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Central Oregon Agricultural Research Center 2008 Annual Report

Oregon State University | Agricultural Experiment Station

Introduction

The Central Oregon Agricultural Research Center (COARC) faculty and staff are pleased to present a summary of research activities conducted during 2008. The 20 reports in this publication focus on vegetable seed (5), grass seed (9), forages and cereals (3), potatoes and peppermint (1), potential new crops (1), and rangeland and non-crop areas (1). We welcome you to peruse the report, read a few abstracts, and perhaps read the entire report on topics of particular interest to you.

Over the last year we have met with a significant number of industry representatives and growers to get your input on how we can best meet the needs of the agricultural community. We would like to thank each of you for your interest in what we do, and for taking time to discuss issues that affect you. In addition, the COARC Advisory Council annually rates proposed research projects for relevance to the local agricultural industry. This provides information helpful to faculty in making appropriate adjustments in focus and time commitments.

Some projects are conducted at the COARC Madras and Powell Butte locations, while others are more appropriately conducted with grower cooperators in commercial fields. A number of projects are joint efforts between local researchers and researchers on campus, other branch stations, or other agencies. An example is the bitterbrush study with National Forest Service (NFS) researchers.

In addition, COARC is establishing a landscape, fruit, and vegetable demonstration garden and student learning center to broaden our impact with the local community. This will increase relevance, support from local citizens, and provide an interface where they will become familiar with agriculture-related issues. We are excited about the opportunities this new project will provide.

We are continuing to expand and streamline our website. Feel free to check out our progress at http://www.oregonstate.edu/dept/coarc/. You will find this publication on the website, along with previous reports and other helpful information. We are developing a searchable database of all research reports published by the COARC. We expect this database to expand in the near future to include research station reports from Klamath Falls, Hermiston, Burns and La Grande. It is our pleasure to work with you and generate relevant research-based information to meet local needs.

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Timing Effect of ManKocide® Application on Bacterial Blight on Carrot Seed, 2008

Rhonda Simmons, Lindsey duToit, Bruce Martens, and Mike Weber

Abstract

Field plantings were set up to evaluate inoculation timing and ManKocide® application pre- and post-inoculation of carrot foliage with *Xanthomonas hortorum* pv *carotae* (*Xhc*) for suppression of bacterial blight. Application timing was tested on both seed-to-seed carrots and transplanted (steckling) carrot roots. Overall, results show a decline in bacteria populations on plots treated with ManKocide® applications. Seed-to-seed plots were moderately controlled by ManKocide® when applied pre- and post-inoculation. Spring inoculated plots were effectively controlled by two post applications of ManKocide® Transplanted carrots showed a more positive response to pre- and post-inoculation applications than those that received only the post-inoculation applications.

Materials and Methods

Two separate trials were planted under furrow irrigation to test the effectiveness of timing applications of ManKocide® in controlling low concentrations of bacterial blight. A randomized complete block design was used with seven replications of nine treatments for seed-to-seed carrots and seven replications of four treatments for transplanted carrots. Carrots were planted in 30-inch rows in long strips through the field. Strips were separated by a 20-ft unplanted alley. Prior to treatments, carrots were removed by tillage from 30-ft cross-alleys between plots along the strips. Thus, plots were 20 ft wide (8 rows) by 20 ft long, separated by alleys either 20 or 30 ft wide.

A female-only carrot line was planted to prevent this field from cross-pollinating with other fields in the region. Seed-to-seed plots were planted August 14, 2007. Steckling plots were transplanted on April 3, 2008. No bees were installed at pollination, but bees were active on flowers from a nearby hive.

Plots were inoculated with a suspension of 10^2 colony-forming units (CFU)/ml concentration of *Xhc* in 0.0125 M phosphate buffer. Fall-inoculated plots were sprayed on September 21, 2007 and spring-inoculated plots on April 14, 2008. Inoculum was applied using a standard CO_2-pressurized backpack sprayer calibrated to apply suspension in 20 gal/acre. Spray boom is 10 ft in width with 5 nozzles (8002 tips), which allowed coverage over 4 rows at a time. Each plot required two passes to cover all eight rows.

ManKocide® was applied at a rate of 2.5 lb/acre using a commercially designed tractor-mounted spray tank and boom. Applications were targeted for 4 days prior to inoculation, 3 days after inoculation, and 10 days after inoculation. Pre- and post-inoculation applications of fall ManKocide® were performed on September 17 and 24, and October 1, 2007. Spring ManKocide® applications were applied on April 10, 17, and 24, 2008.

Treatment list for seed-to-seed plots:

1. No inoculation, no ManKocide® application
2. Fall inoculation, no ManKocide® application
3. Fall inoculation, ManKocide® application 1 pre-inoculation + 2 post-inoculation
4. Fall inoculation, ManKocide® application 2 post-inoculation
5. Spring inoculation, no ManKocide® application
6. Spring inoculation, ManKocide® application 1 pre-inoculation + 2 post-inoculation
7. Spring inoculation, ManKocide® application 2 post-inoculation
8. No inoculation, ManKocide® application 3 fall and 3 spring treatments
9. Fall and spring inoculation, ManKocide® application 3 fall and 3 spring treatments

Treatment list for transplanted plots:

1. No inoculation, no ManKocide® application
2. Spring inoculation, no ManKocide® application
3. Spring inoculation, ManKocide® application 1 pre-inoculation + 2 post-inoculation
4. Spring inoculation, ManKocide® application 2 post-inoculation

Monthly sampling dates were October 8 and November 12, 2007 and sampling resumed again on May 5, 2008. Sampling involved collecting foliage from 30 plants per plot, placing foliage into a new plastic bag, and storing each bag refrigerated until plants were assayed within 24 hours of collection. Assay preparations involved chopping the foliage and placing it in a sterile flask with sterile 0.0125 M phosphate buffer. Flasks of foliage and buffer were shaken for 1 hour on a gyratory shaker. The rinsate from each flask was diluted serially up to 10^{-8}. Using sterile technique to avoid contamination, aliquots of each dilution were spread onto XCS agar and incubated at 82°F for 1 week. When plants were small, all the foliage from each composited carrot was sampled. As plants became larger and bolted, plants were subsampled to include a representative amount of foliage, petioles, stems, and umbels.

From September 15 until September 26, umbels were hand clipped from plots as they matured. One hundred umbels representing a typical harvest range (mostly primary and secondary) were collected and bagged and allowed to further air dry. Hands and tools were disinfected following collection from each plot. After several additional weeks air drying, seed was hand rubbed from each umbel per plot. Seed was deburred, and then passed through screens by hand, using standard research equipment. This procedure simulated the commercial combine-deburring seed-cleaning process. All tools, equipment, and hands were disinfected between each plot sample at each step of the process. Each seed sample was soaked overnight at 4°C in 100 ml of saline (0.85 percent NaCl). Two drops of Tween® 20, a nonionic detergent, were then added to each flask, which was placed on a rotary shaker for 5 min. A dilution series of the wash was plated onto XCS agar medium. Colony-forming units are expressed based on a 10,000 seed sample.

Results and Discussion

Seed-to-seed field

Inoculation was successful as all seven inoculated but non- ManKocide® treated plots tested positive. Foliage symptoms were not apparent until almost 3 months after first inoculation. Symptom severity was not measured due to size of plots and removal of plants during sampling. A low level of disease was not detected on non-inoculated plots until June and then was limited to one or two isolated incidents. Fall-inoculated plants not treated with ManKocide® and those treated with ManKocide® post-inoculation showed a higher final population than those treated pre- and post-inoculation (Table 1). Spring-inoculated plants not treated with ManKocide® and plots treated with ManKocide® post-inoculation showed a higher final population than those treated pre- and post-inoculation. Overall, on average, those plots treated with ManKocide® developed populations of bacteria on seeds under thresholds needed to avoid hot water treatments. Plots inoculated in both fall and spring showed the highest seed bacteria populations of the trial. Bacterial levels on seed were not statistically significant but plots treated with ManKocide® did show a tendency for bacteria levels to be below thresholds.

Steckling field

The initial steckling lot was tested for *Xhc*, resulting in 3 out of 20 roots testing positive for bacteria. The non-inoculated, no ManKocide® check plots did periodically show bacteria populations, which may be due to the infested root stock. Inoculation was successful as all seven inoculated non- ManKocide® treated plots tested positive. End of season bacteria populations were highest on plots inoculated but not treated with ManKocide® and those treated with two post application of ManKocide® (Table 2). Bacteria populations on harvested seed were below thresholds for both treatments using ManKocide® although the two post- ManKocide® applications showed a lower population than the pre- and post-inoculation treatment.

Results favor the importance of using ManKocide® as an effective preventative control of bacterial blight. A repeat trial is scheduled for 2008-2009 to verify relative effectiveness. Humidity was not measured but will be a parameter monitored in the 2008-2009 trial.

Table 1. Population of colony-forming units (CFU) of bacterial blight on seed-to-seed carrot plots.

	Population of bacterial blight on foliage LOG (CFUs/g dry foliage)*						CFUs/10,000 seeds
Treatment	15 Oct	12 Nov	5 May	2 Jun	14 Jul	11 Aug	Harvest seed
No inoculation, no ManKocide®	1.0 c	1.0 c	1.0 c	2.3 cde	1.0 d	1.9 e	2.2
Fall inoculation, no ManKocide®	4.1 a	4.8 a	5.2 a	4.6 a	6.1 a	7.6 a	5.2
Fall inoculation, ManKocide®1 pre-inoc + 2 post-inoc	1.3 bc	1.7 b	2.2 bcd	3.0 bc	4.6 ab	5.6 bc	5.1
Fall inoculation, ManKocide®2 post-inoc	1.9 b	1.0	3.7 ab	2.7 bcd	3.2 bc	6.5 ab	4.5
Spring inoculation, ManKocide®	1.0 c	1.0 c	3.1 ab	3.8 ab	5.6 a	6.3 ab	5.6
Spring inoculation, ManKocide®1 pre-inoc + 2 post-inoc	1.0 c	1.0 c	1.0 d	1.8 cde	1.9 cd	4.2 cd	4.0
Spring inoculation, ManKocide®2 post-inoc	1.0 c	1.0 c	1.0 d	1.9 cde	3.6 bc	2.0 e	4.6
No inoculation, ManKocide®3 fall + 3 spring	1.0 c	1.0 c	1.6 cd	1.0 e	2.7 bcd	3.6 de	3.1
Fall and spring inoculation, ManKocide®3 fall + 3 spring	1.0 c	1.0 c	1.1 d	1.2 de	3.5 bc	4.8 bcd	5.8
LSD (*P* < 0.001)**	0.8	0.7	1.6	1.5	1.9	1.9	*NS*

*CFU = colony-forming units of *Xhc*/g dry foliage. Data were analyzed on a log scale.
**LSD = Fisher's protected least significant difference following ANOVA. Means with the same letter within a column are not significantly different ($P < 0.005$).

Table 2. Population of colony-forming units (CFU) of bacterial blight on transplanted carrot plots.

	Population of bacterial blight on foliage LOG (CFUs/g dry foliage)*				CFUs/10,000 seeds
Treatment	28 May	24 Jun	5 Aug	3 Sep	Harvested seed
No inoculation, no ManKocide®	1.0 b	1.8 b	2.0 b	2.5 c	4.1 ab
Spring inoculation, no ManKocide®	4.7 a	5.9 a	6.8 a	7.2 a	6.5 a
Spring inoculation ManKocide®1 pre-inoc + 2 post-inoc	3.3 a	2.9 b	2.6 b	4.1 bc	5.0 ab
Spring inoculation, ManKocide® 2 post-inoc	4.5 a	3.5 b	3.3 b	5.6 ab	3.6 b
LSD (*P* < 0.001)**	2.0	2.3	2.0	2.2	2.8

*CFU = colony-forming units of *Xhc*/g dry foliage. Data were analyzed on a log scale.
**LSD = Fisher's protected least significant difference following ANOVA. Means with the same letter within a column are not significantly different ($P < 0.005$).

Protection of Seedling Carrot from Frost Heaving

Richard Affeldt, Brad Holliday, Dana Oppenlander, and Bruce Martens

Introduction

Hybrid carrot seed is the single most highly valued crop in central Oregon, having a gross value in 2007 of $9.6 million. Carrot seed acreage has consistently been from 2,000 to 3,000 acres in recent years. Approximately 75 percent of carrot seed acres are planted from seed in August the year before harvest (seed-to-seed); the other 25 percent are spring transplanted from roots (root-to-seed). Frost heaving is a major risk factor for seed-to-seed carrot production in the region. Frost heaving tends to occur during January through March when the soil is moist and frequently freezes and thaws in response to daily temperature fluctuations. The freezing and thawing soil can result in seedling carrots being pushed up out of the soil, or heaved, which results in plant mortality. In some cases frost heaving can result in complete stand failure.

To avoid this type of catastrophic crop loss, growers have attempted various methods to insulate seedling carrots and prevent them from heaving. One method of protecting carrots involves drop spreading spent mint hay over each carrot row. The machinery that is used for this operation is slow so this approach is time consuming, but it does an acceptable job of protecting seedling carrots. The spent mint hay has been readily available in the past because it was a waste product from peppermint grown for oil. Unfortunately, peppermint is no longer widely grown for oil in the region, so the availability of the spent hay has become limited.

Another method of protecting carrots that is commonly used covers several rows at once with a material called Agribond® nonwoven protective fabric. This material does a very good job of protecting carrots but has several drawbacks. First, it is expensive and putting it on and taking it off correctly is labor intensive. Second, the material is susceptible to being blown off the carrots by high winds. Third, it allows pests such as aphids and weeds to proliferate over the winter months. Fourth, the timing for removal in the spring can be risky because any frost after the material is removed can be fatal to the carrots.

Hydro-seeders may be able to overcome some of the limitations that existing methods present for protecting carrots from frost heaving. Hydro-seeders use a sprayable slurry made of water, a shredded biomass product (usually wood product waste or newspaper), and seed; this slurry is frequently used to sow seeds on highly erodible land. A hydro-seeder consists of a large tank with an agitator, a pump, and some type of hose and nozzle system to deliver the slurry. Our interest in this technology was not in sowing seeds, but merely in spraying the mulch over the top of seedling carrots and comparing that to other biomass mulches.

Other biomass products like cattle manure or wood chips are available in large quantities and might serve as a replacement for spent mint hay. However, there are at least two criteria that a mulch must meet to be an acceptable replacement for mint hay: 1) it must not injure the carrots, and 2) it must not get blown away. Other criteria not discussed here are cost and availability.

The objective of this research was to evaluate the potential of several mulch products to prevent frost heaving in seed-to-seed carrots.

Methods and Materials

Two trials were conducted in a commercial field of hybrid carrot grown for seed near Metolius, Oregon. The treatments in one trial consisted of hydro-mulch at five different rates and an untreated check, none of which were replicated. The treatments in the other trial consisted of wood chips, manure, manure plus straw, spent mint hay, and an untreated check that were arranged in randomized complete blocks replicated two times. Hydro-mulch was applied with a small commercial hydro-seeder. The dry mulch products were applied by hand. Application rates for all mulch products are shown in Tables 1 and 2. The treatments were applied to two rows of female carrots spaced 30 inches apart and plots were 20 ft long. The hydro-mulch was applied on January 9, 2008 and the dry mulches were applied on January 14, 2008.

Results and Discussion

The trials were placed in a low area of the field and the soil was very wet from December through early February, making the location likely to experience frost heave. There were major stand differences associated with each row, irrespective of the treatment, and the design was such that it did not account for these stand differences.

The hydro-mulch product was a finely shredded wood-fiber product that included a tacifier and green dye. The hydro-mulch was commercially available in 50-lb bales wrapped in plastic. During calibration of the hydro-seeder we estimated that 25 lb in 200 gal of water was too low a concentration because the slurry was too runny and that 50 lb in 200 gal was too high a concentration because it plugged the hoses. The mixture that seemed to work the best was 50 lb of hydro-mulch in 300 gal of water. Different application techniques were tested on a trial and error basis and as a result, the treatments listed in Table 1 were not replicated.

Low pressure and low volume were needed to successfully apply the hydro-mulch. When the output pressure or volume was too high the mulch would not stay in a narrow band over the row, but instead would tend to splash out of the row when it hit the ground. The largest nozzle that came with the hydro-seeder created a 5-inch band of mulch when held 12 inches above the ground. Removing the nozzle and simply applying the mulch through the standard 0.5-inch garden hose fitting created a 3-inch band of mulch when held 12 inches above the ground. In our opinion the 3-inch band of hydro-mulch made with the garden hose fitting was the best application technique compared to any of the nozzles that we tried (Fig. 1).

