first year, no scientific information on soil quality or transformation can be established.

The District decided not to extend the life of this project for two reasons. The basics of the intent were realized and Washington State University is currently involved in a similar research project on a larger scale, thereby avoiding duplication.

The intention of this project was to show that goat grass could be brought to a manageable level without the aid of fire by leaving the seeds on the surface and using crop rotation with herbicides. It is believed that this has been demonstrated. Below is a chart showing the decline in goat grass germination.

Greenhouse Germinations						
1999 - 2000						
<u>Plots</u>	<u>Count</u> <u>Date:</u>	<u>Sprouted</u> <u>Jointed</u> <u>Goat Grass</u>	<u>Sprouted</u> <u>Wheat</u>	<u>Sprouted</u> <u>Oats</u>	<u>Sprouted</u> <u>Broadleaf</u>	<u>Sprouted</u> <u>Cheat</u> <u>Grass</u>
Colfax	09/1999	5	21	12	23	0
	10/1999	13	26	18	2	0
	11/1999	5	12	9	5	0
	11/1999	3	5	2	2	0
	08/2000	1	0	2	14	0
	11/2000	0	49	1	73	1
	02/2001	0	0	7	4	4
	04/2001	0	0	7	2	0
	06/2001	0	2	4	37	0
Lacrosse	11/1999	0	39	1	11	0
	11/1999	4	0	1	2	2
	08/2000	0	0	43	3	0
	11/2000	0	2	50	7	30
	02/2001	0	4	18	4	0
	04/2001	0	0	5	3	0
	06/2001	0	1	5	2	0