GRASS SEED CROPPING SYSTEMS FOR A SUSTAINABLE AGRICULTURE (GSCSSA) PROGRESS REPORT - 2006

Title: Integrated Disease, Fertilizer, Weed, and Insect Management for Columbia Basin Grass Seed Production

Objectives:

1. Conduct herbicide evaluation research to improve weed control strategies for winter annual grasses (downy brome, rattail fescue, annual bluegrass) and summer annual grasses (crabgrass, barnyard grass, witch grass) in seedling KBG under eastern Oregon irrigated conditions. Facilitate registration of herbicides for grass seed crops in the Columbia Basin.
2. Conduct trials to develop better disease control strategies, including the labeling of new fungicides, for powdery mildew, stripe and stem rust, and choke, in seedling KBG or Chewings Fine Fescue under Columbia Basin irrigated conditions. Trials will include experiments that will look for new materials, and look at different ways to use these fungicides for controlling rust and powdery mildew, i.e. timing of application (fall, winter, spring and pre and post infection) and fungicide application method. Variety trials will compare disease incidence where no fungicides are used to help produce information on relative resistance and how resistance can be used as a means of disease control.
3. Conduct trials in perennial ryegrass and in tall fescue to control ergot, based on timing of fungicides, and the use of fertilizers (copper and boron) and irrigation.
4. Conduct research to evaluate high and conservative nitrogen rates and their impact on disease and weed control. This objective not completed due to an herbicide over spray.
5. Conduct nitrogen fertility studies in tall fescue and perennial ryegrass to provide information to the industry to efficiently improve yields.
6. Investigate the use of sulfuric acid on KBG and perennial ryegrass for residue and impacts on disease incidence and severity. This was not done due to technical issues related to sulfuric acid application.
7. Survey of insect and arthropod pests in different seed grass cultivars. Monitor of the main insect (s) or arthropod (s) found throughout the season. A preliminary assessment of possibly natural biological control in the region also will be made.
8. Disseminate information on weed, nutrition, disease, and insect control and through periodic reports, presentations, and field tours with cooperating industry representatives and growers.

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Abstract of 2006 Progress: Appropriate combinations of primisulfuron and flucarbazone-sodium has potential for control of downy brome with reduced crop injury potential in comparison with primisulfuron applied alone. Metam-sodium applied through irrigation or by rototiller

incorporation can substantially reduce hand-weeding costs during establishment of KBG. Several products including siduron, mesotrione, and quinclorac provided good control of crabgrass in seedling KBG. As for disease pressure, powdery mildew and ergot pressure was high, while stripe rust was low during 2006. Powdery mildew significantly reduced yield in Kentucky bluegrass during 2006 if left uncontrolled. The DMI (triazole) and QoI (strobilurin) fungicides effectively controlled Powdery mildew and significantly increased yield. Ergot was reduced by DMI and QoI fungicides in both perennial ryegrass and tall fescue, when applications began before flowering. An initial survey of insect pests and beneficials in grass seed was conducted in Jan.-Feb. & April–May 2006 using pitfall traps, sweeping nets, and sticky cards in various growers' fields and at HAREC. In all sites, acari (mites), arachnida (spiders), collembola (springtails), diptera (flies), and coleoptera (beetles) were the most common groups. Besides mites, springtails and Staphilinidae (coleoptera, "rove beetles") were the most abundant.

Justification: : In the Columbia Basin, acreage of the four main types of grass grown for seed is estimated to be between 10,000 and 15,000 acres in Oregon, with more grown in Washington. Due to the minor use status of grass seed pesticides, agricultural chemical manufacturers are unwilling to devote resources toward registration of herbicides or fungicides for isolated production areas such as the Columbia Basin. Therefore, weed, disease, and insect control techniques for the Columbia Basin need to be developed through University testing.

Evaluation of weed control practices in non-thermally managed grass seed systems could help identify practices for controlling weeds specific to the Columbia Basin such as downy brome, rattail fescue, annual bluegrass, and others. The information developed from these studies will be used to facilitate registration of herbicides for this production region. This request is being made because minimal funding exists from the ag-chemical industry due to the minor crop status of Kentucky blue grass (KBG).