The hydro-mulch met the two criteria described above because it did not blow away throughout the spring and it did not show any signs of being injurious to the carrots (Fig. 2). However, there were a few problems that could preclude hydro-mulch as a workable practice. First, the volume of water that we used to apply the hydro-mulch was equivalent to 1,250 gal/acre. We had problems trying to reduce the amount of water because the hoses tended to clog. However, this could have simply been a shortcoming of the hydro-seeder we tested. Another difficult aspect of the hydro-mulch was getting it to dissolve in water. Mixing the hydro-mulch in water was time consuming because the mulch bale had to be broken up by hand and fed into the top of the hydro-seeder tank (Fig. 3). The hydro-seeder we used did not agitate with a paddle, but instead used recirculation from the pump. A paddle-type agitator in the hydro-seeder may have sped up the mixing process.

Another treatment was included where the hydro-mulch was applied dry by hand (Table 1). As mentioned above, the hydro-mulch came in a compressed bale wrapped in plastic. The compressed material could be peeled apart by hand, but the consistency was fluffy. We presumed that the dry hydro-mulch would simply blow away once it was spread on the ground; surprisingly it did not.

Four other dry mulches were evaluated: 1) spent mint hay, 2) commercially available wood chips sold for livestock bedding and landscaping, 3) manure that was aged and sifted, and 4) manure that was aged, sifted, and mixed with chopped straw (Table 2). These mulch products were first applied to two rows by hand at an excessively high rate on January 14. On January 21, about 80 percent of the mulch was removed from one of the rows to obtain a more realistic evaluation. Therefore carrot evaluations were made for each row, at a high and a low rate. All of the mulch treatments were extremely stable in wind and did not blow away throughout the spring. This was surprising for the wood chip mulch because it did not retain water like the mint hay and it was much lighter than the manure mulches. All of the manure products caused the carrots to rot. The soil was very warm under the manure compared to the other mulches. Even though the manure was aged, there was still too much biological activity for use at these rates on seedling carrots.

The variability in the carrot stand alone was not accounted for in the experimental design; therefore it was difficult to determine if there was any reduction in frost-heaving from the mulch treatments.

Table 1. Seedling carrot response to hydro-mulch applied January 9, 2008 near Metolius, Oregon.

		April 25, 2008		
		Carrot	Carrot stand	
Hydro-mulch treatments	Rate	injury	Row A	Row B
	lbs/acre	%	--------- plants/yd ---------	
Check	---	0	16	23
Wet in 3-inch band	7,425	0	5	21
Wet in 5-inch band	4,950	0	10	19
Wet in 3-inch band	3,712	0	15	38
Wet in 5-inch band	2,475	0	16	32
Dry in 2-inch band	unknown	0	13	---

Table 2. Seedling carrot response to mulches applied on January 14, 2008 near Metolius, Oregon. [1]

		April 25, 2008 [2]	
Treatments	Rate	Carrot injury	Carrot stand
	lbs/acre	%	plants/yd
Check for high mulch row	---	0	13
Check for low mulch row	---	0	5
Wood chips in 8-inch band	61,200	0	5
	12,200	0	6
Mint hay in 6-inch band	15,300	0	15
	3,060	0	12
Manure in 6-inch band	273,000	95	1
	54,600	80	5
Manure + straw in 6-inch band	216,000	60	4
	43,200	10	10

[1] Shading in table corresponds to the row in which the treatment was applied.
[2] Data shown are means across two replications.

Figure 1. Photograph of hydro-mulch application.

Figure 2. Photograph of seedling carrots under a hydro-mulch covering.

Figure 3. Photograph of hydro-mulch slurry mixing.

Evaluation of Ethofumesate (Nortron) and Asulam (Asulox) for Weed Control in Carrot Grown for Seed

Richard Affeldt

Introduction

Ethofumesate (Nortron®) has recently been registered for use on carrots grown for seed. However, the utility of this herbicide in the existing weed control program is not clear. Ethofumesate is fairly expensive and will not be worth the cost of trying if it offers little improvement beyond current practices.

Asulam (Asulox®) is a relatively old herbicide that may be registered on specialty crops. Currently asulam is only registered on sugarcane. Research conducted on peppermint nearly 30 years ago indicates that asulam is effective on some weeds in the family Asteraceae, like common groundsel (*Senecio vulgaris*) and tansy ragwort (*Senecio jacobaea*) (Arnold Appleby, personal communication). Asteraceae weeds such as horseweed (*Conyza canadensis*) and prickly lettuce (*Lactuca serriola*) are persistent problems in carrot seed production. If asulam was safe on carrots it could be a good tool for managing these weeds.

Methods and Materials

Two field trials were conducted in commercial fields of hybrid carrot grown for seed, one near Culver, Oregon and the other near Madras, Oregon. The trial near Culver consisted of 10-ft by 28-ft plots and the trial near Madras consisted of 10-ft by 20-ft plots; both were arranged in randomized complete blocks replicated four times. Herbicides were applied with a CO_2-pressurized backpack sprayer delivering 20 gal/acre at 40 psi at the rates and timings shown in Tables 1 and 2. Crop injury and weed control were evaluated visually with a 0 to 100 percent rating scale.

Results and Discussion

Carrots in the trial near Culver did not survive well through the winter. The carrot stand was highly variable by the spring, which made it difficult to get spring injury data at that location. Also, we did not apply asulam in the spring because there would not have been good crop safety data to collect.

Ethofumesate did not injure carrots at either location and it partially controlled spring-emerging kochia (*Kochia scoparia*) and black nightshade (*Solanum nigrum*) from the September 24 application (Table 1). Ethofumesate did not control the volunteer bluegrass in the Madras trial. The Madras field had been rotated out of Kentucky bluegrass seed production and the volunteer grass in this trial was growth from old rhizomes and not from seed; control with ethofumesate was not expected in this situation.

Asulam applied in September caused no visual injury to the carrots at either location (Table 1). In the Madras trial asulam applied in September partially controlled the volunteer bluegrass. In the Culver trial, asulam applied in September did not control the spring-emerging kochia and black nightshade. Furthermore, at Madras there was no visual injury to the carrots in the spring following asulam applied in September. However, the June applications of asulam were not safe on the carrots at either rate tested and injury symptoms continued to develop as long as the carrots continued growing (Table 2).

Acknowledgements

I would like to thank Macy Farms and Williams Land & Livestock for accommodating these trials in their production fields.

Table 1. Carrot injury and weed control from fall application of ethofumesate (Nortron), asulam (Asulox), and linuron (Lorox) near Culver and Madras, Oregon, 2007-2008.

	Rate	Culver[2]				Madras[3]			
Treatment[1]	(lb ai/acre)	Carrot 01/Oct/07	Carrot 19/Oct/07	Kochia 04/Jun/08	Bl. Nightshade 04/Jun/08	Carrot 01/Oct/07	Carrot 18/Oct/07	Vol. bluegrass 18/Oct/07	Carrot 05/Jun/08
		----- % injury -----		------ % control ------		----- % injury -----		% control	% injury
Linuron	1.0	0	0	0	0	0	0	73	0
Ethofumesate	2.0	0	0	35	38	0	0	0	0
Ethofumesate + linuron	2.0 + 1.0	0	0	65	53	0	0	73	0
Asulam	1.65	0	0	0	5	0	0	68	0

[1] Applied 24 September 2007 at both locations. All treatments except for ethofumesate alone included R-11 nonionic surfactant at 0.25% v/v. Linuron = Lorox 50 DF. Ethofumesate = Nortron 4 SC. Asulam = Asulox 3.3 L.

[2] At time of application carrots near Culver had two to four leaves. Treatments were applied preemergence to kochia and black nightshade.

[3] At time of application carrots near Madras had one to three leaves. Treatments were applied when volunteer bluegrass had two to four leaves.

Table 2. Carrot injury from spring application of asulam (Asulox) near Madras, Oregon, 2007-2008.

Rate[1]	20/Jun/08[2]	03/Jul/08[3]	05/Aug/08[4]
(lb ai/acre)	-------------------------- % injury --------------------------		
1.65	1	2	38
3.3	10	33	55

[1] Applied 12 June 2008 when carrots were bolting but flowers were not yet open. Treatments included R-11 nonionic surfactant at 0.25% v/v. Asulam = Asulox 3.3 L.

[2] Carrots were at the early flower stage.

[3] Carrots were fully flowered.

[4] Carrots were at the late flower stage.

Tolerance of Parsley Grown for Seed to Linuron (Lorox)

Richard Affeldt

Introduction

Linuron (Lorox®) is a key component in current weed control practices for carrot. Carrot tolerance to linuron is well understood. Parsley is closely related to carrot, both are in the plant family Apiaceae, but there are no crop safety data to support linuron use on parsley. The objective of this research is to evaluate the tolerance of parsley grown for seed to linuron.

Methods and Materials

Two field trials were conducted in commercial fields of parsley grown for seed, one near Culver, Oregon and the other near Madras, Oregon. The trial near Culver consisted of 10-ft by 36-ft plots and the trial near Madras consisted of 10-ft by 30-ft plots; both were arranged in randomized complete blocks replicated four times. Herbicides were applied with a CO_2-pressurized backpack sprayer delivering 20 gal/acre at 40 psi at the rates and timings shown in Table 1. Crop injury was evaluated visually with a 0 to 100 percent rating scale.

Results and Discussion

The leaf-type parsley in the field near Culver did not survive the winter, so the June application was not made at that location and there were no plants to evaluate for injury from the September application. It seems likely that parsley would be more susceptible to herbicide injury from September applications than June applications because the parsley is much smaller in September. In the root-type parsley field near Madras, the June linuron application was made after the last cultivation of the season (lay-by).

Parsley injury from linuron was minor at all the rates and application timings shown in Table 1. The injury that was observed did not persist for long. Neither site had weed populations that were sufficient to evaluate.

Acknowledgements

I would like to thank Agency Farms and H & T Farms for accommodating these trials in their production fields.

Table 1. Response of two types of parsley grown for seed to linuron (Lorox) herbicide in Jefferson County, Oregon, 2007-2008.

Parsley	Treatment[1]	01/Oct/07	08/Oct/07	15/Oct/07	09/Jun/08	20/Jun/08	30/Jun/08
	ai/acre	% injury					
Root-type[2]							
	1.0 lb on 24/Sep/07 + 1.0 lb on 2/Jun/08	0	1	3	0	0	0
	2.0 lb on 24/Sep/07 + 2.0 lb on 2/Jun/08	0	4	8	0	0	0
Leaf-type[3]							
	1.0 lb on 24/Sep/07	0	2	0	--	--	--
	2.0 lb on 24/Sep/07	0	7	3	--	--	--

[1] Linuron applications included R-11 nonionic surfactant at 0.25% v/v. At the time of 24 September 2007 applications the parsley had three to six leaves at both locations. At the time of the 2 June 2008 application the parsley was bolting.

[2] Root-type was grown near Madras, Oregon.

[3] Leaf-type was grown near Culver, Oregon and did not survive the winter.

Evaluation of Ethofumesate (Nortron) and Pendimethalin (Prowl) for Weed Control in Onion Grown for Seed

Richard Affeldt and Brad Holliday

Introduction

Ethofumesate (Nortron®) has recently been registered for use in onions. However, the utility of this herbicide in the existing weed control program is not clear. Ethofumesate is fairly expensive for growers and may not be worth the cost of trying if it offers little improvement beyond current practices. Many herbicides that are registered for use in onion cannot be applied until the onions have two fully expanded leaves. If ethofumesate is safe on onions and it can control some broadleaf weeds, it could fill a gap in current management practices.

Butler et al. (2001) observed no injury to onion from preemergence applications of pendimethalin (Prowl®). However, those results were only for one field in one year. More data are needed to determine if pendimethalin is safe on onion. The objective of this research was to evaluate ethofumesate and pendimethalin alone and in combinations on onion grown for seed.

Methods and Materials

A field trial was conducted in a commercial field of onion grown for seed near Madras, Oregon. The soil type was a Madras sandy loam. The trial consisted of 8-ft by 25-ft plots arranged in randomized complete blocks replicated four times. Herbicide treatments were applied on July 24, 2007 preemergence to the onions with a CO_2-pressurized backpack sprayer delivering 20 gal/acre at 40 psi at the rates and timings shown in Table 1. The field was sprinkler irrigated and the first irrigation was on July 17, 2007. Crop injury was evaluated visually with a 0 to 100 percent rating scale. Stand counts were made in the spring by counting the number of onions per yard of row twice for the male-sterile line and twice for the pollinator line in each plot.

Results and Discussion

At the time of the August 3 and August 10 evaluations, the onions were small and injury was difficult to detect visually. At these two dates there were also too few weeds to evaluate. By September 6, the hand-weeding crew unfortunately removed all the weeds from the trial area so no evaluation of weed control could be made. Stand counts were made for both of the lines in this hybrid field because there was an obvious difference in vigor between the male-sterile and the pollinator line.

On September 6 it was clear that 0.95 lb/acre of pendimethalin had injured the onions (Table 1). Injury from ethofumesate alone was minor. The combination of ethofumesate and pendimethalin at the lower rates caused more injury than either herbicide alone. The injury recorded from both herbicides was from stunting and stand thinning. Injury observed on September 6 persisted through the fall but was no longer visible in the spring once the onions began to grow (data not shown). However, both treatments with 0.95 lb/acre of pendimethalin reduced stand counts compared to the check for the male-sterile line. There were no differences in stand count for the pollinator line.

References

Butler, M., B. Holliday, D. Brooks, and C. Campbell. 2002. Evaluation of preemergence herbicides in seed onions. Pages 35-36 *in* Central Oregon Agricultural Research Center 2001 Annual Report. Special Report 1039.

Acknowledgements

We would like to thank Dean and Brock Brooks at Agency Farms for accommodating this research in their production field.

Table 1. Hybrid onion grown for seed injury and stand counts following preemergence applications of ethofumesate (Nortron) and pendimethalin (Prowl) near Madras, Oregon 2007-2008.

		Onion injury			Stand count[2]	
		03/Aug/07	10/Aug/07	06/Sep/07		
Treatment[1]	Rate	1 leaf	2 to 3 leaf	3 to 5 leaf	MS[3]	Pollenator[4]
	lb/acre	----------- % visual -----------			---- plants/yd ----	
Check	---	0	0	0	33	22
Ethofumesate	0.5	0	0	0	38	26
Ethofumesate	0.75	0	0	3	29	22
Pendimethalin	0.475	0	0	3	31	18
Pendimethalin	0.95	0	0	26	27	18
Ethofumesate + pendimethalin	0.5 + 0.475	0	0	10	31	25
Ethofumesate + pendimethalin	0.75 + 0.95	0	0	36	28	19
LSD (*P* = 0.05)		---	---	---	5	NS

[1]Applied preemergence to onion on 24 July 2007. Also treated with 0.75 lb ae/acre of glyphosate to control emerged weeds. Ethofumesate = Nortron 4 SC. Pendimethalin = Prowl H_2O 3.8 CS.
[2]Means of two subsamples taken per plot.
[3]MS = male-sterile line also called "female" in hybrid production.
[4]Pollinator line also called "male" in hybrid production.

Kentucky Bluegrass Variety Evaluation Under Nonthermal Residue Management

Richard Affeldt and Nikki Lytle

Abstract

A trial was established in a commercial field at Agency Farms north of Madras, Oregon to evaluate the performance of 15 Kentucky bluegrass (*Poa pratensis*) varieties under a nonthermal management system over a 3-year period. This was the establishment year, therefore residue management practices did not play a role in the seed yield data that were collected. Varietal differences observed in years two and three of this study will be of much greater importance because those data will be used to make decisions about variety placement, crop-rotation length, and price structure needed to maintain economic viability under nonthermal conditions.

Introduction

Recently proposed legislation to eliminate open field burning throughout Oregon has created a sense of urgency among the grass seed industry in central Oregon. The Jefferson County Smoke Management Committee has worked to improve the local field burning program in significant ways every year over the last 7 years. One major step they have taken has been a ban on all burning within 0.125 mile of U.S. Highways 26 and 97 in Jefferson County. In addition, Affeldt and Weber (2008) conducted large-plot research to re-evaluate alternative residue management practices. Their research showed that with currently available technology, there is no suitable replacement for field burning that is capable of maintaining seed yield in established stands of Kentucky bluegrass.

