Introduction

The Central Oregon Agricultural Research Center (COARC) faculty and staff are pleased to present a summary of research activities conducted during 2013. The twenty-nine reports in this publication focus on grass seed (7), vegetable seed (4), potatoes and peppermint (4), forages and cereals (2), rangeland (8) community projects (3) and weather data for 2013 (1). We invite you to look through the report, read a few abstracts and perhaps read entire reports on topics of particular interest.

Beginning in 2011, COARC and the central Oregon agricultural community implemented a collective response to the OSU College of Agricultural Sciences Dean's challenge to local beneficiaries of the branch experimental stations around the state to provide 25 percent of the current base budget. Local growers and industry representatives, recognizing the economic value provided by COARC, developed a multi-faceted plan for voluntary contributions to support the station.

Growers across the three counties of central Oregon are being asked to voluntarily contribute \$1/irrigated acre for non-contracted crops. Suggested grower contributions of \$10/acre for carrots, parsley and onions, and \$3/acre for grass seed have been accepted by the large majority of growers in Jefferson County. In addition, there have been annual contributions based on \$4/acre of wheat burned, and seed contractors and agricultural dealers are also committed to providing meaningful annual contributions.

We are humbled and gratified by the level of support COARC has received across central Oregon. This places a high level of responsibility on COARC to meet the needs of local agriculture and ensure we are working to add value to your operation or business, and to the local community.

Your collective support sends the College of Agriculture a strong message that COARC is a valued partner in the local agricultural community. This also gives the college incentive to continue to invest in COARC, and is the reason COARC is often cited around the state as an example of strong local support.

Transfer of funding from the COARC Support Fund at the OSU Foundation to the COARC budget is under the control of local grower representatives. Specific transfers of dollars must be formally requested by the COARC Director, discussed by the COARC Advisory Council and a recommendation made to the committee of six. The intent is to maintain a pool of funds without allowing it to grow beyond a comfortable cushion to meet expected needs.

Each year, the COARC Advisory Council meets with individual researchers to review their projects from the previous year and preview those they are planning for the coming year. We are inviting each person who donated to the COARC Support Fund to provide their input as well. If you are a COARC Supporter, you are receiving a questionnaire seeking your input to be shared with the Advisory Council and COARC faculty and staff. Be assured your thoughts will be taken seriously as we work to continually earn your respect and support.

COARC's economic impact upon the local agricultural community is seen through applied research, product registrations, educational programs and services, and new crop evaluation. COARC is proactive about addressing agricultural issues in the region, and providing an incentive for growers to support our research and educational activities.

A recent example is ongoing research being conducted on the movement of nitrogen fertilizer in the soil and Kentucky bluegrass grown for seed. Essentially all the nitrogen applied was recovered one and two years later either in the plant or top two feet of soil A similar project was initiated on winter wheat during the fall of 2013.

A companion research project determined the amount of ammonia volatilization that occurs with urea-based fertilizers under central Oregon conditions. Losses in the 25 percent range, or 40 pounds nitrogen per acre, are common when urea is applied to bluegrass seed fields following the last irrigation in mid-October. What is being learned from these projects is changing the way agricultural dealers and growers are doing business related to fertilizer handling and crop nutrition.

A second example is the initiation of an alfalfa variety evaluation in August, 2011 that includes both conventional and Roundup Ready cultivars. For the first time, this four-year project will provide independent feed value testing (ADF, NDF) for each of the four cuttings, in addition to the protein and yield data provided in the past. We have been successful at making the results available in near real time to assist in your management decisions. This research is being funded by entry fees from the seed companies, at no cost to local alfalfa growers.

I look forward to hearing your thoughts, answering any questions, discussing your concerns, or sharing ideas on how to collectively increase COARC's positive economic impact on the central Oregon agricultural community. Feel free to give me a call at 541-475-7107.

Marvin Butler, Director
Central Oregon Agricultural Research Center

Note: Any reference to a product or company is for specific information only and does not endorse or recommend that product or company to the exclusion of others that may be suitable. Nor should information and interpretation thereof be considered as recommendations for application of any pesticide. Pesticide labels should always be consulted before any pesticide use.

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Effect of Nitrogen Source and Timing on Kentucky Bluegrass Seed Yield in Central Oregon, 2012-2013

Marvin Butler, Rhonda Simmons, Neil Christensen and Don Horneck

Abstract

Kentucky bluegrass seed growers in central Oregon surface-apply nitrogen fertilizer in early to mid-October after the final irrigation of the season. This research measured the impact of nitrogen sources and timing on seed yield in commercial fields. Urea, urea coated with Agrotain at 3 lbs/ton, and ammonium nitrate were applied at 150 lbs N/acre prior to, or after, the final irrigation in the fall. Data analyses revealed that there were no statistically significant differences in seed yield among nitrogen fertilizer sources or timing of nitrogen fertilizer application. The significance of, and possible explanations for, these results are discussed.