Disease issues differ in the Columbia Basin from those in the Willamette Valley. Of major concern in the Willamette Valley is stem rust. In contrast, stripe rust has been the overwhelming rust problem in the Columbia Basin, though stem rust can be a problem at times. How these two rusts differ in development and the use of control strategies is unknown. However, research over the last years has found that seedling KBG is more susceptible than established plantings and that considerable cost savings from fungicide applications could be realized by knowing the general susceptibility of specific grass lines to rusts and/or powdery mildew. Also, a common practice in established KBG fields is to graze them in the fall. What effect grazing has on rust development has not been investigated. In addition to rust diseases, powdery mildew, ergot, and choke are also present and cause losses to growers by reducing yield, increasing cleaning costs, and/or through the cost of using fungicides. Ergot has specifically been increasing in severity over the last two years. Research just completed has shown ergot reduction as being expensive, requiring three or more fungicide applications. Interestingly, ergot control has been shown to be reduced/controlled in other crops by the application of boron and copper fertilizers at specific times. Water control may also play a part in how ergot progresses and possibly be used for control. While research the past several years has contributed greatly to the understanding of these disease issues, there is still much to learn related to the best control methods under conditions found in the Columbia Basin. Further, information from these studies will assist the registration of new chemicals.

Nutritional needs and their interaction with weed control and disease controls methods have been demonstrated as secondary objectives over the past several years. Kentucky

bluegrass is shallow rooted relative to other grass species. This grass has also been shown to use less nitrogen than perennial ryegrass and tall fescue, 150 kg/ha vs. 250 kg/ha respectively. With these issues, nitrogen management in KBG is difficult during seed production. More severe disease pressure from powdery mildew and weed pressure from grasses such as downy brome have been observed where higher N rates have been used. Kentucky bluegrass fertilization rates and timing issues need to be better defined relative to seed yield, N efficiency, disease interactions and weed interactions. Understanding when nitrogen is used by the plant along with disease and weed interactions assists the industry to better manage their grass seed crops and provides an opportunity to reduce production costs.

Insects and arthropods in general, are reported to be a significant problem in other grass production areas. For instance, insects including white grubs, billbugs and sod webworms can destroy planting of grasses in some locations. Given the diversity of crops and rotations, a survey to identify potential insects and other arthropods problems in the Columbia Basin is needed. In addition, pest populations should be monitored so that timely and cost effective application (s) of pesticides or other control methods could be made.

Progress: A more in depth discussion and presentation of our grass seed research can be found in two locations: the first is from our annual field day and the second is an annual research summary that is sent to growers every year.

http://oregonstate.edu/weeds/articles/HAREC%2005%20field%20day.pdf

http://oregonstate.edu/weeds/
Follow the research link to "2006 Northeastern Oregon Grass Seed Research"

Objective 1: Appropriate combinations of primisulfuron and flucarbazone-sodium has potential for control of downy brome with reduced crop injury potential in comparison with primisulfuron applied alone. Primisulfuron applied alone at typical field use rates can cause unacceptable KBG injury under Columbia Basin conditions. A GSCSSA funded trial allowed us to evaluate reduced rates of primisulfuron with addition of flucarbazone-sodium. Metam-sodium applied through irrigation or by rototiller incorporation can substantially reduce hand-weeding costs during establishment of KBG. Lower metam-sodium rates can be effective at reducing downy brome, rattail fescue, and broadleaf weeds if applied with an appropriate amount of irrigation, or with rototill incorporation. Several products including siduron, mesotrione, and quinclorac provided good control of crabgrass in seedling KBG. The products evaluated for crabgrass control are not currently registered for use in grass seed production in Oregon, Washington, or Idaho, but we are cooperating with individual chemical companies to pursue appropriate herbicide labeling for the three state region.

Objective 2: A series of five studies were conducted at the Hermiston Agricultural Research and Extension Center (HAREC) near Hermiston, OR to evaluate the management strategies to control powdery mildew and stripe rust in Kentucky bluegrass.

These studies included:
1. This study (01-06) was initiated in the fall of 2005 on seedling Kentucky bluegrass to determine the effect of powdery mildew and stripe rust on yield of Kentucky bluegrass var. Baron, Barzan, and Midnight, as well as compare a standard fungicide program (3

applications of propiconazole) beginning in April with an enhanced fungicide program (4 applications of propiconazole) beginning in March on powdery mildew control and yield.

2. This study (04-06a) was initiated in the fall of 2005 on seedling Kentucky bluegrass to determine the efficacy of the bio-fungicide Sonata® on powdery mildew and stripe rust. Sonata®, *Bacillus pumilus* strain (QST 2808), is a bacterium that produces enzymes believed to be anti-fungal. The objectives of this trial were to determine if Sonata provides powdery mildew and/or stripe rust control as a stand alone treatment or in combination with propiconazole and propiconazole + azoxystrobin.

3. This study (04-06b) was initiated in the fall of 2005 on seedling Kentucky bluegrass to determine the efficacy of the systemic fungicide Absolute®, a mixture of trifloxystrobin and tebuconazole fungicides on powdery mildew and stripe rust in seedling Kentucky bluegrass and compare it to propiconazole and propiconazole + azoxystrobin.