The current situation consisting of a local ban on burning along the highway, a looming statewide ban on burning, and no suitable alternative to burning has created a need for variety performance data for Kentucky bluegrass managed without burning. Kentucky bluegrass variety performance data could be used by growers and seed companies to determine which varieties to grow along the highway, where burning is already banned. Furthermore, if all burning was banned these data could be used to determine varietal feasibility and the price structure needed to maintain economic viability.

The objective of this research was to evaluate the performance of 15 Kentucky bluegrass varieties under a nonthermal management system over a 3-year period.

Materials and Methods

A trial consisting of large, nonreplicated plots was established in a commercial field at Agency Farms north of Madras, Oregon. The soil was a Madras sandy loam and a soil test prior to seedbed preparation indicated a pH of 5.8 and soil organic matter at 1.7 percent. Based on the soil test the field was amended with 1 ton/acre of lime ($CaCO_3$), 100 lb/acre of potash (K_2O), and 200 lb/acre of 20.5-0-0-24 fertilizer. Each bluegrass variety was planted on August 7, 2007 in a plot that was roughly 50 by 725 ft, consisting of 20 beds with 2 rows spaced 14 inches apart per bed, with beds spaced 16 inches apart. Kentucky bluegrass seeding depth was approximately 0.25 inch; the seeding rate was 5.8 lb/acre for all varieties except 'A01-299', which was seeded at 10 lb/acre because the seed had been harvested in July prior to planting. The plots were randomized but not replicated. Ten beds of 'Geronimo' Kentucky bluegrass were planted on the edge of the trial as a border. The trial was furrow irrigated and the first irrigation began the day after planting. After the first irrigation, glyphosate was broadcast on the field to control emerged weeds. One row of 'Crest' was missing from the plot and was replanted with a single row seeder on September 6, 2007. Additional weed control consisted of a single broadcast application on October 23, 2007 of bromoxynil, MCPA, and dicamba for broadleaf weed control, hand-hoeing, and a single between-row spray application of the nonselective herbicide paraquat on November 9, 2007. Another 125 lb/acre of 40-0-0-6 fertilizer was applied December 14, 2007. Fungicide, consisting of myclobutanil and sulfur, was applied on April 2, 2008 for powdery mildew.

Swathing timing was determined by conducting moisture testing according to methods developed by the International Seed Testing Association. The target seed moisture for swathing was 24 to 28 percent. Swathing dates were as follows:

- July 4, 2008: 'Geronimo' (border), 'Shamrock', and 'Volt'
- July 6, 2008: 'Crest', 'Atlantis', and 'Merit'
- July 8, 2008: 'Bandera' and 'A00-891'
- July 9, 2008: 'Rhapsody', 'A00-1400', 'Bordeaux', and 'A01-299'
- July 10, 2008: 'Valor'
- July 11, 2008: 'Bariris'
- July 12, 2008: 'Monte Carlo', 'Zinfandel'

Seed threshing was conducted with an International 403 combine. Each plot was threshed as soon as it was dry. Harvested seed was placed in steel fork-lift totes that were tagged with a lot number and transported to Central Oregon Seeds, Inc. (COSI) for cleaning. Seed cleaning is further discussed below.

Results and Discussion

Variety selection for the trial was established through an advisory committee that consisted of local seed contractors. CHS, Inc., Central Oregon Seeds, Inc., and Wilbur-Ellis worked with grass seed breeding companies to select varieties that may have potential under no-burn production along with other standard varieties. The advisory committee also worked out the overall management strategy for the trial. Agronomic aspects were the same for each variety except for the harvest timing, which was done according to maturity as described below. In order to be consistent with actual commercial production practices, the committee decided to make each plot as large as possible and forego replicating.

Most of the trial had very few weeds, but four plots ('Atlantis', 'Bordeaux', 'Valor', and 'A00-1400') on one edge of the field were infested with downy brome (*Bromus tectorum,* also known as cheatgrass). Downy brome was managed with hand-hoeing and between-row spraying. When downy brome control measures were completed, visual estimates of the remaining infestation were made on May 22, 2008. The downy brome infestation was determined to be from 20 to 28 percent in these four plots. Beacon® (primisulfuron) is currently the only herbicide that could have selectively controlled the downy brome; however primisulfuron was not used because of the risk of crop injury it poses.

The fungicide application on April 2 served as preventative step for powdery mildew management. No further development of powdery mildew was observed.

Seed cleaning was completed with commercial equipment at the COSI cleaning facility near Madras. Seed containers were labeled only with a lot number and the cleaning operations were blind, so that COSI personnel handling the seed had no knowledge of variety identity. The percent cleanout, clean seed yield, and pure seed are listed in Table 1 and are ranked by seed yield. Since this was the establishment year there was no effect from not burning post-harvest residues. The ability of these varieties to yield well without burning over the next 2 years will be the most important part of this research.

Seed purity and germination were tested professionally at Agri-Seed Testing, Inc. in Salem, Oregon. Seed germination was inexplicably low for many of the newer or numbered varieties.

In the short-term, the results from this research will be used to determine which varieties can be effectively grown in the phased-out area along U.S.Highways 26 and 97. In the long-term, should field burning ever be banned, this research could be used to determine variety placement, crop-rotation length, and price structure needed to maintain economic viability.

References

Affeldt, R., and M. Weber. 2008. Non-thermal residue management in Kentucky bluegrass. Pages 24-26 *in* Central Oregon Agricultural Research Center 2007 Annual Report. Special Report 1084.

Acknowledgements

We are extremely grateful to Dean Brooks for not only permitting this research to be done at Agency Farms, but also for the active role he took in helping to design, plant, manage, and harvest the trial. We are grateful to Mike Weber, Jim Carroll, and Al Short, who were the three key individuals on the advisory committee. Further thanks go to Jim Carroll for the field scouting expertise he provided for this trial. The advisory committee also benefited from the input of Les Gilmore, Brad Holliday, and Jordan Trimmer. A very special thank you goes to Gary Harris for his donation of the International 403 combine we used to harvest these plots.

Table 1. Kentucky bluegrass seed yield under nonthermal residue management at Agency Farms north of Madras, Oregon, 2007-2008.

Variety	Cleanout	Clean seed yield[‡]	Pure seed	Germination
	%	lb/acre	%	%
Merit	21	1,501	98.25	89.00
Shamrock	12	1,406	99.26	90.25
Crest	17	1,399	97.76	87.00
Volt	17	1,369	94.95	76.75
Bandera	15	1,364	95.41	79.00
A00-891	17	1,295	93.24	59.75
Atlantis[†]	25[†]	1,244	98.90	85.00
Bordeaux[†]	29[†]	1,014	94.46	66.50
Monte Carlo	19	958	95.31	71.25
A01-299	24	918	92.78	61.75
Rhapsody	21	873	93.87	58.25
Valor[†]	29[†]	782	75.04	53.50
A00-1400[†]	38[†]	752	94.55	60.75
Zinfandel	26	740	93.78	64.75
Bariris	31	583	94.28	74.25

[‡] Seed yield and variety rank were similar in small plots at COARC (data not shown).

[†] Indicates plots with an infestation of downy brome (also known as cheatgrass) that was visually estimated at 20 to 28 percent.

Kentucky Bluegrass Variety Response to Primisulfuron

Richard Affeldt, Marvin Butler, and Nikki Lytle

Abstract

A replicated field trial was conducted at the Central Oregon Agricultural Research Center near Madras, Oregon to evaluate seedling Kentucky bluegrass (*Poa pratensis*) variety response to Beacon® (primisulfuron) herbicide. Primisulfuron injured some varieties more than others, and seed yield was reduced compared to the untreated check for 6 of the 15 varieties: 'Valor', 'Bariris', 'Monte Carlo', 'A00-891', 'Bandera', and 'Bordeaux'. Primisulfuron had no effect on eight of the varieties and actually increased seed yield from 'Atlantis' and 'Shamrock'.

Introduction

Beacon® (primisulfuron) is currently the only registered herbicide that effectively controls rough bluegrass (*Poa trivialis*) and downy brome (*Bromus tectorum*) in seedling Kentucky bluegrass. Observations in commercial seed production suggest that Kentucky bluegrass varieties can have varying levels of sensitivity to primisulfuron and is not recommended for use on sensitive varieties. Mueller-Warrant et al. (1997) reported differences in varietal sensitivity to primisulfuron but significant seed yield losses were not observed. Today, many of the varieties previously tested for sensitivity to primisulfuron are no longer extensively produced in Central Oregon. The objective of this research was to evaluate response of traditional and newer releases of Kentucky bluegrass varieties to primisulfuron application during the year of establishment.

Methods and Materials

A field trial was established at the Central Oregon Agricultural Research Center north of Madras, Oregon. The trial consisted of 15 varieties of Kentucky bluegrass that were chosen for evaluation in a variety trial, which was being conducted in a commercial field at Agency Farms (see "Kentucky Bluegrass Variety Evaluation under Nonthermal Residue Management" in this report). The soil was a Madras sandy loam and a soil test prior to seedbed preparation indicated a pH of 7.3 and soil organic matter at 1.6 percent. Based on the soil test the field was amended with 400 lb/acre of 16-16-16-8 fertilizer. Also, the trial area was treated with 107 lb/acre of metam-sodium (Vapam® 4.26 HL), which was applied through the irrigation system 3 weeks prior to planting to kill weed seeds in the soil. The trial was planted on August 10, 2007 with row spacing of 14 and 16 inches every other row. Kentucky bluegrass seeding depth was approximately 0.25 inch; the seeding rate was 5.8 lb/acre for all varieties except 'A01-299', which was seeded at 10 lb/acre because the seed had been harvested in July prior to planting. The trial was sprinkler irrigated and the first irrigation was made on August 13, 2007.

Broadleaf weed control consisted of broadcast applications of bromoxynil and MCPA on September 19, 2007 and again on April 25, 2008. The few remaining weeds were removed by hand. Another 140 lb/acre of 40-0-0-6 fertilizer was applied April 25, 2008. Fungicide, consisting of myclobutanil and sulfur, was applied on May 15, 2008 for powdery mildew.

The trial was arranged as a split-plot design, with 10-ft by 40-ft main plots and two 10-ft by 20-ft subplots. Subplots included an untreated check and primisulfuron. Main plots and subplots were randomized within four replicated blocks. The primisulfuron treatment was made as a split-application with 0.018 lb ai/acre (0.38 oz Beacon/acre) applied on September 26, 2007 when the Kentucky bluegrass had one to two tillers, followed by an additional 0.018 lb ai/acre (0.38 oz Beacon/acre) applied on April 18, 2008 when Kentucky bluegrass was 3 to 6 inches tall. The April 18 primisulfuron application was made just after the first irrigation of the spring. Primisulfuron was applied with a CO_2-pressurized backpack sprayer delivering 20 gal/acre at 40 psi.

Crop injury was determined by making visual evaluations on a percentage scale when Kentucky bluegrass was in a vegetative growth stage on April 18, 2008 and again when the Kentucky bluegrass was in a reproductive growth stage on July 3, 2008. Seed yield was measured by harvesting a sample of grass from each plot into burlap sacks when seed moisture for that variety was 24 to 28 percent. Harvest dates were as follows:

- July 5, 2008: 'Shamrock' and 'Volt'
- July 7, 2008: 'Atlantis', 'Crest', and 'Merit'
- July 8, 2008: 'Bandera' and 'A00-891'
- July 9, 2008: 'Rhapsody', 'Bordeaux', and 'A01-299'
- July 10, 2008: 'Monte Carlo', 'Valor', and 'A00-1400'
- July 12, 2008: 'Bariris' and 'Zinfandel'

These samples were air-dried and threshed in a Hege plot combine; seed samples were de-bearded and cleaned. Clean seed yield data were analyzed with paired t-tests comparing primisulfuron to the untreated check using the mixed model in SAS.

Results and Discussion

Primisulfuron injured some varieties more than others and seed yield was reduced compared to the untreated check for 6 of the 15 varieties: 'Valor', 'Bariris', 'Monte Carlo', 'A00-891', 'Bandera', and 'Bordeaux' (Table 1). Based on anecdotal information regarding primisulfuron injury to commercial fields of Kentucky bluegrass, yield losses from 80 to 90 percent may have occurred. The seed yield reductions observed in this study suggest that other factors are more likely the cause of severe crop injury.

Primisulfuron did not injure seven of the varieties included in this study, and actually increased seed yield of 'Atlantis' and 'Shamrock' (Table 1). We see no clear explanation for this increase. The metam-sodium was applied in order to avoid interference on treatment effects from grassy weed competition. There was very little weed pressure in the trial. Also, primisulfuron sometimes reduced lodging, as listed in Table 1, but there was no consistent correlation between reduced lodging and reduced seed yield from primisulfuron in these data.

Kentucky bluegrass can be injured from primisulfuron use and some varieties are more susceptible to injury than others. However, in this research most varieties were not injured. The seed yield reductions observed here suggest that other factors are likely to be involved in severe cases of crop injury from primisulfuron. The other factors include but are not limited to planting date, application timing, and weather conditions at the time of application. Based on our experience we developed the following guidelines to avoid injury to seedling Kentucky bluegrass from primisulfuron.

1. Choose a tolerant variety, if possible.
2. Do not apply the full rate (0.76 oz Beacon/acre) in one application. Instead, split the application and apply 0.38 oz in the fall followed by an additional 0.38 oz in the spring.
3. In central Oregon, plant Kentucky bluegrass by August 15 to avoid having to apply during the erratic weather conditions that tend to occur in the fall.
4. If possible, avoid applying primisulfuron before or after major changes in daily high temperatures.
5. Only apply primisulfuron once Kentucky bluegrass has reached the one- to two-tiller stage.

References

Mueller-Warrant, G.W., D.S. Culver, S.C. Rosato, and F.J. Crowe. 1997. Kentucky bluegrass variety tolerance to primisulfuron. Pages 51-52 *in* W.C. Young III (ed.) Seed Production Research, Oregon State University.

Acknowledgements

We would like to thank our advisory committee, which consisted of Mike Weber, Jim Carroll, and Al Short for their direction and input on this project. We would also like to thank Bob Crocker for his expertise and help in managing and harvesting this trial.

Table 1. Response of newly seeded Kentucky bluegrass to primisulfuron (Beacon®) herbicide at the Central Oregon Agricultural Research Center, Madras, Oregon, 2007-2008.[1]

Variety	Vegetative injury[2]	Reduced heading[3]	Lodging[4] Check	Lodging[4] Beacon	Seed yield Check	Seed yield Beacon	Seed yield comparison[5]
	------------------ (% Visual)	------------------			----- (lb/acre)	-----	
Atlantis	21	0	78	59	1,287	1,559	**
Merit	18	3	53	36	1,660	1,663	NS
Rhapsody	20	5	48	10	1,051	992	NS
Valor	23	18	56	2	972	704	**
Bariris	19	4	99	71	827	608	*
Crest	14	15	63	34	1,593	1,415	NS
Monte Carlo	15	18	38	1	1,095	894	*
Shamrock	9	0	79	68	1,581	1,827	**
A00-891	14	4	81	42	1,955	1,566	***
A00-1400	13	1	93	44	957	832	NS
Bandera	16	15	28	0	1,335	1,131	*
Bordeaux	25	9	95	31	1,290	979	***
Volt	14	6	79	78	1,473	1,349	NS
Zinfandel	15	8	40	16	1,007	835	NS
A01-299	30	9	78	30	912	898	NS

[1]Primisulfuron (Beacon 75 DG) was applied at 0.38 oz product/acre on September 26, 2007 when Kentucky bluegrass had one to two tillers, followed by an additional 0.38 oz product/acre on April 18, 2008, when Kentucky bluegrass was 3 to 6 inches tall. All primisulfuron applications included R-11® nonionic surfactant at 0.25 percent v/v.

[2]Injury from primisulfuron compared to an untreated check, evaluated April 18, 2008.

[3]Reduced heading from primisulfuron compared to an untreated check, evaluated July 3, 2008.

[4]Evaluated July 2, 2008.

[5]Comparison made with a paired t-test. NS = Not Significant, * *P* = 0.1, ** *P* = 0.05, *** *P* = 0.01.