Introduction

Kentucky bluegrass seed growers in central Oregon surface-apply nitrogen (N) fertilizer in autumn after the irrigation season, to provide the majority of N for the coming growing season. Historically, concern over too much regrowth in the fall influenced growers to delay fertilization until growth rate slowed. Delayed application of urea means that growers depend on precipitation to incorporate N fertilizer. Under these conditions there is potential volatilization loss of N as ammonia (NH_3) with urea-based fertilizers, particularly when there is little or no precipitation over weeks or months following N application.

The objective of this project was to evaluate whether seed yield was affected by different N sources applied before or after the final irrigation in early to mid-October.

Methods and Materials

Trials were conducted in three second-year commercial Kentucky bluegrass fields of cultivar Gladstone (Field 1), Crest (Field 2), and Merit (Field 3) grown for seed. Nitrogen source variables included urea, urea coated with Agrotain at 3 lbs/ton, and ammonium nitrate, all applied at 150 lb N/acre. Each nitrogen source was applied either prior to, or three weeks after, the last irrigation in the fall. Pre-irrigation fertilizer was applied on October 4, 2012 for Field 1 and October 10 for Fields 2 and 3. Post-irrigation fertilizer was applied on November 6 for Field 1 and on November 5 for Fields 2 and 3.

Plots at each location were 6 ft by 25 ft, with N Source X Timing treatments replicated four times in a randomized complete block design. Plots were covered with tarps to exclude commercial fall fertilizer application. Otherwise, plots were managed by the grower cooperators similar to the rest of the field. Irrigation at Field 1 is by furrow, while Field 2 and 3 are under center pivot. Plots were swathed at Field 1 using a Jeri mower due to corrugates for furrow irrigation, while a small-plot, forage harvester was used for Field 2 and 3. Plots were harvested on July 5, 2013 for Field 1 and 2, and July 8 for Field 3. Samples were bagged and hung to dry until threshing with a stationery Wintersteiger plot combine. Seed samples were cleaned using a debearder and small scale Clipper cleaner at the USDA-ARS Seed Conditioning lab in Corvallis to determine clean seed weight.

Results and Discussion

Statistical analysis of combined data revealed that while seed yield was increased significantly by N fertilization, and differed significantly across locations, there were no significant differences among N fertilizer sources or between pre- and post-irrigation N application (Table 1). Seed yield differences among fields were likely caused by differences in the varieties being grown and/or differences in site potential. Positive responses to N fertilizer applied at 150 lb N/acre were measured at all locations (Table 2). Nitrogen fertilizer increased seed yield by 141 lb/acre (21%) at Field 3, 156 lb/acre (50%) at Field 1, and 550 lb/acre (241%) at Field 2. Differences in magnitude of seed yield response to N across locations are likely attributable to differences in yield potential and/or the capacity of soils to supply N to plants.

Absence of significant differences among N fertilizer sources or between N application times would be expected if either (1) volatilization losses of NH_3 were minimal, or (2) the rate of N fertilizer applied was greater than rate needed to maximize seed yield. Data collected in this study are not sufficient to distinguish between these two possibilities. However, data from an earlier study with ^{15}N-labeled urea fertilizer showed that 93 to 100% of fall-applied N fertilizer could be accounted for in above-ground biomass and soil in the spring (COARC unpublished data). This suggests that perhaps NH_3 volatilization losses may not be as great under central Oregon conditions as in other areas of the state.

Although results across the three locations from this one year of data suggest that N source and timing do not significantly affect seed yield, there may continue to be concern about excessive regrowth following early fall fertilizer application. However, many of the newer varieties being grown produce less biomass and excessive regrowth may be less of a problem than it has been in the past. A review of temperatures during the fall of 2012 indicates they were similar to or slightly above the five year average. These weather conditions would not be expected to significantly change fall regrowth from the norm for recent years.

Table 1. Kentucky bluegrass seed yield as influenced by N fertilizer Source and Timing across three locations near Madras, Oregon, 2013.