4. This study (05-06) was initiated in the fall of 2005 on seedling Kentucky bluegrass to determine the efficacy of protectant (mancozeb, chlorothalonil, and mancozeb + chlorothalonil) and systemic (azoxystrobin, propiconazole, and azoxystrobin + propiconazole) fungicides against powdery mildew and stripe rust in seedling Kentucky bluegrass and determine the most economical interval for use of the various fungicides.

5. This study (06-06) was initiated in the fall of 2005 on seedling Kentucky bluegrass to determine the efficacy of applying propiconazole + azoxystrobin during the fall (F), winter (W), early spring (ES), late spring (LS), and summer (S) and all possible combinations in controlling powdery mildew and stripe rust and determine the effect on application timing on seed yield.

A brief summary of the 5 studies are as follows:

1. A wide range in yield potential and susceptibility to powdery mildew among Kentucky bluegrass var. Barzan, Baron, and Midnight exists. Barzan is highly resistant to powdery mildew, while Baron and Midnight are moderately and highly susceptible, respectively. Barzan (2,091 lb/acre) and Baron (1,834lb/acre) have higher yield potentials than Midnight (1,172 lb/acre). Maximum Powdery mildew control in var. Barzan, Baron, and Midnight was achieved with 0, 3, and 4 applications of propiconazole respectively. No stripe rust was present in the plots.

2. All fungicide programs except Sonata alone reduced powdery mildew compared to the untreated control. Propiconazole alone and in combination with Sonata was most effective in reducing powdery mildew, while propiconazole + azoxystrobin alone and alternating Sonata with propiconazole were not as effective. No stripe rust was present in the plots.

3. The fungicide Absolute, a mixture of trifloxystrobin and tebuconazole, appears to have the same efficacy against powdery mildew on Kentucky bluegrass as propiconazole alone or propiconazole + azoxystrobin. When adding crop oil to Absolute for powdery mildew control, methylated seed oil or non-ionic surfactants were equally effective. No stripe rust was present in the plots.

4. The systemic fungicides propiconazole and azoxystrobin are superior to the protectant fungicides mancozeb and chlorothalonil in controlling powdery mildew in Kentucky bluegrass. Among the three systemic fungicides tested, Tilt and Quilt was superior to Quadris in controlling powdery mildew. The optimum fungicide spray interval to reduce powdery mildew severity, increase yield and maximize revenue in a mildew susceptible variety of Kentucky bluegrass appeared to be two weeks. No stripe rust was present in the plots.

5. Applications of Quilt (propiconazole + azoxystrobin) during February, March, and April are optimum to reduce powdery mildew and increase revenue per acre. No stripe rust was present in the plots.

Objective 3: A series of five studies were conducted; one on a commercial growers field and four others at the Hermiston Agricultural Research and Extension Center (HAREC) near Hermiston, OR to evaluate management strategies to control ergot in Perennial ryegrass and Tall fescue.

These studies included:

1. This study (04-05) was initiated in the fall of 2005 on established perennial ryegrass to evaluate the susceptibility of nine different varieties (Pavillion, Casper, Metropolitan, PST-2J$, PST-2RT, PST-TLA, PST-2LGL, Brightstar SLT, and Williamsburg) to ergot and observe yield potential.

2. This study (05-05) was initiated in the fall of 2005 on established tall fescue to determine 1) when applications of propiconazole + azoxystrobin should begin in relation to flowering for ergot control, and 2) determine if soil applied copper and foliar applied boron had any effect on ergot.

3. This study (09-06) was initiated in the fall of 2005 on seedling tall fescue to determine how effective soil applied copper, foliar applied boron, and foliar applied fungicides with different mode of actions are in controlling ergot.

4. A study (10-06) was initiated in the fall of 2005 on seedling perennial ryegrass to evaluate what impact three levels of ergot (applied in the fall) had on seed yield and ergot infection in seed in three different varieties grown in the southern Columbia basin.

5. A study was initiated in the spring of 2006 to determine: 1) If ergot infection can be reduced in perennial ryegrass by reducing the frequency of irrigations per week, while applying the same amount of water; 2) The effect of various fungicides and an insecticide on ergot control under the different irrigation frequencies; and 3) The effect the different irrigation frequencies have on yield.

A brief summary of the 5 studies is as follows:

1. This study demonstrated that different varieties of perennial ryegrass have different yield potentials as well as different levels of ergot susceptibility, although the mechanism of possible resistance is not understood.

2. Initiating fungicide applications prior to flowering and continuing through flowering reduced the amount of ergot, while initiating fungicide applications 5 days after flowering began provided no ergot control. Multiple foliar applications of boron provided no ergot control and should not be considered a viable ergot management tool. Although soil applied copper did not reduce ergot, the experimental design did not allow a definitive conclusion to be drawn because ascospores originating outside of the copper treated plots may have contaminated the plots.

3. DMI and QoI fungicides effectively reduced ergot in seedling tall fescue cv. Labarinth, while the two micronutrients and the multi site fungicides did not.