Evaluation of Palisade on Fifteen Kentucky Bluegrass Varieties Grown for Seed in Central Oregon, 2007-2008

Marvin Butler, Rich Affeldt, Linda Samsel, and Nikki Lytle

Abstract

The growth regulator, Palisade™ (Trinexapac-ethyl), was evaluated on 15 Kentucky bluegrass (*Poa pratensis*) varieties grown for seed at the Central Oregon Agricultural Research Center. The influence of Palisade on seed yield, plant height, and lodging were documented. Treatments were applied at the boot stage and varieties were harvested based on maturity. Seed yields were significantly increased for 7 of the 15 varieties and decreased for 1. Application of Palisade almost uniformly decreased lodging, while reduction in plant height was less consistent.

Introduction

Research to evaluate Palisade on Kentucky bluegrass was conducted in commercial seed fields of 'Merit' or 'Geronimo' from 1999 to 2003. Yields were increased by 31 to 36 percent 4 of the 5 years when Palisade was applied at 22 oz/acre from the second node (Feekes 7) to heads just becoming visible (Feekes 10.1). Late application when the heads extended just above the flag leaf (Feekes 10.4) produced the greatest reduction in plant size, while plants tended to outgrow the effect of earlier Palisade applications. No differences between treatments in weight per 1,000 seeds were observed, and percent germination was not adversely affected.

Methods and Materials

This research was conducted at the Central Oregon Agricultural Research Center (COARC) near Madras. A split-plot design was used, with 10-ft by 60-ft main plots and 3 10-ft by 20-ft subplots. Subplots were randomized and included Palisade, Beacon® (primisulfuron), and an untreated check. Main plots were replicated four times in a randomized complete block design. Palisade was applied at 24 oz/acre on May 14 when most varieties were in the boot stage. The exceptions were the early maturing varieties 'Volt' and 'Shamrock', where the heads were starting to appear.

Application was made with a CO_2-pressurized, hand-held boom sprayer at 40 psi and 20 gal/acre water using TeeJet 8002 nozzles. Plant height was measured on June 20 and percent lodging was estimated on July 2. A research-sized swather was used to harvest a 40-inch by 17-ft portion of each Kentucky bluegrass plot as varieties matured from July 5 to July 10. Samples were placed in large burlap bags and hung in the equipment shed to dry, then combined by hand-feeding the samples into a stationery Hege small-plot combine. Seed samples were transported to the Hyslop Farm near Corvallis where they were debearded, run through a small scale clipper cleaner, and clean seed weight was determined.

Results and Discussion

Seed yield (Table 1) was significantly increased for 7 varieties by as much as 35 percent for ‘A01-299’ and 32 percent for ‘Atlantis’. Yield was decreased by 18 percent for ‘A00-891’, while there was no significant change for 7 varieties. Lodging was significantly reduced for 14 of the 15 varieties, with ‘Bariris’ showing no change. Results were mixed concerning plant height, with 11 varieties shorter by as much as 15 percent following Palisade application and 4 varieties taller by as much as 6 percent. These mixed results are likely the results of plants outgrowing the effect of Palisade by the time height measurements were taken.

Table 1. Effect of Palisade growth regulator on seed yield, lodging, and plant height for 15 Kentucky bluegrass varieties, Madras, Oregon, 2008.

	Clean seed yield (lb/acre)				Lodging (%)		Plant ht (in)	
Variety	Check	Palisade	% Check	Signif.	Check	Palisade	Check	Palisade
Atlantis	1287	1696	132	***[1]	78	36	29.00	30.25
Merit	1660	1860	112	*	53	3	26.75	23.75
Rhapsody	1051	1040	99	ns	48	0	25.25	22.25
Valor	972	1029	106	ns	56	0	23.75	20.25
Bariris	827	1066	129	**	100	92	27.00	28.50
Crest	1593	1664	104	ns	63	7	26.50	25.25
Monte Carlo	1095	1015	93	ns	37	0	26.00	22.25
Shamrock	1581	2031	128	***	79	46	29.25	27.25
A00-891	1955	1595	82	***	81	23	25.25	24.00
A00-1400	957	1235	129	**	93	60	24.75	25.25
Bandera	1335	1299	97	ns	28	1	26.75	24.25
Bordeaux	1290	1527	118	**	95	21	26.25	27.00
Volt	1473	1457	99	ns	79	43	26.75	26.50
Zinfandel	1007	1006	100	ns	40	0	25.00	22.50
A01-299	912	1228	135	***	78	21	27.25	27.00

[1] Comparison with paired t-test: ns = non-significant, * for $P = 0.10$, ** for $P = 0.05$, *** for $P = 0.01$

Evaluation of Fifteen Kentucky Bluegrass Varieties for Tolerance to Powdery Mildew, 2007-2008

Marvin Butler, Rich Affeldt, Linda Samsel, and Nikki Lytle

Abstract

Fifteen Kentucky bluegrass (*Poa pratensis*) varieties grown for seed production were evaluated for tolerance to powdery mildew (*Erysiphe graminis*) in central Oregon. This is the first year of a 3-year study to determine varietal tolerance and the influence of stand age on the severity of the disease in a no-burn management system. The level of disease ranged from 0.3 for 'A00-891' to 2.8 for 'Merit'.

Introduction

New fungicide products have been regularly evaluated for control of powdery mildew in Kentucky bluegrass seed production fields in central Oregon since 1998. Products have included the historical industry standard Bayleton® (triadimefon), along with Tilt® (triadimefon), Tilt® (propiconazole) plus Bravo® (cholorothalonil), new products such as Laredo® (myclobutanil), Folicur® (tebuconazole), Quadras® (azoxystrobin), and Quilt (azoxystrobin plus propiconazole), and alternative materials like Microthiol (sulfur) and stylet oil. The objective of this project is to determine susceptibility of 15 varieties being grown without open field burning for residue management, and the influence of stand age of disease severity. This is the first year of a 3-year study.

Methods and Materials

This research was conducted at the Central Oregon Agricultural Research Center (COARC) near Madras. A split plot design was used, with 10-ft by 60-ft main plots and three 10-ft by 20-ft subplots. Subplots were randomized and included Palisade, Beacon, and an untreated check. Main plots were replicated four times in a randomized complete block design. The untreated single plots within the split plots were used for this project.

Plots were evaluated using a rating scale of 0 (no mildew present) to 5 (total leaf coverage) on May 14, 2008. The following day the entire plot area was treated with Laredo at 12 oz/acre plus Microthiol at 5 lb/acre.

Results and Discussion

Powdery mildew ratings (Table 1) ranged from less than 1.0 for 'A00-891', 'Valor', 'Monte Carlo', 'Rhapsody' and 'Zinfandel' to 2.6 for 'Atlantis' and 2.8 for 'Merit'. This may be due in part to plant growth characteristics in addition to natural plant tolerance. 'Atlantis' and 'Merit' are larger plants with more rank growth, creating an environment conducive to disease development.

Table 1. Tolerance of Kentucky bluegrass varieties grown for seed to powdery mildew (*Erysiphe graminis*) near Madras, Oregon evaluated on May 14, 2008.

Variety	Powdery mildew Ratings (0-5)	Powdery mildew Significance
A00-891	0.3[1]	a[2]
Valor	0.6	ab
Monte Carlo	0.7	ab
Rhapsody	0.7	ab
Zinfandel	0.8	ab
Bordeaux	1.0	bc
A00-1400	1.0	bc
Bandera	1.5	cd
Bariris	1.8	de
Crest	1.8	de
Shamrock	2.1	def
Volt	2.3	efg
A01-299	2.3	efg
Atlantis	2.6	fg
Merit	2.8	g

[1]Rating scale was 0 (no mildew) to 5 (total leaf coverage).
[2] Mean separation with LSD $P \leq 0.05$.

Downy Brome Control in Kentucky Bluegrass with Dimethenamid-P (Outlook) and Pendimethalin (Prowl)

Richard Affeldt and John McKenzie

Introduction

Kentucky bluegrass (*Poa pratensis*) fields are usually burned and propane-flamed in order to stimulate fertile tiller development after seed harvest. These fields are then irrigated from September to mid-October before the Kentucky bluegrass goes dormant for the winter. Downy brome (*Bromus tectorum*) often germinates during this September/October irrigation period and can grow throughout much of the remaining fall and winter. It may grow up to 4 to 6 inches in diameter by the time Kentucky bluegrass goes dormant for the winter. Downy brome of this size can be difficult to control with herbicides during the dormant period.

Outlook® (dimethenamid-P) and Prowl H_2O® (pendimethalin) are currently registered for use in grass seed production. Ideal application timing for these two herbicides is after field burning and prior to the first irrigation. However, some crop consultants have had concerns about Kentucky bluegrass injury when these herbicides are tank-mixed. Also it has been difficult to quantify the extent to which these herbicides are controlling downy brome. The objective of this research was to evaluate Kentucky bluegrass tolerance at this application timing and quantify downy brome control with dimethenamid-P and pendimethalin.

Methods and Materials

A field trial was conducted in a commercial field of Kentucky bluegrass grown for seed near Culver, Oregon. The trial consisted of 10-ft by 28-ft plots arranged in randomized complete blocks replicated four times. Herbicide treatments were applied on September 11, 2007 with a CO_2-pressurized backpack sprayer calibrated to deliver 20 gal/acre at 40 psi at the rates and timings shown in Table 1. At the time dimethenamid-P and pendimethalin were applied in this trial, the field had been burned and some charcoal remained on the soil surface. There was also no Kentucky bluegrass regrowth. The trial was placed along an edge of the field that had a severe infestation of downy brome. The field was sprinkler irrigated and the first irrigation following seed harvest occurred the day after the herbicide treatments were applied. Crop injury and weed control were evaluated visually with a 0 to 100 percent rating scale.

Results and Discussion

The emergence of downy brome within the trial area was very low in two of the four replications, so control ratings in Table 1 are the result of only two replications. However, even in the two replications with downy brome emergence, it was difficult to evaluate control until May. The higher rates of dimethenamid-P and pendimethalin delayed the fall regrowth of Kentucky bluegrass (Table 1). However, this injury was minor and by May 21, 2008 there were no visual signs of crop injury and no reduction in seed heading was observed in any of the treated plots on July 3, 2008.

Dimethenamid-P controlled downy brome better than pendimethalin at the rates tested. The combination of dimethenamid-P and pendimethalin did not improve control of downy brome compared to dimethenamid-P alone. None of the herbicide treatments controlled more than 90 percent of the downy brome, but downy brome populations were greatly reduced from all herbicide treatments.

The downy brome suppression and minimal crop injury from dimethenamid-P applied post-harvest could improve management of this difficult weed.

Acknowledgements

We would like to thank Kurt Locke for accommodating this research in his production field.

Table 1. Kentucky bluegrass injury and downy brome control from pendimethalin (Prowl) and dimethenamid-P (Outlook) near Culver, Oregon, 2007-2008.

		Kentucky bluegrass			Downy brome[2]
		08/Oct/07	21/May/08	03/Jul/08	21/May/08
Treatment[1]	Rate	0.5-inch ht	4-inch ht	heading	heading
	lb/acre		% injury		% control
Pendimethalin	2.0	3	0	0	55
Pendimethalin	3.0	10	0	0	63
Dimethenamid-P	0.7	9	0	0	83
Dimethenamid-P	1.0	15	0	0	70
Pendimethalin + Dimethenamid-P	2.0 + 0.7	6	0	0	70
Pendimethalin + Dimethenamid-P	3.0 + 1.0	19	0	0	75

[1]Applied September 11, 2007, the day before the first irrigation following seed harvest. After harvest the field was burned and some charcoal remained on the soil surface.
[2]Ratings are for downy brome control across two replications.

Sod Webworm Management System for Kentucky Bluegrass Seed Production in Central Oregon, 2008

Marvin Butler, Linda Samsel, Glenn Fisher, and Ralph Berry

Abstract

Pheromone traps that emit a scent to attract male sod webworm moths (*Chrysoteuchia topiaria*) were placed in the 4 quadrants of 11 commercial fields of Kentucky bluegrass seed production in early May of 2008. Moths were collected and counted weekly through July 21. Sod webworm moths collected ranged from 27 to 1,253 across the 11 fields. The peak flight was in early to mid-July, with 170 sod webworm moths collected per field per week. Compared to other growing regions, these numbers are considered relatively low. Peak numbers of cutworm moths (*Protagrotis obscura*) occurred during late June to mid-July. Collection of sod samples from problematic fields during October included one with many billbugs, others were found with infestations of cutworms, aphids, or winter grain mites.

Introduction

Surveys of insect pests in Kentucky bluegrass fields were conducted in central Oregon and the Grande Ronde Valley during 2003-2005. Results indicated the presence of sod webworm (*Chrysoteuchia topiaria*) and cutworms (*Protagrotis obscura*) in central Oregon. No billbugs (*Sphenophorus venatus confluens*) were collected in 2003-2004, while 22 were collected during 2004-2005. At that time sod webworms were considered an emerging pest that could have a financial impact on Kentucky bluegrass fields in central Oregon.

More recently the project has focused on sod webworm populations and distribution during the 2005, 2006, and 2008 seasons. The strategy has been to use pheromone traps that emit a scent to attract males in order to track the number of the sod webworm moths. This has been followed by sod sampling to determine the correlation between moth and larval populations. The objective of this research is to determine whether pheromone traps can be used as an indicator of which fields will have high populations of larvae in the fall, when control measures are applicable. The number of cutworms collected in pheromone traps has been tracked as well.

Methods and Materials

Four pheromone traps were placed in each of the 4 quadrants of 11 commercial Kentucky bluegrass seed production fields in early May. Fields with potential insect problems in the Madras and Culver areas were chosen for the project this season. Contents of the traps were collected approximately weekly from May 12 to July 21, with the number of sod webworm and cutworm moths noted. Traps were removed prior to harvest operations, and the resulting data provided to the appropriate fieldman for follow-up with growers.

All fields with significant numbers of sod webworm moths were treated in the fall, making them unsuitable for follow-up sod sampling. Instead, the project focused this fall on problem fields indentified by cooperating fieldmen. Eight sod samples per field were collected from four fields and processed using Berlese funnels.

Results and Discussions

The overall peak flight of sod webworm moths was from July 1 to July 20 (Table 1). This is comparable to previous years. During peak flight the total number of sod webworm moths collected per field per week from the four traps was near 170. The total number of sod webworm moths collected per field varied from 27 to 1,253. These numbers are considered relatively low compared to the Willamette Valley.

Cutworm moths attracted to the traps were tracked as well (Table 2). Peak numbers were collected during June 18 through July 20, with the number collected per field per week during this time near 25. The total number of cutworms collected per field ranged from 47 to 265. The number of cutworms collected is considered relatively low compared to other growing regions. The cutworm lifecycle appears to be similar to that of sod webworm.

Four problem fields were the focus of this project during the fall of 2008. Sod samples collected at Location 1 on October 19 indicated infestations of cutworms and aphids, with some sod webworms, billbugs, springtails, and rove beetles. Samples collected at Location 2 on October 28 revealed a large number of billbugs, a variety of mites, aphids, and early stages of springtails—this despite insecticide applications directed at the perceived problem. At Location 3 sod samples collected on October 19 showed an infestation of winter grain mites, aphids, some cutworms, and a few sod webworm. Samples collected on October 19 at Location 4 revealed infestations of winter grain mites and aphids, some cutworms, billbugs, and sod webworms, and many springtails.

Following are some informal observations. Fieldmen and growers indicate that higher numbers of larvae are often found under windrows where there is greater protection and higher moisture levels. It is believed that field dry down following harvest, followed by open field burning makes a relatively inhospitable environment for emerging larvae. In some years the presence of moths during the summer is followed by few to no larvae in the fall. This seems to occur at the same time both in central Oregon and the Willamette Valley. This observation would seem to indicate the cause may be a regional weather event, such as exceptionally hot, dry weather following harvest.

Table 1. Sod webworm moths collected per field using pheromone traps from May 7 to July 21, 2008, near Madras, Oregon.

	Sod webworm moths									
Field	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7	Sample 8	Sample 9	Total
1	2	1	0	6	17	1	---	---	---	27
2	6	2	0	0	1	21	82	339	91	542
3	16	4	2	0	3	9	15	62	55	166
4	2	3	0	0	3	15	52	114	249	438
5	3	5	4	1	1	10	13	41	42	120
6	2	2	---	0	10	13	50	73	49	199
7	1	---	14	1	9	29	146	243	95	538
8	---	---	---	---	1	6	126	228	46	407
9	7	7	2	1	7	84	82	446	617	1,253
10	4	0	0	0	---	2	63	171	128	368
11	2	5	2	4	---	7	24	131	73	248
Total	45	29	24	13	52	197	653	1,848	1,445	

Table 2. Cutworm moths collected per field using pheromone traps from May 7 to July 21, 2008, near Madras, Oregon.