Variable	Seed yield (lbs/acre)
N Fertilizer Source	
Unfertilized control	408 a[1]
Urea@ 150 lb N/acre	688 b
Agrotain-coated Urea @ 150 lb N/acre	683 b
Ammonium Nitrate@ 150 lb N/acre	701 b
N Fertilizer Timing	
Pre-Irrigation(October 4 or 10, 2012)	700 ns[2]
Post-Irrigation(November 4 or 5, 2012)	681 ns
Location	
Field 1	443 a[3]
Field 2	600 b
Field 3	808 c

LSD(P = 0.05) [1]41, [2]NS, [3]92

Table 2. Kentucky bluegrass seed yields at three sites near Madras, Oregon where three N fertilizer sources were applied at 150 lb N/acre prior to or after the final fall irrigation in 2012.

N Fertilizer Source/Timing	Field 1	Field 2	Field 3
	------------------- Seed yield (lbs/acre)	--------------------	
Unfertilized control	309 c	228 b	687 c
Pre-Irrigation			
Urea	447 ab	727 a	917 a
Agrotain-coated Urea	492 ab	784 a	780 bc
Ammonium Nitrate	527 a	768 a	850 b
Post-Irrigation			
Urea	429 ab	811 a	793 abc
Agrotain-coated Urea	410 bc	827 a	806 abc
Ammonium Nitrate	487 ab	753 a	821 abc
LSD (P = 0.05)	113	161	135

Volunteer Wheat Control in Newly Seeded Kentucky Bluegrass Grown for Seed

Gustavo Sbatella and Sasha Twelker

Abstract

Wheat seeds lost before or during harvest can become the source of volunteer plants in the following crop. Volunteer wheat plants compete for resources with the crop similarly to other weeds. In spring of 2012, a field study was initiated in central Oregon to evaluate volunteer wheat control with herbicides with grass activity in newly established Kentucky bluegrass. Treatments included ethofumasate, mesotrione, and primisulfuron applied at different timings and rates. High levels of volunteer wheat control were recorded with ethofumasate and primisulfuron but were associated with high levels of crop injury resulting in significant reduction of grass seed yield. The marginal volunteer wheat control with mesotrione, combined with a low level of crop injury resulted in the highest crop yield among the tested treatments.

Introduction

Crop rotation in central Oregon often involves planting perennial grass for seed in August following wheat harvest. Wheat grain losses occur before and during harvest. As a result, wheat seeds remain in the soil and become the source of volunteer plants in the next crop. Volunteer wheat plants then compete with the perennial grass crop for light, nutrients and water, similar to other weeds, affecting yields, quality and even compromising new stands. Control of annual grasses growing in competition with perennial grasses is difficult due to morphological and physiological similarities, drastically limiting herbicide control options. Management options are further restricted due to the limited alternatives available for grass control in perennial grass seedlings. These management complexities and the resulting crop losses make the control efficacy of volunteer wheat and potential crop injury of currently labeled options a high priority.

Materials and Methods

A field study was conducted in September, 2012 on a newly planted Kentucky bluegrass field at the Central Oregon Agricultural Research Center located in Madras, Oregon. The study design was a randomized complete block with four replications, with a plot size of 10 ft by 30 ft. The treatments consisted of ethofumasate (Nortron®), mesotrione (Callisto®), and primisulfuron (Beacon®). Ethofumasate and mesotrione were applied pre-emergence and early post, while primisulfuron was applied early post and in two post emergence sequential applications. Herbicides were applied with a backpack sprayer calibrated to deliver 20 gallons of spray solution per acre at 40 psi pressure using XR 8002 Teejet® nozzles. Application dates and environmental conditions for each study are detailed in Table 1.Herbicide rates and adjuvants are detailed in Table 2. Herbicide efficacy and crop injury were evaluated in spring of 2013.Plots were harvested in 2013 to determine the impacts of each treatment on grass seed yield.

Results and Discussion

Volunteer wheat control and crop injury differed between treatments and time of application (Table 2). For instance, control with ethofumasate applied at pre-emergence was excellent (98 percent) but crop injury was significant (38 percent). Kentucky bluegrass injury was reduced to 18 percent when ethofumasate was applied early post emergence, but only 10 percent of volunteer wheat was controlled. The application of mesotrione at pre-emergence resulted in only 5 percent control of volunteer wheat with a crop injury of 3 percent. Control with mesotrione improved to 68 and 59 when applied early post at rates of 3 and 6 fl oz/acre, and no crop injury was observed for this treatment in spring. Primisulfuron applied at 0.76 oz/acre, or in sequential applications of 0.38 oz/acre each, provided 97 and 92 percent volunteer wheat control respectively. Nevertheless, a high level of crop injury was observed with this treatment in spring. Ethofumasate and primisulfuron treatments provided high levels of volunteer wheat control but were associated with elevated crop injury that resulted in lower seed yield (Table 2). Mesotrione at 3 or 6 oz/acre provided partial volunteer wheat control (68 and 59 percent) but combined with a low crop injury resulted in seed yields of 167 and 155 lb/acre, the highest among all treatments. Results from this study indicate that volunteer wheat control in newly established stands of Kentucky bluegrass with labeled herbicide is difficult because the most effective treatments cause unacceptable levels of crop injury ,while control with the safest products are not commercially acceptable. The levels of control and crop injury observed with the use herbicides emphasizes the need to implement an integral control program that includes cultural practices that ensure vigorous stands of Kentucky bluegrass, and reduction of wheat seed losses during harvest. The current study will be repeated in 2014, to confirm initial findings and explore other potential options.