4. Perennial ryegrass var. Americus was the most susceptible to ergot, while Pavillion was the least susceptible. There was no difference in seed yield between the varieties when ergot levels were zero, but var. Pavillion had higher yields when plots were inoculated with low and high levels of ergot. This study also suggested that small plots may not be totally effective in evaluating soil treatments for ergot control because of the contamination from other plots as witnessed by the same amount of ergot in the no inoculum and high inoculum plots.

5. Irrigation management may be a very important component in controlling ergot under center-pivot irrigation. The results found in this study suggest less frequent application of water may be of use in reducing ergot, but only to the point where yield is not sacrificed. All fungicide treatments in this study reduced levels of ergot to well below the 3% allowable tolerance.

Objective 4: See above

Objective 5: Tall fescue did not respond to nitrogen above the base rate. N-rate was 50-200 lb/a. Tall fescue yield was not significant even though all N treatments yielded (average 1894 lb./a) higher than the check (1620 lb./a). Ergot was measured across N-rates and was not impacted. Biomass in perennial ryegrass was not affected by N-rate but the trend was an increase with increasing N. Biomass in tall fescue showed a positive response to increasing N. Tiller height for both grasses was not impacted by N-rate. Fertile tiller number increased with increasing N-rate in tall fescue and decreased in perennial ryegrass.

Objective 6: See above

Objective 7: **A** preliminary survey of insect and other arthropod pests in seed grass crops was conducted in Jan.-Feb. & April–May 2006 using pitfall traps, sweeping nets, and sticky cards in various growers' fields and at the Hermiston Agricultural Research & Extension Center. The identification and quantification of all pests and beneficials found were recorded. Samples were taken following a similar protocol developed by Butler et al. (2004) in Central

Oregon (http://cropandsoil.oregonstate.edu/seed-ext/Pub/2004/28.pdf). Results indicated the presence of acari (mites), arachnida (spiders), collembola (springtails), diptera (flies), and coleoptera (beetles). Collembola was by far the most abundant. Two species of collembola were ID: *Isotoma* and *Entomobryia.* In general, collembola are part of the community of decomposers that break down and recycle organic wastes; however, their presence in large numbers in growers' fields sometimes justifies chemical application. Further studies are needed regarding the ecological role of collembola in grass seed fields. For more information regarding our pest and beneficial survey, visit http://oregonstate.edu/Dept/hermiston/Silviarondon.php Additional samples are still being sorted, processed and identified. Data will be available for winter meetings and peer reviewed papers are expected after the second year of this project.

Objective 8: An annual field day is held in May where approximately one hundred industry representatives and growers from Oregon and Washington attend to view and discuss current research being conducted in grass seed production.
An annual report is compiled and sent to over 75 growers and industry representatives. This report is posted on the web

http://oregonstate.edu/weeds/articles/HAREC%2005%20field%20day.pdf

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Interaction: Carol Mallory-Smith and Jed Colquhoun, Oregon State University weed scientists, on developing statewide recommendations and registrations for herbicides in grass seed production. John Hart, Extension soil scientist, Oregon State University, advice on fertilization rate and timing, interpretation of data. Bill Young, Extension Seed Production Specialist, advice on fertilization rate and timing, interpretation of data. Marvin Butler, Oregon State University Extension Service, advice on disease control issues, dissemination of information obtained from this project. Darrin Walenta, Oregon State University Extension Service, Union County, dissemination of information. Nick David and Casey Royer, OSU Hermiston and Larry Bennett and Sandy Frost, OSU Pendleton, plot organization, maintenance and timing and methods for applications of materials.

Timeline:

Weed control	
Herbicide trials to evaluate potential products	August 2003 to December 2006
Disease control	
Fungicide trials to compare new products	August 2003 to December 2006
Collect weather data	August 2003 to December 2006
Variety trial to suppress disease	August 2003 to December 2006
Nutrition	August 2003 to December 2006

Publications, Reports, and Presentations for Current Year:

2006 HAREC Grass Seed Research Report. 42 pp. published in-house and distributed to over 150 area grass seed growers and industry representatives. Access via: http://oregonstate.edu/weeds/

Bennett, L. H., S. M. Frost, and D. A. Ball. 2006. Grass weed control with flucarbozone-sodium in seedling Kentucky bluegrass seed production. West. Soc. Weed Sci. Res. Prog. Rpt. p. 131.

Tarasoff, C. S, D. A. Ball, and C. A. Mallory-Smith. 2007. Afterripening requirements and optimal germination temperatures for Nuttall's alkaligrass and weeping alkaligrass. Weed Sci. (Accepted and in press).

Ball, D. A., S. Frost, and L. Bennett. 2007. ACCase inhibitor herbicide resistance in downy brome in Oregon. Weed Sci. (Accepted and in press).