	Cutworm moths									
Field	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7	Sample 8	Sample 9	Total
1	2	0	1	18	24	2	---	---	---	47
2	2	0	1	0	0	13	15	11	7	49
3	3	2	2	11	23	20	30	29	12	132
4	14	3	3	5	12	30	35	34	42	178
5	1	3	3	5	4	20	28	37	39	140
6	2	36	---	34	13	31	40	71	38	265
7	2	---	1	1	18	37	42	18	15	134
8	---	---	---	---	9	20	33	1	18	81
9	3	4	3	1	20	2	9	0	9	51
10	4	1	1	1	---	8	27	0	30	72
11	6	0	0	13	---	19	34	7	52	131
Total	39	49	15	89	123	202	293	208	262	

Winter Grain Mite Control in Kentucky Bluegrass Grown for Seed in Central Oregon, 2008

Marvin Butler, Dennis Scott, Linda Samsel, and Jim Carroll

Abstract

The winter grain mite (*Penthaleus major*) is considered the major insect pest in Kentucky bluegrass (*Poa pratensis*) seed production in central Oregon. Several insecticides were compared to dimethoate, the industry standard. None of these products provided significantly greater control of winter grain mites than the current product of choice, dimethoate.

Introduction

The winter grain mite has long been considered the major insect pest in Kentucky bluegrass seed production in central Oregon. Other pests include sod webworm (*Chrysoteuchia topiaria*), cutworm (*Protagrotis obscura*), and most recently billbugs (*Sphenophorus venatus confluens*). The product of choice for control of winter grain mites has been dimethoate. The objective of this project is to evaluate new and alternative materials for efficacy compared to this industry standard.

Methods and Materials

The trial was conducted in cooperation with S & L Farms in a commercial Kentucky bluegrass seed field on the Agency Plains north of Madras, Oregon. Insecticides that were compared with the industry standard dimethoate included Lorsban® (chlorpyrifos), Baythroid® (beta-cyfluthrin), and Oberon® (spiromesifen). Plots were 10 ft by 25 ft replicated 4 times in a randomized complete block design. Treatments were applied November 7, 2008 using a CO_2-pressurized hand-held boom sprayer outfitted with TeeJet 8002 nozzles on a 9-ft boom operated at 40 psi and applying 20 gal/acre water.

Mite counts were made using 8 2-inch crown and soil core samples per plot. Samples were stored under refrigeration while waiting processing in Berlese funnels. Insects were collected into jars and identified using a dissecting microscope. Precounts were taken prior to application on November 3 and following application on November 12, 17, 24, and December 1, 2008. Dimethoate was applied to clean up the entire plot area on January 2, 2009.

Results and Discussion

None of the insecticides provided significantly greater control of winter grain mites than the industry standard, dimethoate (Table 1). Although the winter grain mite population was relatively modest at the time of insecticide application, the performance of Oberon was not significantly different from the untreated plots.

Table 1. Winter grain mite control following insecticide applications on November 7, 2008 in Kentucky bluegrass grown for seed near Madras, Oregon.

Treatment	Product /acre	Mites per plot									
		Pre-count		Nov 12		Nov 17		Nov 24		Dec 1	
Dimethoate[1]	0.67 pint	3.50	ns[2]	1.50	ns	1.00	ns	0.25	a	1.25	ab
Lorsban	0.5 pint	6.25	ns	0.50	ns	0.50	ns	0.25	a	0.25	ab
Baythroid	28 fl oz	2.50	ns	2.00	ns	0.75	ns	0.00	a	0.00	a
Oberon	8 fl oz	5.00	ns	8.75	ns	3.50	ns	8.75	c	4.00	ab
Oberon	12 fl oz	6.25	ns	3.25	ns	5.75	ns	3.25	bc	3.25	ab
Untreated	-----	5.25	ns	6.75	ns	5.50	ns	4.75	ab	5.00	b

[1]Dimethoate = dimethoate, Lorsban = chlorpyrifos, Baythroid = beta-cyfluthrin, Oberon = spiromesifen.

[2]Mean separation with LSD at $P \leq 0.05$.

Evaluation of Simulated Hail Damage to Kentucky Bluegrass Seed Production in Central Oregon, 2008

Marvin Butler, Mark Zarnstorff, Linda Samsel, and H & T Farms

Abstract

This is the second year of a 3-year study to determine the effect of simulated hail damage on Kentucky bluegrass (*Poa pratensis*) seed yields. Treatments were applied at three growth stages in the spring to simulate 33, 67, and 100 percent damage. Treatments of 33 and 67 percent damage applied at head emergence caused significantly greater yield reductions than those applied at the boot stage or seed fill. It appears the plant may be particularly sensitive to damage at head emergence. When 100 percent damage was applied at the boot stage, seed yield was reduced by only 59 percent, indicating the plants may be able to recover from significant damage at that stage.

Introduction

Kentucky bluegrass seed production has historically been an integral part of agriculture in central Oregon. In recent years there has been a decline in acreage due to reduction in price from an oversupply, but more recently acreage has rebounded. The objective of this project is to determine the impact from timing and severity of hail damage on seed production of Kentucky bluegrass. This information will assist the National Crop Insurance Service in developing methodology to evaluate hail damage on Kentucky bluegrass.

Methods and Materials

This is the second year of a multiple year evaluation on the effect of simulated hail damage on Kentucky bluegrass seed production. The study was conducted in a commercial third-year field of 'Monte Carlo' with H & T Farms near Culver, Oregon. Plots were 5 ft by 15 ft, with 3-ft alleyways, replicated four times in a randomized complete block design.

Variables established for this study included three treatment timings and three levels of damage. Damage treatments were inflicted at the boot stage, at head emergence, and during seed fill. Severity of damage inflicted was targeted at 33, 67, and 100 percent compared to undamaged plots.

A Jari mower was used to cut 3-ft alleyways across the front and back of each block of plots. Treatments were made on May 20, June 13, and July 1 using a weed eater with plastic blades held on edge at a 45 degree angle or perpendicular to the ground for the 100 percent treatment. The target amount of foliage or seed heads removed was one-third of the growth, two-thirds of the growth, or removal of all plant material above 1-2 inches. A research-sized swather was used to harvest a 40-inch by 12-ft portion of each Kentucky bluegrass plot on July 15, the date commercial harvest of the field was begun. Samples were placed in large burlap bags and hung in the three-sided equipment shed at the Central Oregon Agricultural Research Center to dry.

When samples were dry they were combined using a stationary Hege, with seed samples processed using a debearder follow by a Clipper cleaner.

Results and Discussion

The data (Table 1) are very similar to those collected last year. The same treatments caused similar reductions in yield with nearly the same comparative ranking of treatments to last year. This gives us confidence in the results across two varieties, stand age, and growing season.

It is clear that damage at head emergence resulted in the greatest reduction in yield. Treatments that applied 33 or 67 percent damage at head emergence had a significantly greater effect on seed yield than did other treatment timings. It appears that Kentucky bluegrass is particularly susceptible to damage at head emergence.

Even with 100 percent damage at the boot stage, the plant was able to recover with 41 percent of the yield compared to the untreated plots. Damage later in plant development, at head emergence or seed fill, eliminated any yield potential. Lesser damage of 33 and 67 percent inflicted at seed fill appeared to cause less reduction in seed yield than the same damage at the boot stage. This is despite heavier than intended damage inflicted at seed fill.

Table 1. Simulated hail damage on Kentucky bluegrass grown for seed with damage inflicted at the boot stage, head emergence, and seed filling prior to harvest on July 15, 2007.

Hail damage		Seed yield		
Damage (%)	Growth stage	lb/acre		% Untreated
Untreated	---	821	a[1]	100
33	Seed fill	622	b	76
33	Boot	568	b	69
67	Seed fill	453	c	55
100	Boot	338	d	41
67	Boot	335	d	41
33	Heads emerged	186	e	23
67	Heads emerged	67	f	8
100	Heads emerged	0	f	0
100	Seed fill	0	f	0

[1]Mean separation with Least Significant Difference (LSD) at $P \leq 0.05$.

Jefferson County Smoke Management Pilot Balloon Observations, 2008

Linda Samsel, Marvin Butler, and Kristi Fisher

Abstract

Pilot balloon (Piball) observations are a major component of the daily decision-making process used in managing open field burning of grass seed and wheat fields in Jefferson County. Piballs are used to track local wind direction and speed. Piballs are released daily from the Central Oregon Agricultural Research Center and the Culver Fire Department between 10:00 a.m. and 2:30 p.m. Piball releases allow for more accurate decisions under marginal conditions. The Piball is essential in minimizing adverse smoke impacts on the local communities.

Introduction

The Piball program that began in 1998 incorporates weather balloon information into the daily routine along with the information the Jefferson County Smoke Management Team receives from the Oregon Department of Agriculture Weather Center. The objective is to provide real-time wind pattern, wind speed, and wind direction information to assist the Smoke Management Coordinator in making a decision whether or not to allow burning. The Smoke Management Program's goal is to prevent smoke intrusion into the local communities and yet allow growers to burn their fields in a timely manner.

During the 2008 burning season there was a total of 13,492 acres burned, 5,910 acres of grass, and 7,582 acres of wheat. Emphasis is put on allowing more burning on the better burn days and not allowing burning on the marginal days, when smoke could impact the local communities. During 2008, open field burning began on July 28and ended on September 25. Due to cold spring weather the harvest was late and the fields were not ready to be burned until later in the season.

Materials and Methods

During the 2008 season, balloons were released between two to four times daily. First release was in the morning at approximately 10:00 a.m. at the Culver Fire Department, with occasional releases sent up in the afternoon. Other balloon releases occurred at various times between 10:30 a.m. and 3:00 p.m. at the Central Oregon Agricultural Research Center. On heavy burning days, the Piball was put up each hour, on-the-hour. For fields with various influences such as wind, location, and topography, balloons were released onsite at the edge of the field for accurate readings. The release times were requested daily from the Smoke Management Coordinator.

During Piball releases, wind direction and speed are determined at 1-min intervals for a period of 10 min using an observation Theodolite System and a 26-inch-diameter heliumfilled balloon. These readings go into the software program, Piball Analyzer, which analyzes the data in three different components. The first is the Piball Sounding, a spreadsheet translating the azimuth and elevation readings from the Piball into wind direction and average wind speeds. The second is the hodograph, which charts wind direction, and third is the Profile page, which graphs wind speed. The results are provided to the Jefferson County Smoke Management Coordinator, who uses this information to determine the field burning status.

Results

The Piball program is an important tool to determine real-time conditions. It is particularly helpful on marginal burn days to assist the program coordinator in making the decision whether to allow burning when conditions are either changing or hard to determine visually. Using the Piball and having it available for release prior to making the final decision has proven to be a valuable tool.

2008 Winter and Spring Wheat Variety Trials

Rhonda Simmons, Mylen Bohle, Mark Larsen,
Mary Verhoeven, Mike Flowers, and Jim Petersen

Introduction

Central Oregon is well situated to the markets in Portland, Oregon. Public and private Pacific Northwest plant breeders release new cereal varieties each year. To provide growers with accurate, up-to-date information on variety performance, a statewide variety-testing program was initiated in 1993 with funding provided by the Oregon State University (OSU) Extension Service, OSU Agricultural Experiment Station, Oregon Wheat Commission, and the Oregon Grains Commission. Central Oregon Agricultural Research Center (COARC) has participated in the program every year since 1993. These variety trials support breeding efforts, end-use quality testing, variety release decisions, variety quality recommendations, and provide important information on variety performance to Oregon wheat growers.

Yield, height, lodging, and heading dates were recorded for Madras, one of nine locations around Oregon that participate in the Oregon Elite Yield Trial. Results are summarized and reported through extension publications, county extension newsletters such as the Central Oregon Ag Newsletter, as well as in other popular press media. Data are also summarized for all trials and are available on the OSU Cereals Extension web page (http://cropandsoil.oregonstate.edu/wheat/). For future reference, use the web site for earliest access to data, as trial results are posted as soon as they are available. Previous cereal variety and other production trial data (1993-2002) are available at the following web site http://cropandsoil.oregonstate.edu/cereals/. Due to budget constraints, this web site is no longer updated, but the information is still available.

Materials and Methods

The entries were planted into plots, 4.5 ft by 20 ft, at the rate of 30 seeds/ft^2, in 6 rows, 8-inch row spacing, with an Oyjord plot drill in a randomized block design, with 3 replications. The winter wheat trial was planted on September 25, 2007 and spring wheat trials were planted on April 7, 2008.

Soil samples were taken to a depth of 14 inches, the extent of the soil depth. The samples were analyzed by Agri-Check Laboratory at Umatilla, Oregon.

Table 1. Soil test results from samples taken on October 23, 2007, for the statewide Oregon Elite Wheat Variety Trials, at Central Oregon Agricultural Research Center, Madras, Oregon.

Soil depth	pH	NO_3[1]	NH_4	P	K	S
(in)		(lb/acre)	(lb/acre)	(ppm)	(ppm)	(ppm)
0-14	7.1	27	11	31	444	15.9

[1]NO_3 = nitrate, NH_4 = ammonia, P = phosphorus, K = potassium, S = sulfur.

The winter wheat variety trials were fertilized with 550 lb/acre of 30-10-0-7 (165 lb N, 55 lb P_2O_5, 38.5 lb S per acre) on March 25, 2008. Estimated total nitrogen (soil plus fertilizer N) in the top 14 inches of soil available to the plants was 192 lb/acre.

Weeds were controlled in winter wheat with an application of 1.5 pt/acre Bronate® and 4.0 oz/acre of Banvel® product, and 2 pt/100 gal non-ionic surfactant on April 11, 2008. Weed control for the spring wheat trial included the application of 1.2 pt/acre of 24-D Amine and 2 oz/acre of Banvel® on May 19, 2008

Cereal leaf beetles were abundant in the spring wheat trial in June and Lorsban® was applied through irrigation at 1.0 pt/acre to control them on June 13, 2008.

The trials were irrigated as needed with a 30-ft by 40-ft spacing, solid-set sprinkler (9/64-inch heads) irrigation system. Date of first irrigation for the winter wheat variety trial occurred on April 14, 2008 and the last irrigation occurred on July 15, 2008. Date of first irrigation for the spring wheat trial occurred on April 24, 2008 and ended on July 25, 2008. Yield was corrected to 12 percent moisture and protein to 10 percent moisture.

Heading dates were recorded when 50 percent heading occurred. Just prior to harvest, lodging scores (percent of plot) and plant height (inches) measurements were taken. Harvested area was approximately 15 ft by 4.5 ft for the winter and spring wheat trial. A Hege plot combine was used to harvest the entries. Harvest date for the winter wheat trial was August 13, 2008 and August 28, 2008 for the spring wheat trial. The grain samples were shipped to and processed at the OSU Hyslop Farm at Corvallis, Oregon, and percent protein was predicted by NIRS whole grain analyzer. Statistical analyses were by analysis of variance (ANOVA) using general linear model, PROC GLM, of SAS version 9.1 (SAS Institute, Cary, NC, 2002). Treatment means were separated by Fisher's protected least significant difference (PLSD 0.05) test.

Results and Discussion

Winter Wheat Trial

The winter wheat trial yield average was 127.8 bu/acre, and yields ranged from 103.5 to 142.8 bu/acre (Table 2). For the top-yielding 26 entries, 'Goetze' to 'ORCF-101', there were no significant differences between varieties, with a yield range of 125.6 to 142.8 bu/acre (PLSD 0.05, 18.8 bu/acre). Yield data were corrected to 12 percent moisture.

Average test weight for the trial was 59.6 lb/bu. Test weight ranged from 57.0 ('OR2051126') to 61.7 lb/bu ('Skiles' ORH010085).

Heading dates ranged from 152.7 days from January 1 (day of year, doy) to 167.3, or a range of 14.6 days. Oregon line 'Goetze' was the earliest to head at 152.7 doy; 'Masami' was the last entry to head at 167.3 doy.