Acknowledgments

The authors would like to thank TimVanDomelen for his collaboration on this project.

Table 1.Application date and environmental conditions for the herbicide applications.

Application timing	A	B	C
Application Date	9/28	11/2	11/22
Time of Day	9 AM	10 AM	11:00 AM
Air temperature (F)	68	42	44
Relative Humidity (%)	31	80	56
Wind Speed (MPH)	2	2	5
Wind Direction	SSE	NW	NE

Table 2. Percent volunteer wheat control, crop injury and Kentucky bluegrass seed yield.

No.	Name[1]	Rate	Unit	Code[2]	Control[3] Percent		Injury Percent		Yield lb/acre	
1	Nortron	3	pt/acre	A	98	a	38	b	91	bc
2	Nortron	3	pt/acre	B	10	c	18	c	34	c
3	Callisto	6	fl oz/acre	A	5	c	3	c	86	bc
4	Callisto	3	fl oz/acre	B	68	b	0	c	167	a
	COC	1	% v/v	B						
	Ammonium Sulfate	8.5	lb/100 gal	B						
5	Callisto	6	fl oz/acre	B	59	b	0	c	155	ab
	COC	1	% v/v	B						
	Ammonium Sulfate	8.5	lb/100 gal	B						
6	Beacon	0.38	oz wt/acre	B	97	a	60	a	42	c
	COC	1	% v/v	B						
	Beacon	0.38	oz. wt/acre	C						
	COC	1	% v/v	C						
7	Beacon	0.76	oz. wt/acre	B	92	a	40	b	88	bc
	COC	1	% v/v	B						
8	Untreated Check				0	c	0	c	67	c
	LSD (P=.05)				15		16		55	

[1]Before using an herbicide, make certain is it properly labeled for the intended use.
[2]Abbreviations: Crop Oil Concentrate, COC; A= pre-emergence; B= early Post emergence; C=20 days after B
[3]Means among columns followed by the same letter are not different at P=0.05.

Medusahead (*Taeniatherum caput-medusae*) Control with Applications of Post-emergence Herbicides Labeled in Kentucky Bluegrass applied in spring

Gustavo Sbatella and Sasha Twelker

Abstract

Reports indicate that medusahead is present in Kentucky bluegrass seed production fields in central Oregon. An integral approach to control medusahead should include the possibility of using post emergence herbicides to control emerged medusahead plants. A field study was conducted at the Central Oregon Research Center (COARC) located in Madras, Oregon, to evaluate the efficacy of post emergence herbicides currently labeled for use in established stands of Kentucky bluegrass for medusahead control. Herbicides were applied in April, 2013 to medusahead plants with 2 true leaves fully expanded. Herbicides tested included: Beacon®, Sencor 75DF, dicamba, Axiom®, Everest®, and Callisto®. Evaluations performed 30 days after treatment showed none of the tested herbicides provided acceptable levels of medusahead control. The implementation of an integral approach for medusahead control is necessary to overcome the limitation of not having effective post emergence herbicides as an option for control.

Introduction

Because of their morphological and physiological similarities, it is difficult to control annual grasses within a field of perennial grasses. The persistence of annual grass infestations results in a perpetual loss of yield. Medusahead is a ubiquitous invader of rangelands and pastures, and recent reports indicate that this annual grassy weedy species is present in Kentucky bluegrass (KBG) seed production fields in central Oregon. The presence of Medusahead raises concerns among producers because it has the potential to reduce yields and affect seed quality. The best way to address the medusahead problem is an integral approach that includes control practices that promote healthy, vigorous stands of KBG, avoid weed seed dispersal to production fields and a weed control program that includes herbicides. The use of post emergence herbicides is critical for the success of an integral approach since they can provide control of emerged plants actively growing in an infested field. Therefore, testing the effectiveness for medusahead control of herbicides already labeled in Kentucky bluegrass is a priority because obtaining a label for a new product is costly and requires time.