Average plant height was 35.8 inches for the trial. Heights ranged from 31.3 inches

(‘Goetze’) to 40.3 inches (‘OR9901619’).

Lodging average was a bit higher than in previous years with 24.8 percent for the trial. Lodging ranged from 0 percent (8 entries) to 73.3 percent (‘OR2050301’); 14 entries had scores of 10 percent or less.

Protein average was 10.4 percent and ranged from 9.4 to 12.2 percent. A protein value of 10.5 is the average goal of the trial and is a benchmark for the correct amount of nitrogen fertilizer.

‘Goetze’ (‘ORH010920’) is a soft white winter wheat and was released in fall of 2007. ‘Goetze’ has a superior grain yield potential in state trials, similar or better than ‘Tubbs’, but is less cold tolerant than ‘Stephens’. ‘Goetze’ matures reasonably early, has short straw, and has shown good disease resistance to stripe rust.

‘ORCF-101’ and ‘ORCF-102’ are soft white winter wheats that possess CLEARFIELD® herbicide resistance technology. ‘ORCF-102’ has disease response similar to its parent lines ‘Madsen’ and ‘Weatherford’. Height and lodging are both favorable to central Oregon production under wheel lines. ‘ORCF-102’ yielded in the top five varieties and matures mid to late in the season.

Spring Wheat Trial

The spring wheat trial yield average was 114.4 bu/acre, and yields ranged from 91.5 to 142.7 bu/acre (Table 3). For the top-yielding five entries, ‘Cabernet’ to ‘Merill’, there were no significant differences between varieties with a yield range of 127.4 to 142.7 bu/acre (PLSD 0.05, 15.6 bu/acre).

Average test weight for the trial was 60.3 lb/bu. Test weight ranged from 56.3 lb/bu (‘77-154-98’) to 63.7 lb/bu (‘B02-0081’).

Heading dates ranged from 170 days from January 1 (doy) to 182, or a range of 12 days. ‘Blanca Grande’ was the earliest to head at 170 doy; ’77-154-098’ was the last entry to head at 182 doy.

Average plant height was 36 inches for the trial. Heights ranged from 31 inches (‘Patwin’ and ‘RS150076R’) to 42 inches (‘OR4041451’).

Lodging average was a bit higher than in previous years with 17 percent for the trial. Lodging ranged from 0 percent (3 entries) to 65 percent (‘Louise’); 14 entries had scores of 10 percent or less.

Protein average was 12.1 percent and ranged from 10.5 to 14.0 percent. All of the hard white spring wheat entries had acceptable protein levels of greater than 12 percent. Hard red spring wheat varieties did not reach the acceptable protein goal of 14 percent. ‘Cabernet’, the highest yielding entry, only had 11.4 percent protein. The trial was not fertilized for hard red spring wheat.

Table 2. Statewide variety testing program for winter wheat, Madras, Oregon, 2008.

Variety or line	Class[1]	Yield bu/acre	Test weight (lbs/bu)	Heading (doy)[2]	Height (in)	Lodging (%)	Protein (%)
Goetze (ORH010920)	SWW	142.8	59.5	152.7	31.3	0.0	10.2
ORF2 267-03	SWW	141.0	61.2	158.7	37.7	8.3	9.4
OR2040728	SWW	140.3	59.0	156.0	34.0	10.0	10.7
Tubbs-06/Rod Blend	SWW	139.5	60.4	164.0	39.3	38.3	10.2
ORCF-102	SWW	139.4	60.7	160.3	36.0	0.0	9.9
ID99-435	SWW	139.0	59.9	159.3	38.7	20.0	10.1
BU6W00-523	SWW	138.8	61.8	158.0	34.7	1.7	10.1
OR2040726	SWW	138.3	60.0	155.7	31.7	0.0	10.6
Tubbs-06	SWW	137.5	59.9	157.7	36.7	13.3	10.0
OSUPOP-35-2CL	SWW	136.5	60.4	157.3	36.0	20.0	10.1
Skiles (ORH010085)	SWW	135.9	61.7	162.0	34.0	11.7	10.7
OR2050293	SWW	135.5	59.6	156.7	33.3	11.7	10.6
Salute	SWW	134.5	59.4	157.0	34.7	0.0	10.4
OR2050299	SWW	133.6	59.7	159.3	36.3	10.0	10.9
Tubbs	SWW	132.6	59.7	161.3	37.7	1.7	10.0
OR9901619	SWW	132.5	60.6	165.3	40.3	28.3	10.3
OR2050301	SWW	132.2	58.3	157.7	36.7	73.3	10.6
ID9364901A	SWW	132.0	60.5	162.0	35.7	38.3	10.2
AP700CL	SWW	131.3	59.9	158.3	36.7	16.7	10.8
Idaho 587	SWW	129.5	59.6	154.0	33.3	25.0	11.1
OR2051126	SWW	129.3	57.0	158.7	34.7	23.3	9.9
IDO 0859	SWW	129.0	60.0	158.0	32.7	0.0	10.5
Westbred 528	SWW	128.9	61.5	152.7	35.3	41.7	10.7
Weatherford	SWW	128.3	61.1	165.3	37.0	13.3	10.7
ORSS-1757	SWW	125.9	60.3	162.0	36.7	10.0	9.3
ORCF-101	SWW	125.6	59.7	158.3	34.3	0.0	10.6
OR2050910	SWW	123.3	59.6	166.3	36.3	43.3	10.3
ORH010837	SWW	122.9	57.6	152.7	33.0	66.7	10.6
Cara	CLUB	122.7	60.6	164.7	36.7	0.0	10.7
Stephens	SWW	122.5	60.1	153.0	33.7	40.0	10.3
Masami	SWW	119.6	60.4	167.3	38.0	30.0	10.2
Legion	SWW	119.6	59.4	159.7	36.7	53.3	10.1
Gene	SWW	116.7	58.9	155.0	30.3	0.0	11.7
Madsen	SWW	116.6	60.1	166.7	34.7	13.3	10.5
Bitterroot	SWW	110.3	60.9	163.7	38.0	65.0	10.3
Xerpha	SWW	107.8	60.8	166.7	39.0	48.3	10.7
ORCF-103	SWW	107.7	60.1	165.0	38.7	68.3	9.6
OR2050914	SWW	104.9	59.2	166.3	37.0	65.0	10.4
Coda	CLUB	103.5	61.5	165.7	38.3	56.7	12.2
Mean		127.8	59.6	160.0	35.8	24.8	10.4
PLSD (0.05)		18.8	2.0	3.8	3.2	35.8	1.0
CV%		9.0	7.8	1.5	5.5	88.8	5.6

[1]SWW = soft white winter wheat, Club = club wheat, [2]DOY = day of year from January 1.

Table 3. Statewide variety testing program for spring wheat, Madras, Oregon, 2008.

Variety or line	Class[1]	Yield bu/acre	Test weight (lbs/bu)	Heading (doy)[2]	Height (in)	Lodging (%)	Protein (%)
Cabernet	HRS	142.7	61.0	175	32	2	11.4
RI10348W	HWS	137.8	60.8	171	33	0	12.3
Lassik	HRS	135.3	61.2	179	33	0	11.9
B02-0081	HRS	133.1	63.7	174	34	3	12.5
Merill	SWS	127.4	59.1	180	37	0	11.1
WA008039	SWS	125.5	60.9	176	38	30	10.6
Blanca Grande	HWS	123.0	62.1	170	32	8	13.2
BZ604-008	SWS	122.9	60.8	173	36	45	10.9
Alturas	SWS	121.6	60.7	176	37	13	10.5
OR4990114	HRS	119.9	61.3	174	36	13	12.0
Clear White	HWS	119.9	61.3	170	33	3	12.5
BZ601-002	SWS	119.0	60.2	174	38	30	11.4
Hank	HRS	118.8	60.1	175	36	2	13.1
IDO377S	HWS	117.5	61.8	176	37	7	12.3
RS150076R	HRS	112.1	58.9	174	31	5	12.3
OR4031111	HRS	110.9	59.8	177	39	17	12.0
Alpowa	SWS	109.8	61.0	178	36	36	12.7
77-154-98	SWS	109.6	56.3	182	37	30	10.9
RSI50603R	HRS	108.8	60.2	173	34	3	13.6
BZ901-717	HRS	105.1	61.5	172	40	17	14.0
Nick	SWS	104.5	60.8	172	37	25	11.6
Jefferson	HRS	103.2	61.6	176	38	43	12.4
WA008008	SWS	102.8	59.6	173	38	20	11.4
Patwin	HWS	101.4	58.3	180	31	5	13.7
WA007954	HRS	101.3	60.0	177	37	10	13.0
BZ903-445-WP	HWS	100.4	58.6	176	35	25	14.0
Louise	SWS	99.5	58.3	176	39	65	11.4
37C-3	HWS	93.4	59.1	180	34	3	12.4
OR4041451	SWS	91.5	58.6	181	42	23	11.2
Mean		114.4	60.3	175	36	17	12.1
LSD (0.05)		15.6	1.3	2.3	2.8	38	1.0
CV (%)		8.4	1.3	2.0	2.0	2.0	5.2

[1]HRS = hard red spring wheat, HWS = hard white spring wheat, SWS = soft white spring wheat.
[2]DOY= day of year from January 1.

Chemical Control of Clover Mite in Orchardgrass

Mylen Bohle, Glenn C. Fisher, Rich Affeldt, and Amy J. Dreves

Abstract

Clover mites have been a problem in central Oregon since 2000. The mites, which feed on grass pasture and hay fields, cause yield reductions, and total loss of fields can occur when the infestation is severe. No trials to date have found any product that will control the clover mite. Five treatments were applied in May of 2008 to test their efficacy on clover mites. None of the treatments had any effect on clover mites.

Introduction

Clover mites (CLM), *Bryobia praetiosa*, have been a problem in central Oregon grass pasture and hay fields since 2000. Localized infestations of this mite have injured orchard grass pastures in Deschutes, Jefferson, and Crook counties of Oregon. Populations build in late winter and spring, and the piercing and sucking action of the mites stunts and yellows spring regrowth. Occasionally entire crowns are killed. The mites feed on grass pasture and hay fields, causing yield reductions, and total loss of fields can occur when the infestation is severe. Previous field trials with registered miticides and insecticides have not identified effective products to control this pest. Additional products were evaluated for CLM control in an orchard grass hay field in late spring, 2008, in Central Oregon near Tumalo in Deschutes County.

Materials and Methods

This field trial was initiated on May 6, 2008 for control of CLM in an established orchardgrass hay field on the Steve Wheeler farm. The grass was beginning to break dormancy at this time. Plots measured 20 ft by 20 ft in a randomized complete block design, and were replicated four times. Five treatments were applied on May 6. Liquid products were delivered with a CO_2-powered backpack sprayer using flat fan nozzles (XR 11002). A hand-held boom covering a 10-ft swath was used to apply treatments. Spray pressure was set at 40 psi and delivered an equivalent 20 gal/acre of spray solution. A non-ionic surfactant, SuperSpread 7000, was added to all treatments. An untreated check was included.

Post-treatment evaluation of plots consisted of extracting four, 2.5- inch-diameter grass cores, randomly, to a depth of 2 inches, from each treatment replication on May 12, 2008 (6 days after treatment [DAT]). A 2.5-inch core instrument was used to extract the samples. Cores were placed in paper bags and transported in a cooler back to the Oregon State University lab, Corvallis for evaluation. Each sample of four cores was set under Berlese funnels with 25W bulbs for 4 days. Specimens dropped from samples into jars of 70 percent alcohol below the funnels. Mites were counted under a microscope and numbers were recorded. The mean number of CLM per core was calculated for each treatment.

Additional post-treatment grass core samples (3-, 2.5-inch cores) were collected from each treatment (as described above) on May 20 (14 DAT), May 20 (21 DAT), and June 2, 2008 (28

DAT). Data were subjected to analysis of variance (ANOVA) and means were separated using Tukey's Standardized Range Test at *P*-value = 0.05. All values were transformed using log transformation to equalize variance. Original means (± SEM) are presented in Table 1.

A visual damage rating value from 1 (serious pest injury) to 4 (no injury, healthy appearing grass) was applied to the grass stands in each plot on June 2, 2008. Grass damage ratings are presented in Table 2.

Results and Discussion

None of the treatments significantly reduced CLM numbers below those of the untreated check (UTC) at the first evaluation date (Table 1).

At 14 DAT, Bifenthrin was the only treatment with significantly fewer mites than the UTC. However, note that populations of CLM rapidly declined in all plots, including the UTC, by this sampling date. This phenomenon has been observed in previous trials at this time of year.

By 21 DAT, mites had declined to negligible levels in all plots, and plots with Bifenthrin and Acramite® had significantly fewer mites compared to the rest of the treatments.

At 28 DAT, mites continued to decline in the UTC and none of the treatments had significantly fewer mites than the UTC.

Table 1. Clover mite numbers (per 2.5-inch core) results from insecticides applied in May 2008 for the clover mite insecticide trial at the Steve Wheeler Farm, Tumalo, Oregon.

Treatment[1]	Rate	Mean (± SEM) no. of clover mites per 2.5-inch grass core [2, 3]			
		6 DAT 5/12/08	**14 DAT** 5/20/08	**21 DAT** 5/27/08	**28 DAT** 6/2/08
1. Untreated check	0 lb/acre	266.8 ± 30.8 a	109.4 ± 11.3 a	5.1 ± 1.0 a	2.0 ± 0.59 ab
2. Spiromesifen 2SC -low rate (Oberon)	8 fl oz/acre	208.0 ± 55.6 a	99.7 ± 26.4 ab	3.9 ± 0.49 a	3.2 ± 1.2 ab
3. Spiromesifen 2SC -high rate (Oberon)	12 fl oz/acre	150.0 ± 52.3 a	83.8 ± 9.3 ab	5.3 ± 1.1 a	2.5 ± 1.4 ab
4. B-cyfluthrin 1EC (Baythroid XL)	2.8 fl oz/acre	334.6 ± 46.8 a	118.0 ± 26.1 a	2.5 ± 0.74 a	5.8 ± 1.5 a
5. Bifenthrin 2EC (Brigade)	6.4 fl oz/acre	221.2 ± 42.7 a	43.3 ± 9.1 b	0.4 ± 0.08 b	0.7 ± 0.30 ab
6. Bifenazate 50WS (Acramite)	2 lb/acre	303.3 ± 37.3 a	55.6 ± 11.1 ab	0.4 ± 0.08 b	0.3 ± 0.08 b
	F-Test	2.14	4.33	26.50	3.26
	P value	< 0.1067	< 0.0092	< 0.0001	< 0.0285

[1] All treatments were applied on May 6, 2008.

[2] Each sample consisted of 3 or 4, 2.5-diameter grass cores placed under Berlese funnels in the laboratory. Specimens were extracted in EOH-filled jars.

[3] Counts were transformed using log and separated using Tukey's Standarized Range Test. Means with different letters are significantly different.

Differences in visual damage between plots were difficult to discern (Table 2). The treatments had no effect on economic response to numbers of mites, and we also believe that treatments were applied too late in the spring to have had any noticeable effect on plant injury.

Table 2. Mean visual damage rating of grass stands for each treatment.

Treatment	Mean visual damage rating value 1 (bad) to 4 (good)
1. Untreated check	2.63
2. Spiromesifen 2SC - low rate (Oberon)	2.63
3. Spiromesifen 2SC - high rate (Oberon)	2.25
4. B-cyfluthrin 1EC (Baythroid XL)	2.40
5. Bifenthrin 2EC (Brigade)	2.75
6. Bifenazate 50WS (Acramite)	2.50

The trial was to be repeated in October 2008 if mites were present in other grass pasture or hay fields. However, no clover mites were detected in fields infested the previous winter and spring. We plan to repeat this experiment with some of the same treatments as well as other treatments in spring 2009 if potential for damage from CLM is significant.

Evaluation of Pendimethalin (Prowl) Tank-Mixes on Roundup Ready Alfalfa

Richard Affeldt and Chuck Rice

Introduction

The non-selective herbicide glyphosate (Roundup PowerMAX®) can be used to selectively control weeds in Roundup Ready® alfalfa. Glyphosate has no soil residual activity and will only control weeds that have emerged at the time of application. Therefore, tank-mixing glyphosate with an herbicide that has soil residual activity to control multiple flushes of weeds may improve the utility of Roundup Ready technology.