Materials and Methods

A field study looking at post emergence herbicides for Medusahead control was initiated in April, 2013. The study was conducted on an established Kentucky bluegrass field at COARC. The study design was a randomized complete block with four replications. Plot size was 10 ft wide by 30 ft long. Medusahead seeds were planted inside a permanent 6 ft^2 quadrant to ensure weed infestation in all plots. The treatments consisted of primisulfuron (Beacon®), metribuzin (Sencor 75DF) dicamba, flufenacet + metribuzin (Axiom®), flucarbazone (Everest®), mesotrione (Callisto®). Herbicides were applied with a backpack sprayer calibrated to deliver 20 gallons of spray solution per acre at 40 psi pressure using XR 8002 Teejet® nozzles. Application date and environmental conditions are detailed in Table 1.Herbicide rates and adjuvants are detailed in Table 2. Herbicide efficacy was evaluated 30 days after application.

Results and Discussion

Medusahead control provided by all tested post emergence herbicides currently labeled for use in Kentucky bluegrass was poor and never reached levels of commercially acceptable control. The best control was recorded for Sencor 75DF at 0.5 lb/acre with only 31 percent control. Results from this first study indicate that control of developed medusahead plants infesting established stands of Kentucky bluegrass with labeled post emergence herbicide is deficient and won't provide a commercially acceptable level of control. The low efficacy levels observed for medusahead control with labeled herbicides emphasizes the need to implement an integral control program that includes cultural practices that ensure vigorous stands of Kentucky bluegrass, seed dispersal prevention and the use of pre-emergence herbicides among other efforts, The current study will be repeated in 2014, to confirm initial findings and explore other potential options.

Acknowledgments

The authors would like to thank Tim VanDomelen for his collaboration on this project.

Table 1. Application date, environmental conditions for herbicide applications.

Application Date	4/18
Time of Day	9 AM
Air temperature (F)	47
Relative Humidity (%)	54
Wind Speed (MPH)	3
Wind Direction	WNW

Table 2. Medusahead percent control compared to the untreated checks 30 days after application.

	Treatment	Rate	Unit	Percent Control
1	Beacon®	0.75	oz/acre	19
	MSO	1	% v/v	
	Ammonium sulfate	2	% v/v	
2	Sencor 75DF®	0.5	lb/acre	31
	NIS	0.25	% v/v	
	Ammonium sulfate	2	% v/v	
3	Dicamba	2	qt/acre	0
	NIS	0.25	% v/v	
	Ammonium sulfate	2	% v/v	
4	Axiom®	10	oz/acre	19
	NIS	0.25	% v/v	
	Ammonium sulfate	2	% v/v	
5	Everest 70 WDG®	0.85	oz/acre	13
	NIS	0.25	% v/v	
	Ammonium sulfate	2	% v/v	
6	Callisto®	6	fl oz/acre	13
	NIS	0.25	% v/v	
	Ammonium sulfate	2	% v/v	

Medusahead (*Taeniatherum caput-medusae*) Control with Fall Applications of Pre-Emergence Herbicides Currently Labeled in Kentucky Bluegrass

Gustavo Sbatella and Sasha Twelker

Abstract

Reports indicate that medusahead is present in Kentucky bluegrass seed production fields in central Oregon. As part of an integral approach to control medusahead, pre-emergence herbicides can be used to control germination of seeds in infested fields. A field study was conducted at the Central Oregon Research Center (COARC) located in Madras, Oregon, to evaluate the efficacy of pre-emergence herbicides currently labeled for use in established stands of Kentucky bluegrass for medusahead control. Herbicides were applied in October, 2012 and supplemental irrigation was used after application to ensure proper herbicide incorporation. The best medusahead control was obtained with the following herbicides: Outlook®at 21 fl oz/acre, Callisto® at 6 fl oz/acre, and Nortron® at 3 qt/acre, with weed control ranging between 88 and 99 percent. Several of the tested labeled herbicides had no impact on medusahead control when applied pre-emergence. Results indicate that options are available among labeled herbicides to prevent establishment of medusahead from seed.

Introduction

Control of annual grasses within a field of perennial grasses is difficult because of their morphological and physiological similarities. The invasive annual grass medusahead is an aggressive invader of rangelands and pastures, and recent reports indicate that the species is present in Kentucky bluegrass (KBG) seed production fields of central Oregon. The presence of medusahead raises concerns among producers because it has the potential to reduce yields, and affect seed quality. The best way to address the medusahead problem is an integral approach that includes control practices that promote healthy and vigorous stands of KBG, avoid weed seed dispersal into production fields and a weed control program that includes herbicides. The use of pre-emergence herbicides is critical to the control of medusahead as they can provide control of seeds already present in an infested field. Therefore, testing the effectiveness for medusahead control of herbicides already labeled in Kentucky bluegrass is a priority because obtaining a label for a new product is costly and requires time.

Materials and Methods

A field study looking at pre-emergence herbicides applied in fall for medusahead control was initiated in October, 2012. The study was conducted on an established Kentucky bluegrass field at COARC. The study design was a randomized complete block with four replications. Plot size was 10 ft wide by 30 ft long. Medusahead seeds were planted inside a permanent 6 ft^2 quadrant to ensure weed infestation in all plots. The treatments consisted of dimethenamid (Outlook®), mesotrione (Callisto®), ethofumasate (Nortron®), oxyfluorfen (Goal 2 XL®), pendimethalin (Prowl H_20®), terbacil (Sinbar®), and metolachlor (Dual Magnum®). Herbicides were applied with a backpack sprayer calibrated to deliver 20 gallons of spray solution per acre at 40 psi pressure using XR 8002 Teejet® nozzles. Following herbicide application the study area was irrigated for soil incorporation of the herbicides. Application date and environmental conditions are detailed in Table 1. Herbicide rates are detailed in Table 2. Herbicide efficacy was evaluated in spring of 2013.

Results and Discussion

Among the tested pre-emergence herbicides, three stood out for their effectiveness in medusahead control. Outlook®at 21 fl oz/acre, Callisto® at 6 fl oz/acre, and Nortron® at 3 qt/acre provided 90, 88 and 99 percent control respectively. In contrast, no medusahead control was observed with the pre-emergence application of Goal 2 XL®, Prowl H20®, Sinbar® and Dual Magnum. No crop injury was observed after the application of the herbicide treatments. Results from this study indicate that control of medusahead seed germination infesting established stands of Kentucky bluegrass is possible with the use of pre-emergence herbicides already labeled for use in the crop. This study was repeated this fall for results next spring of 2014, to confirm initial findings.

Acknowledgments

The authors would like to thank TimVanDomelen for his collaboration on this project.

Table 1.Application date and environmental conditions for the herbicide applications.

Application Date	10/2
Time of Day	9 AM
Air temperature (F)	57
Relative Humidity (%)	54
Wind Speed (MPH)	6
Wind Direction	SSE

Table 2. Medusahead percent control compared to the untreated checks in spring of 2013.

	Treatment[1]	Rate	Unit	Percent Control[1]	
1	Outlook®	21	fl oz/acre	90	b
2	Callisto®	6	fl oz/acre	88	b
3	Nortron®	3	qt/acre	99	b
4	Goal 2 XL®	3	fl oz/acre	0	c
5	Prowl H20®	3	qt/acre	0	a
6	Sinbar®	1	lb/acre	0	a
7	Dual Magnum®	21	fl oz/acre	0	a
	Untreated Check			0	a
	LSD (P=.05)			8	

[1]Means among columns followed by the same letter are not different at P=0.05.

Medusahead (*Taeniatherum caput-medusae*) Control Efficacy of Pre-emergence Herbicides Labeled in Kentucky Bluegrass Applied at 3 Different Timings During Fall of 2012.

Gustavo Sbatella and Sasha Twelker

Abstract

Reports indicate that Medusahead is present in Kentucky bluegrass (KBG) seed production fields in central Oregon. Medusahead plants establish primarily during the fall, but the emergence pattern is affected by moisture distribution. The efficacy of pre-emergence herbicides applied in the fall for Medusahead control relies on rainfall for appropriate incorporation, since irrigation water is no longer available. For this reason, a timely application of pre-emergence herbicide is important. A field study was conducted in the fall of 2012, comparing Outlook® (21 fl oz/acre) and Prowl H_20® (3.2 qt/acre) applied at three different timings during the fall for Medusahead control. The majority of the rainfall recorded during the duration of the study was concentrated in the first 60 days. Medusahead control with Prowl H_20® was poor (25 percent) when applied in October and no control was obtained with the later applications. The best medusahead control was observed with the November and December applications of Outlook, 82 percent and 75 percent respectively, but control failed with the early application in October. Results indicate that Outlook® applications when timely applied can be an option for Medusahead control when irrigation water is no longer available.

Introduction

Because of their morphological and physiological similarities, it is difficult to control annual grasses within a field of perennial grasses. The persistence of annual grass infestations results in a perpetual loss of yield. Medusahead is a ubiquitous invader of rangelands and pastures, and recent reports indicate that this annual grassy weedy species is present in Kentucky bluegrass (KBG) seed production fields in central Oregon. The presence of Medusahead raises concerns among producers because it has the potential to reduce yields, and affect seed quality. Finding an effective control for Medusahead that is already labeled for KBG is a high priority because obtaining a label for a new product requires time. Medusahead infestations in pastures and rangelands are characterized by rapid and aggressive spread. To address infestations in KBG fields, a rapid and effective response is required. Medusahead plants establish primarily during the fall, but the emergence pattern is often not uniform because germination is strongly affected by moisture distribution. The control efficacy of pre-emergence herbicides in the fall can be compromised under these conditions, since herbicides can be broken-down before seed germination by light, soil microorganisms, etc., affecting the performance. For this reason, a timely application of pre-emergence herbicide is important.