Pendimethalin (Prowl H_2O®) is a soil-residual herbicide that inhibits cell division in emerging seedlings of susceptible species. Pendimethalin has recently been registered for use on alfalfa and could possibly reduce the number of glyphosate applications needed each growing season to control weeds in Roundup Ready alfalfa by providing residual control. The objective of this research was to evaluate weed control and alfalfa tolerance to pendimethalin when applied to Roundup Ready alfalfa.

Methods and Materials

Two field trials were conducted in commercial fields of Roundup Ready alfalfa; one near Culver, Oregon, and another near O'Neil, Oregon. The Culver trial consisted of 10- by 30-ft plots and the O'Neil trial consisted of 8.5- by 35-ft plots arranged in randomized complete blocks replicated four times. Herbicide treatments were applied on June 24, 2008 at Culver and on June 25, 2008 at O'Neil with a CO_2-pressurized backpack sprayer calibrated to deliver 20 gal/acre at 40 psi at the rates shown in Table 1. The Culver trial was irrigated with center pivot sprinklers and the O'Neil trial was irrigated with wheel-line sprinklers.

Crop injury and weed control were evaluated visually with a 0 to 100 percent rating scale. Alfalfa yield was determined by harvesting a 3.5-ft strip from the middle of each plot. Fresh weights were measured in the field and a 1.0-lb sample was taken from each plot and dried at 145°F and then re-weighed to quantify percent dry matter. Additionally, two 2.69-ft^2 quadrats were harvested from each plot and the alfalfa and weed species were separated by hand. Each separated component was then dried and weighed to quantify relative alfalfa and weed species composition on a dry matter basis.

Results and Discussion

At the time of the herbicide applications both fields had already had the first cutting of alfalfa harvested and one sprinkler irrigation since harvest. At Culver there was 2 inches of new growth and at O'Neil there was 1 inch of new growth on the alfalfa. At Culver some witchgrass (*Panicum capillare*), yellow foxtail (*Setaria pumila*), and horseweed (*Conyza canadensis*) emerged at the time of application. The horseweed had been cut from first alfalfa harvest and was regrowing. No flush of weed germination occurred between the second and third cutting of alfalfa at Culver. There was a very limited population of all weed species in the trial at O'Neil.

Pendimethalin and diuron applied alone resulted in very little crop injury (Table 1). At Culver, tank-mixes with imazamox (Raptor®), 2,4-DB (Butyrac 200®), or glyphosate (Roundup PowerMAX) with pendimethalin increased alfalfa injury; the injury was greatest with 2,4-DB tank-mixes. At O'Neil, only pendimethalin with 2,4-DB caused crop injury. Crop injury was greater at Culver probably because there was more alfalfa growth at the time of application. Alfalfa injury at Culver was still visible after the second alfalfa cutting. No treatment statistically reduced yield, but yields trended lower in tank-mixes with imazamox and glyphosate and this reduction might have been detected statistically with more than four replications in the trial. It was surprising that the tank-mix with glyphosate caused any injury on a Roundup Ready cultivar. We have no explanation for this. Unfortunately a treatment of glyphosate applied alone was not included in these trials; it may have been useful to quantify the overall tolerance of the Roundup Ready alfalfa cultivar.

Pendimethalin and diuron applied alone did not adequately control witchgrass, yellow foxtail, or horseweed at Culver. Most of the weeds had already emerged at the time of application and therefore control was not expected (Table 2). However, pendimethalin tank-mixed with glyphosate controlled all three weeds. As mentioned above, a treatment of glyphosate applied alone was not included and would have given a better indication of the usefulness of pendimethalin for residual weed control. Pendimethalin tank-mixed with imazamox controlled witchgrass and yellow foxtail but only suppressed horseweed. Based on weed control observed with pendimethalin applied alone, we conclude that pendimethalin did not contribute strongly to the observed weed control with glyphosate and imazamox tank-mixes.

Acknowledgements

We would like to thank Jeff Whitaker and Bonnie Craig for accommodating this research in their production alfalfa fields.

Table 1. Roundup Ready® alfalfa injury and yield following herbicide treatments near Culver and O'Neil, Oregon, 2008.

		Culver					O'Neal[4]			
Treatment[1]	Rate[2]	02/Jul/08 10-in ht	09/Jul/08 15-in ht	17/Jul/08 20-in ht	Yield[3]	07/Aug/08 8-in ht	02/Jul/08 10-in ht	10/Jul/08 14-in ht	22/Jul/08 e-bloom	Yield[3]
	lb/acre	------------ % injury		-----------	lb/acre	% injury	-------------- % injury		--------------	lb/acre
Check	---	0	0	0	2,237[5]	0	0	0	0	3,774
Pendimethalin	1.9	5	6	6	2,196[5]	0	3	1	3	3,623
Pendimethalin	3.8	6	5	6	---	5	5	4	0	---
Pendimethalin + imazamox[6]	1.9 + 0.39	9	13	6	1,989	3	6	6	5	3,645
Pendimethalin + 2,4-DB[7]	1.9 + 0.5	15	26	23	---	8	18	21	9	---
Pendimethalin + glyphosate[8]	1.9 + 0.77	13	14	11	1,957	1	1	0	1	3,911
Diuron	0.6	0	1	4	---	5	5	5	1	---
LSD (P = 0.05)	---	---	---	---	NS	---	---	---	---	NS

Applied 24/Jun/08 near Culver and 25/Jun/08 near O'Neil after first cutting. Pendimethalin = Prowl H_2O 3.8 CS. Imazamox = Raptor 1 L. 2,4-DB = Butyrac 200 2.0 L. Glyphosate = Roundup PowerMAX 4.5 L. Diuron = Karmex 80 DF.

[2]Pendimethalin and diuron rates are pounds active ingredient/acre. Imazamox, 2,4-DB, and glyphosate rates are pounds acid equivalent/acre.

[3]Alfalfa yield on a dry matter basis.

[4]No injury was observed at O'Neil on 19 August 2008 with 12 inches of growth after second cutting (data not shown).

[5]Alfalfa yield contained 2 percent weeds on a dry matter basis as determined by hand-separations. All other yields reported contained 0 percent weeds.

[6]Included Hasten methylated seed oil at 1.0 percent v/v and 32 percent urea ammonium nitrate at 2.5 percent v/v.

[7]Included R-11 non-ionic surfactant at 0.25 percent v/v.

[8]Included R-11 non-ionic surfactant at 0.25 percent v/v and 8-0-0 liquid ammonium sulfate at 4.5 percent v/v.

Table 2. Weed control following herbicide treatments in Roundup Ready® alfalfa near Culver, Oregon, 2008.

Treatment[1]	Rate[2]	02/Jul/08			09/Jul/08			17/Jul/08			07/Aug/08[3]		
		Witch-grass	Yellow foxtail	Horse-weed	Witch-grass	Yellow foxtail	Horse-weed	Witch-grass	Yellow foxtail	Horse-weed	Witch-grass	Yellow foxtail	Horse-weed
	lb/acre	% injury											
Pendimethalin	1.9	5	5	0	33	33	30	24	24	25	40	40	0
Pendimethalin	3.8	30	30	3	40	40	38	38	38	5	65	65	25
Pendimethalin + imazamox[4]	1.9 + 0.39	73	73	50	97	97	93	98	98	98	99	99	25
Pendimethalin + 2,4-DB[5]	1.9 + 0.5	18	18	13	33	33	95	44	44	93	38	33	45
Pendimethalin + glyphosate[6]	1.9 + 0.77	97	98	73	97	97	97	98	98	100	95	94	100
Diuron	0.6	28	28	0	23	23	8	23	23	25	28	28	0

[1]Applied 24 Jun3 2008.
[2]Pendimethalin and diuron rates are pounds active ingredient/acre. Imazamox, 2,4-DB, and glyphosate rates are pounds acid equivalent/acre.
[3]Ratings were made after second cutting.
[4]Included Hasten methylated seed oil at 1.0 percent v/v and 32 percent urea ammonium nitrate at 2.5 percent v/v.
[5]Included R-11 non-ionic surfactant at 0.25 percent v/v.
[6]Included R-11 non-ionic surfactant at 0.25 percent v/v and 8-0-0 liquid ammonium sulfate at 4.5 percent v/v.

Potato Variety Development—2008 Progress Report

Steven R. James, Brian Charlton, Darrin Culp, Erik Feibert, Dan Hane, Clint Shock, Isabel Vales, and Solomon Yilma

Abstract

Seed increases, single hill, and variety trials were conducted in 2008 at Central Oregon Agricultural Research Center (COARC) as a part of statewide, Tristate (Oregon, Washington, and Idaho) and western regional potato variety development programs. Seed of 651 selections was produced for 2009 statewide, Tristate, and regional trials. Also, 53,662 single-hill selections were grown; 466 were selected for further evaluation. Virus levels were very low in all 2008 seed production.

Advanced and preliminary statewide variety trials were grown at Powell Butte in 2008. AO96141-3, a high-yielding processing selection, has completed 3 years of regional testing and will be considered for release. Selections AO96305-3 and AO96365-2 will be advanced to 2009 regional trials while AO00057-2 will be evaluated another year in the Tristate trial.

Selections AO96160-3 and AO96164-1 were named and are slated for release in 2009. AO96160-3 is an attractive russet with high yields and can be used for fresh market or processing. The name 'Owyhee Russet' was chosen for this selection. AO96164-1 is also a high-yielding russet selection with outstanding processing characteristics. 'Sage Russet' was selected as the name for AO96164-1.

Introduction

A small program to develop new potato varieties for the Oregon potato industry was begun in the early 1970's at what was then called Central Oregon Experiment Station and Klamath Experiment Station. The program has evolved over the years in both the number of selections evaluated and the number of sites used for evaluation. Over 80,000 varieties and selections were evaluated in 2008 at five Oregon sites and one Washington site.

The primary emphasis of the potato variety development program is developing new potato varieties with improved yield, quality, grade, pest resistance, and nutritional quality. The overall objectives of the current program are as follows:

1) Develop efficient potato varieties for processing, chipping, traditional fresh market, and specialty enterprises. Focus on the needs of each production region in Oregon;
2) Identify and incorporate genetic resistance to various production concerns including pests, diseases, nematodes, and environmental stresses;
3) Develop production management guidelines for selections nearing release.

COARC is ideally located and equipped to accomplish these objectives in cooperation with other state and regional experiment stations. The research center has the capacity to screen thousands of new clones and produce high quality, disease-free seed of promising selections. This report discusses activities at COARC in 2008 for developing new potato varieties.

Materials and Methods

Seed Increases

The Powell Butte site of COARC is the major seed potato production site for cooperative regional, Tristate, and statewide potato variety trials.

Prior to planting, 4.3 pt/acre of Eptam® 7E were incorporated into the soil on May 16, 2008. An Iron Age assisted feed potato planter was used to band 864 lb/acre of 16-16-16-7 (NPKS) fertilizer at planting. Seed increases were planted from June 5 to June 17 (excluding weekends). One hundred twenty tuber units (six seed pieces each) of each regional, 60 tuber units of each Tristate and advanced statewide, 30 tuber units of each first-year statewide, and 15 tuber units of each preliminary selection were planted. Individual seed pieces were planted 9 inches apart within the row and tuber units were separated by 18 inches. Two rows were planted 36 inches apart and were bordered on either side by a blank row or a 10-ft alley for tractor access. The blank rows/tractor alleys provided space for sprinkler laterals, roguing, and spraying with minimal vine contact. At planting, 0.29 lb ai/acre of Admire® Pro was sprayed into the open furrow to control aphids and other sucking insects.

The seed increase blocks were rogued for potato virus Y (PVY), potato virus X (PVX), potato leaf roll virus (PLRV), and other bacterial and viral diseases each week during the growing season.

Weeds were sprayed on June 23 with a tank mix of 0.5 lb/acre of Sencor® DF and 1.0 oz/acre of Matrix®. The seed increase block was desiccated on September 5 and again on September 11, using 1.5 pt/acre of Reglone®. The seed increase block was harvested October 8, 9, and 13, 2008.

Single Hills and Early Generation Seed Increases

Approximately 53,660 seedling tubers (small tubers produced in greenhouses from true potato seed) were planted in 2008. These tubers were produced from genetic crosses made in Oregon, Washington, and Idaho. Parental germplasm was selected to produce progeny with russet skin and good internal quality, resistance to PVY, potato tuberworm, root knot and stubby root nematodes, late blight, and powdery scab. Individual tubers were planted 27 inches apart in 36-inch rows June 2-4, 2008. Fertilizer and herbicide application, and management practices were identical to those in the seed increases trials.

First and second field generation material for which less than five total tubers existed were planted in a combination selection/increase trial. Three hundred thirty-nine selections from seedling tubers grown at Powell Butte in 2007 and 35 selections from seedling tubers grown at Klamath Falls in 2007 were planted at Powell Butte on June 5. Approximately 18 seed pieces (3 tuber units of 6 pieces each) of each clone were planted in the same spatial arrangement as the regional and statewide seed increases. Each clone was separated by 'All Blue' potatoes, which were planted to reduce variety mixing at harvest. Fertilizer and weed control were the same as for regional and statewide increases.

The selection trials/increases were harvested on September 30, 2008 by lifting with a level bed potato digger. Selection was based on appearance, shape, malformations, skin color and type, and size and shape uniformity. Selections were bagged and all non-selected clones were left in the field.

Variety Trials

Two variety trials were grown at Powell Butte in 2008. Twenty-four varieties/selections were entered in the statewide variety trial and 78 varieties/selections were evaluated in a statewide preliminary variety trial (PYT2).

Prior to planting, 4.3 pt/acre of Eptam 7E were incorporated into the soil on May 16, 2008. The plots were planted May 22, 2008 and 864 lbs/acre of 16-16-16-7 (NPKS) fertilizer was banded to the sides and slightly below the seed pieces at planting time. On June 23, 2008, 0.38 lb ai/acre of metribuzin and 1 oz/acre of Matrix was applied as a tank-mix when plants were 4 to 5 inches high. The field was irrigated with 0.5 inch of water after the application.

The variety trials were arranged in randomized block designs; the statewide trial had four replications, the PYT2 trial two replications. Seed pieces were placed 9 inches apart in rows spaced 36 inches apart and each plot was separated by two hills of 'All Blue' potatoes. The individual plots in the statewide trial were 21 ft long (26 seed pieces) and the PYT2 plots were 18 ft long (22 seed pieces). The trials were sprinkler irrigated twice weekly according to demand.

Potato vines were desiccated with 1.5 pt/acre of Reglone on September 5 and September 11 and the vines were removed by flaming prior to harvest. The statewide trial was harvested on October 21, 2008 and graded the following day. The PYT2 trial was harvested on October 14; the PYT2 plots were graded October 16 and 20. For each plot, the total number of tubers was recorded and the total weight was recorded for each of six categories: under 4 oz, culls, twos, 4- to 6-oz U.S. number ones, 6- to 12-oz ones, and over 12-oz ones. A 10-lb sample from each plot was taken for french frying, specific gravity determination, and internal defect grading.

Specific gravities were determined by weighing approximately 10 lb of tubers in air and water. Ten tubers from each plot were sliced longitudinally and internal defects were scored as percent of tubers with a given defect. Ten tubers from each plot were stored for 2 months at 50°F for french frying. A 1-inch by 0.25-inch-thick strip from each tuber was fried for 4 min at 375°F. Each strip was evaluated for color and dark ends. Color was assessed using a photovolt reflectance unit and converted to USDA scores based on the "USDA Standard Color Chart for Frozen French-fried Potatoes".

Results and Discussion

Seed Increases

In 2008, 31 selections were increased for regional and Tristate trials and 621 selections were increased for Oregon trials. Of the 10,500 tuber units planted in 2008, 153 were diagnosed in the field with PVY (1.46 percent) and removed from production. About one-third of the total PVY was limited to four selections. The improvement in PVY infection was likely due to obtaining certified seed of several of the check varieties and improvements in sterilization at cutting.

Because of the large number of clones and the importation of material from other programs, it has been difficult to totally eliminate viral infection. Winter eye-indexing, ELISA testing during the growing season with field test kits, intensive roguing, and aphicide applications have kept viral infection relatively low as compared with the early days of the variety development program.

Single Hills and Early Generation Seed Increases

Over 53,660 seedling tubers from 511 genetic crosses were planted in 2008. These single-hill selections were dug on September 30 and evaluated by a team of potato researchers, breeders, and processors from several western states. The evaluation team retained 466 selections to be advanced to 2009 second field generation selection trials. The selections were based on visual criteria, such as relative yield, tuber size, shape, uniformity, and overall appearance. More intensive evaluations as well as pest resistance will be assessed in future years.