Materials and Methods

A field study looking at fall applications of pre-emergence herbicides for Medusahead control was initiated in October, 2012 in Jefferson County, Oregon. The study was conducted on non-agricultural land in order to ensure a high level of Medusahead infestation. Medusahead thatch was removed before spraying to improve soil contact by herbicides. The entire area was later sprayed with glyphosate, to ensure that the Medusahead plants inside the plots would only be those that germinated after the initiation of the study. The study design was a randomized complete block with four replications. Plot size was 10 ft wide by 30 ft long. The treatments consisted of applying pendimethalin (Prowl H_20®) and dimethenamid (Outlook®) at three different timings. To determine the time of the year when the majority of the Medusahead germinations occurred, three sets of untreated checks were included, one for each application timing. At each application, the corresponding untreated check was sprayed with glyphosate to eliminate the medusahead that had previously germinated. Herbicide efficacy was evaluated in the spring of 2013. Herbicides were applied with a backpack sprayer calibrated to deliver 20 gallons of spray solution per acre at 40 psi pressure using XR 8002 Teejet® nozzles. Application dates and environmental conditions are detailed in Table 1. Herbicides were evaluated 120 days after the last application (DAT).

Results and Discussion

The number of medusahead seed heads in the untreated checks of the application timings, averaged 15 heads/ft^2 for October, 9 heads/ft^2 for November and 5 heads/ft^2 for December. Counts indicate that most of the seed germination occurred during the first 60 days of the study, period when the highest rainfall was recorded (Table 3). Weed control with Prowl H_20® was poor (25 percent) after the first application and no control was observed with the November and December applications (Table 2). Outlook® provided satisfactory levels of control when applied in November (85 percent) and December (72 percent), but no control was provided by the early application in October.

Fall rainfall patterns determine the germination of medusahead seeds, and successful control with pre-emergence herbicides is going to depend on the active ingredient used and a timely application that will ensure soil incorporation with rain. Results suggest that Outlook® is a herbicide capable to perform under these conditions.

Acknowledgments

The authors would like to thank Jay McCabe and Bill Durette for their collaboration on this project.

Table 1. Application dates, environmental conditions, for all application timings.

	A	B	C
Application Date	10/21	11/23	12/11
Time of Day	12 PM	11 AM	10 AM
Air temperature (F)	48	42	46
Relative Humidity (%)	42	79	47
Wind Speed (MPH)	5	4	6
Wind Direction	SW	ENE	S

Table 2. Medusahead percent control compared to the untreated checks, 120 days after the last application.

	Treatment[1]	Rate	Unit	Code[2]	% Control[3]	
1	Prowl Prowl H_20®	3.2	qt/acre	A	26	b
2	Prowl Prowl H_20®	3.2	qt/acre	B	0	c
3	Prowl Prowl H_20®	3.2	qt/acre	C	0	c
4	Outlook®	21	fl oz/acre	A	0	c
5	Outlook®	21	fl oz/acre	B	85	a
6	Outlook®	21	fl oz/acre	C	72	a
7	Untreated Check				0	c
	LSD (P=.05)				26	

[1]Some treatments included in the study were used for experimental purposes and are NOT currently labeled for public use. Before using an herbicide, make sure it is properly labeled for the intended use.
[2]Application codes: A= 10/21/2012; B=11/23/2012; C=12/11/2012
[3]Means among columns followed by the same letter are not different at P=0.05.

Table 3. Amount of rainfall in inches recorded during the period of study.

Period 2012-2013	Inches
10/21 – 11/21	1.46
11/21 – 12/21	2.23
12/21 – 1/21	0.64
1/21 – 4/20	1.04

Evaluating Desiccants for After Harvest Burn Down in Grass Seed Fields

Gustavo Sbatella and Sasha Twelker

Abstract

The potential use of herbicides for plant burn down after harvest in Kentucky bluegrass was evaluated in central Oregon in fall, 2013. Two studies with different environmental conditions after the applications were conducted in October. The herbicides tested included glufosinate (Rely 280®) at 3.5 pt/acre, saflufenacil (Sharpen®) at 4 fl oz/acre, diquat (Reglone®) at 2 pt/acre, flumioxazin (Valor®) at 3 oz/acre, and propane burner as the comparison standard. Diquat reduced percent moisture in plant tissue regardless of the environmental conditions after spraying, although effects were more rapid under cloudy weather with rain showers. Glufosinate 10 days after treatment, provided moisture reduction equivalent to diquat and propane burner with sunny and dry conditions followed the application. None of the tested herbicides had an impact on plant biomass production, a factor that should be taken in consideration if this is the management objective.