The 343 selections retained from the 2007 Powell Butte single-hills plus 35 specialty selections retained from single-hills grown at Klamath Falls in 2007 were planted at Powell Butte in 2008. Advancing to preliminary trials to be conducted in 2009 were 68 russet-type and 11 specialty selections. Many of the advancing selections have some type of pest resistance.

Statewide Variety Trial

The results of the statewide russet potato variety trial grown at Powell Butte are shown in Table 1. AO96141-3, a high-yielding processing selection, has completed 3 years of regional testing and will be considered for release. Selections AO96305-3 and AO96365-2 will be advanced to 2009 regional trials while AO00057-2 will be evaluated another year in the Tristate trial. Both AO96305-3 and AO96365-2 are attractive russets with uniform shape and size. These two selections have excellent internal quality and are suited for fresh market or processing. Additional retained selections include AO02183-2, AO01114-4, AO02060-3, AO02118-2, and OR04057-2. The decision to retain or discard individual clones was based on collective data from identical trials grown at five Oregon locations: Powell Butte, Hermiston, Klamath Falls, Ontario, and Corvallis.

Selections AO96160-3 and AO96164-1 were named and are slated for release in 2009. Variety trial testing for these two selections was completed in prior years. AO96160-3 is an attractive russet with high yields and can be used for fresh market or processing. The name ‘Owyhee Russet’ was chosen for this selection. AO96164-1 is also a high-yielding russet selection with outstanding processing characteristics. ‘Sage Russet’ was selected as the name for AO96164-1.

Preliminary Yield Trial (PYT2)

The retained selections from the PYT2 potato variety trial grown at Powell Butte are shown in Table 2. The trial contained a total of 78 entries but only 9 were advanced to the 2009 statewide variety trial. Selections OR05078-1 and OR05081-1 have resistance to potato tuberworm, while retained selection POR06V12-3 has resistance to PVY. The decision to retain or discard individual clones was based on collective data from identical trials grown at four Oregon locations: Powell Butte, Hermiston, Klamath Falls, and Ontario.

Table 1. 2008 statewide russet potato variety trial grown at Powell Butte, Oregon.

Selection	Yield Total	Yield No. 1	% No. 1	Tuber size	L/W ratio	Spec. grav.	Fry color	Sugar ends	HH/ BC	Black spot	Vine mature
	cwt/a	cwt/a	%	oz			USDA	%	%	%	5=Late
R Burbank	414	248	60	4.5	1.93	1.084	1.39	0	0	0	3.5
Ranger	368	292	79	6.7	1.94	1.086	0.77	0	0	0	3.0
Norkotah	466	369	79	6.8	1.85	1.076	1.84	0	3	0	2.0
AO96141-3	419	335	80	7.1	2.08	1.096	0.00	0	0	3	3.5
AO96305-3	340	278	82	6.1	1.99	1.087	0.00	0	0	0	3.0
AO96365-2	410	306	75	6.7	1.53	1.080	0.48	0	0	0	3.0
AO98282-5	378	266	70	5.9	1.88	1.094	0.00	0	3	5	4.0
AO00057-2	351	260	74	8.3	1.64	1.085	0.00	0	3	0	3.0
AO01057-5	435	361	83	7.3	1.58	1.078	1.45	0	0	0	2.0
AO02019-3	349	267	77	7.9	1.99	1.083	0.95	3	0	0	4.0
AO02182-1	370	274	74	7.9	1.82	1.072	1.38	0	0	0	3.5
AO02183-2	407	289	71	5.1	1.98	1.082	0.00	0	0	0	3.0
AO01114-4	367	286	78	5.8	1.73	1.093	1.53	3	0	3	3.5
AO02060-3	411	334	81	7.5	1.82	1.083	0.25	0	0	0	3.5
AO02118-2	361	306	85	6.8	1.56	1.075	0.00	0	0	0	3.0
AO03003-3	419	277	66	4.9	1.91	1.079	0.00	0	0	3	2.0
AO03096-5	427	317	74	5.4	1.82	1.098	0.57	0	0	0	4.0
OR03085-5	378	266	70	6.1	1.49	1.085	0.41	0	0	3	3.0
OR03151-4	410	254	62	5.1	1.59	1.082	1.21	3	0	5	4.0
OR04018-5	311	246	79	7.7	1.94	1.085	0.00	0	0	0	3.5
OR04057-2	392	226	58	5.2	1.83	1.081	0.00	0	0	3	3.0
OR04062-1	340	251	74	5.4	1.60	1.087	0.46	0	0	0	3.0
POR05V016-2	391	311	80	6.6	1.69	1.078	0.42	0	0	0	3.0

Table 2. Retained selections from the 2008 preliminary-2 russet potato variety trial grown at Powell Butte, Oregon.

Selection	Yield Total	Yield No. 1	% No. 1	Tuber size	L/W ratio	Spec. grav.	Fry color	Sugar ends	HH/ BC	Black spot	Vine mature
	cwt/a	cwt/a	%	oz			USDA	%	%	%	5=Late
R Burbank	367	191	52	3.9	1.93	1.086	1.21	5	0	0	3.5
Ranger	349	261	75	7.1	1.88	1.091	0.00	0	0	5	3.0
Norkotah	318	246	77	5.5	1.90	1.074	0.90	0	10	0	2.0
AO99135-3	338	275	81	7.6	1.73	1.084	0.49	0	0	0	3.5
AO99152-1	389	304	78	6.3	1.89	1.095	1.27	0	0	0	3.0
AO00131-1	384	292	76	5.6	1.67	1.090	1.19	5	0	10	4.0
AO03087-4	379	317	84	7.0	1.72	1.090	0.00	0	0	10	4.0
AO03420-1	269	129	48	5.0	1.58	1.092	0.67	0	0	0	3.5
OR05039-4	391	350	89	7.4	1.91	1.084	0.56	0	0	0	3.5
OR05078-1	421	312	74	5.3	1.18	1.078	0.00	0	10	0	3.5
OR05081-1	416	329	79	5.5	1.23	1.082	0.08	0	35	0	3.0
POR06V12-3	434	309	71	5.1	1.86	1.102	0.30	0	0	5	3.5

Weed Control in Sugarbeet Grown for Seed

Richard Affeldt and Gordon Fellows

Introduction

Sugarbeet must go through a vernalization period in order to flower. When sugarbeet is grown for seed in central Oregon, seed is planted from late July to early August and is then harvested the following August. Also, when seed production fields are planted, a blank row is left between male sterile and pollinator lines. The combination of a long cropping season and the amount of open soil surface that is left for hybrid seed production creates a long period of time for weeds to successfully proliferate. Summer-annual weeds that emerge around the time of sugarbeet flowering can be especially difficult to control because once sugarbeets bolt and initiate flowering, no more cultivation can be done.

Soil-residual herbicides applied shortly before or after the last cultivation could reduce summer-annual weed infestations that tend to interfere with harvest. The objective of this research was to evaluate dimethenamid-P (Outlook®), pendimethalin (Prowl®), and ethofumesate (Nortron®) for sugarbeet tolerance and control of summer-annual weeds.

Methods and Materials

Two field trials were conducted in commercial fields of sugarbeet grown for seed, one near Metolius, Oregon and the other near Madras, Oregon. Both trials consisted of 10-ft by 30-ft plots arranged in randomized complete blocks replicated four times. Herbicides were applied on April 16, 2008 at both locations with a CO_2-pressurized backpack sprayer delivering 20 gal/acre at 40 psi. Herbicide rates and tank-mixes are shown in Table 1. The trial at Madras was furrow irrigated and the trial at Metolius was sprinkler irrigated with wheel-lines. Crop injury and weed control were evaluated visually with a 0 to 100 percent rating scale.

Results and Discussion

All three of the herbicides tested require some sort of incorporation with water or tillage to work well according to the labels. In both fields, herbicide treatments were applied prior to cultivation and the first irrigation of the spring. Sugarbeets appeared to be dormant on April 16 at the time of application. Sugarbeets at Madras received the first spring irrigation on May 12, 2008, and at Metolius on May 15, 2008.

None of the herbicide treatments resulted in any visual injury at either location (data not shown). Only the trial at Madras had a population of weeds that emerged after the herbicide application (Table 1). Control of redroot pigweed (*Amaranthus retroflexus*) was best with dimethenamid-P plus ethofumesate. Control of redroot pigweed was poorest with pendimethalin plus ethofumesate. Overall, summer-annual weeds were not large problems in either of these fields, but all three of the herbicide tank-mixes we evaluated improved control of the summer-annual redroot pigweed compared to the check.

Acknowledgements

We would like to thank Stan Sullivan and Bob Vanek for accommodating these trials in their production fields.

Table 1. Redroot pigweed control with herbicides in sugarbeet grown for seed near Madras, Oregon, 2007-2008.

Treatment[1]	Rate	Redroot pigweed
	lb/acre	% control 9/Jul/08
Dimethenamid-P + pendimethalin	0.84 + 0.475	72
Dimethenamid-P + ethofumesate	0.84 + 1.88	90
Pendimethalin + ethofumesate	0.475 + 1.88	53

[1] Treatments were applied 16 April 2008 prior to final cultivation and first spring irrigation. Dimethenamid-P = Outlook 6 EC. Pendimethalin = Prowl H_2O 3.8 CS. Ethofumesate = Nortron 4 SC.

Strategy for Restoring Central Oregon Rangeland from Medusahead to a Sustainable Bunchgrass Environment, 2007-2008

Marvin Butler, Dan Comingore, Floyd Paye, Dan Ball, and Linda Samsel

Abstract

Annual grassy weeds medusahead (*Taeniatherum caput-medusae*) and cheatgrass (*Bromus tectorum*) are capable of crowding out bunchgrasses, leaving rangelands with little feed for cattle and more prone to devastating fires and soil erosion. Two sets of plots were established at two locations, one where bunchgrasses remained despite significant populations of medusahead and a second where few bunchgrasses were present. Herbicide treatments only were applied to the first, with herbicide applications followed by planting of six bunchgrass species to the second. Herbicide only applications controlled medusahead, and without this competition bunchgrass size increased. Inadequate moisture following two late herbicide applications and planting resulted in poor performance of these products and plant establishment at the second set of plots.

Introduction

Medusahead (*Taeniatherum caput-medusae*) is a Category B noxious weed on the Jefferson County Weed Control List for containment. It is predominant on millions of acres of semi-arid rangeland in the Pacific Northwest. It is extremely competitive and crowds out all other vegetation on infested rangeland, including such undesirable species as cheatgrass or downy brome (*Bromus tectorum*). Medusahead and cheatgrass often out-compete bunch grasses that stabilize the soil and provide feed for cattle and other herbivores. Medusahead and cheatgrass dramatically increase the fuel load, creating hotter, more destructive range and forest fires. They also allow soil structure to deteriorate, setting the stage for increased soil erosion.

Rangeland restoration research in the Great Basin indicates that it is extremely difficult to go directly from medusahead and cheatgrass domination to establishment of native species. However, species like crested wheatgrass (*Agropyron cristatum*) are able to get established and create a bunchgrass system where native grass can be successfully reintroduced over time.

Plots were established at two locations on the Big Cove Ranch near South Junction north of Madras, Oregon. Each location included two sites, one where bunchgrasses were still present despite high populations of medusahead, and a second nearby location where few to no bunchgrasses remained due to domination by medusahead. Herbicide application only where adequate bunchgrasses remained is thought to increase vigor and give bunchgrass the competitive edge. Herbicide applications followed by planting of six bunchgrasses where there were minimal bunchgrasses will provide an opportunity to evaluate methodology to reestablish a bunchgrass environment.

Methods and Materials

During the fall of 2007 small plots were established at two locations where bunchgrasses remained. The herbicides Plateau® (imazapic), Journey® (imazaic + glyphosate), Matrix® (rimsulfuron), and Landmark® (sulfometuron + chlorsulfuron) were applied to 10-ft by 25-ft plots replicated four times. Plateau and Journey were applied October 13 and Matrix and Landmark were applied November 21, 2007. Application equipment was a CO_2-pressurized hand-held boom sprayer outfitted with TeeJet 8002 nozzles on a 9-ft boom operated at 40 psi and applying 20 gal water /acre.

The four herbicides were also applied where minimal bunchgrasses remained in single large plots 40 ft by 480 ft or 20 ft by 180 ft, depending on location. Applications were made using a 4-wheeler outfitted with a single Floodjet nozzle with an application width of 20 ft. Plateau and Journey were applied October 12 and Matrix and Landmark were applied December 28, 2007.

Perpendicular to the large herbicide plots, six species of bunchgrasses were planted on December 12 in 10-ft or 20-ft-wide plots replicated 3 or 4 times, depending on location. Seeding rate was 15 lb/acre using a 10-ft-wide Truax Rough Rider Rangeland drill planting 10 rows on 12-inch centers. Bunchgrasses included crested wheatgrass, intermediate wheatgrass (*Agropyron intermedium*), bluebunch wheatgrass (*Pseudoroegneria spicata*), Sandberg's bluegrass (*Poa sandbergii*), Sherman big bluegrass (*Poa secunda*), and smooth brome (*Bromus inermis*).

Germination of bunchgrasses was informally evaluated in April and June. Plots were evaluated for herbicide efficacy on September 19, 2008. Plant height of established crested wheatgrass and intermediate wheatgrass at the meadow location was evaluated on September 30, 2008.

Results and Discussion

All four herbicides applied to control medusahead and give the competitive edge to established intermediate wheatgrass or crested wheatgrass provided 100 percent control at the meadow location (Table 1). At the bench location, Plateau and Journey provided 100 percent control, while Matrix provided 98 percent and Landmark 68 percent control.

The large strip plots treated with Plateau and Journey resulted in 100 percent control at both locations (Table 2). The Matrix and Journey applications provided inadequate control at both locations. These two treatments were not applied until December 28. Inadequate moisture until April is thought to be the cause of their poor performance. The same herbicides applied on November 21 to the small plots performed at or nearer expectation. The lighter soil at the bench location combined with lack of precipitation negatively affected both the large and small plot performance compared to the heavier soil at the meadow location.

Both intermediate wheatgrass in the small plots and the crested wheat in the large plots at the meadow location had significantly increased growth following herbicide applications compared to the untreated plot. The best growth followed application of Journey, followed by Plateau, then Matrix and Landmark.

Establishment of the six bunchgrasses was inadequate at both locations due to lack of moisture. Germination was poor by mid-May; rain in late May and early June resulted in additional but inadequate germination. The best performers under these conditions were crested wheatgrass, followed by intermediate wheatgrass and bluebunch wheatgrass.

Table 1. Herbicide applications to small plots for control of medusahead on the Cove Ranch north of Madras, Oregon, 2007-2008.

		Meadow location		Bench location
Treatments[1]	Product /acre	Medusahead control (%)	Interm.wheatgrass height (inch)	Medusahead control (%)
Plateau	6 oz	100	19.6	100
Journey	1 pt	100	20.2	100
Matrix[2]	4 oz	100	17.4	98
Landmark[2]	0.75 oz	100	18.7	68
Untreated	-----	0		0

[1]Plateau = imazapic 2 lb ae/gal, Journey = imazapic 0.75 lb ae/gal + glyphosate 1.5 lb ae/gal, Matrix = rimsulfuron 25 percent, Landmark = sulfometuron 50 percent + chlorsulfuron 25 percent.
[2]Treatment included a silicon surfactant at 0.25 percent v/v.

Table 2. Herbicide applications to large plots for control of medusahead on the Cove Ranch north of Madras, Oregon 2007-2008.

		Meadow location		Bench location
Treatments[1]	Product /acre	Medusahead control (%)	Crested wheatgrass height (inch)	Medusahead control (%)
Plateau	6 oz	100	15.7	100
Journey	1 pt	100	17.6	100
Matrix[2]	4 oz	70	15.6	40
Landmark[2]	0.75 oz	20	14.2	0
Untreated	-----	0	12.6	0

[1]Plateau = imazapic 2 lb ae/gal, Journey = imazapic 0.75 lb ae/gal + glyphosate 1.5 lb ae/gal, Matrix = rimsulfuron 25 percent, Landmark = sulfometuron 50 percent + chlorsulfuron 25 percent.
[2]Treatment included a silicon surfactant at 0.25 percent v/v.