Introduction

Grass seed fields can remain in a vegetative state when mild and moist conditions follow harvest. The removal of this green biomass is then delayed, affecting the development of the crop during the next season. Under these conditions, the management of the remaining straw is a challenge to all grass seed fields. Desiccants are used as harvest aids in many crops, and would facilitate the foliar burn down of the grass plants when applied after harvest. This approach would particularly benefit, fields within an eighth of a mile of highways where burning is not allowed. However, there can also be a benefit for fields that are burned, include more timely management of the crop residues, reduced number of fires required after harvest due to less remaining residue, and reduced propane burning. These factors can help minimize the amount of smoke produced by field burning. The herbicide Paraquat has been used as desiccant, but increasing restrictions regarding pesticide residues makes the labeling of this product very difficult. A new generation of harvest aids are currently being applied to other crops, but no information regarding their use or impacts in grass seed fields is available.

The objective of this study was to evaluate the use of herbicides as desiccants for burn down in grass seed fields with inadequate drying following harvest.

Materials and Methods

Two field studies were conducted in October of 2013 on an established Kentucky bluegrass field at COARC, Madras, Oregon. The study design was a randomized complete block with four replications with a plot size of 12 by 25 ft. The treatments consisted of glufosinate (Rely 280®), saflufenacil (Sharpen®), diquat (Reglone®), flumioxazin (Valor®), and propane burner as the comparison standard. Not all herbicides tested for burn down are currently labeled for use in grasses grown for seed, but were selected because they are being used in other crops as harvest aids. Herbicides were applied with a backpack sprayer calibrated to deliver 20 gallons of spray solution per acre at 40 psi pressure using XR 8002 Teejet® nozzles. Application dates and environmental conditions for each study are detailed in Table 1.Herbicide rates and adjuvants are detailed in Table 2.Moisture content from plant tissue was estimated by harvesting plant biomass from a 6 ft^2 area. Fresh and dry weight of plant samples collected 3, 7 and 10 days after treatment (DAT) was recorded. Plots will be harvested in 2013 to evaluate the impacts of each treatment on grass seed yield.

Results and Discussion

The percent moisture in plant biomass in study "A" was reduced with diquat applied at 2 pt/acre, reduction occurred quickly and was evident 3 DAT (Table 2). Moisture reduction obtained with diquat was comparable to the use of propane burner. Moisture content increased in the following days reaching 48 percent for diquat 10 DAT. Nevertheless, this moisture content remained the lowest among the tested treatments.

In study "B" diquat at 2 pt/acre and glufosinate at 3.5 pt/acre effectively reduced plant moisture similarly to the use of propane burner, but the reduction was only noticeable 10 DAT.
The studies were located adjacent to each other so the differences observed in herbicide performance can be attributed greatly to the environmental conditions following the applications. For study "A" conditions after the application were cloudy and with showers (Average daily radiation = 316 Langley/day, total rain = 0.1 inches), while for study "B" weather was mostly sunny and dry (Average daily radiation = 437 Langley/day, total rain = 0).

Desiccants were effective in reducing the percent moisture in plant tissue but they had no impact in total biomass produced (Table 3). This fact should be taken in consideration if biomass reduction is a management objective. The impact of these treatments in seed yield will be evaluated next year. There are herbicides that have the potential to be alternatives for use as burn down in Kentucky bluegrass, performance will not only depend on the active ingredient used, but also by environmental conditions following after the application. Nevertheless, none of these alternatives will have an impact on plant biomass as the use of propane burner.

Acknowledgments

The authors would like to thank Hoyt Downing and Mitchell Alley for their collaboration on this project.

Table 1. Application date and environmental conditions for the herbicide applications.

	Study "A"	Study " B"
Application Date	10/3	10/10
Time of Day	11 AM	9 AM
Air temperature (F)	46	41
Relative Humidity (%)	70	82
Wind Speed (MPH)	3	3
Wind Direction	W	SW

Table 2. Plant biomass percent moisture for each treatment, 3, 7 and 10 days after treatment.

				Plant biomass % moisture[3]											
				Study "A"						Study "B"					
	Treatment[1][2]	Rate	Unit	3 DAT[2]		7 DAT		10 DAT		3 DAT		7 DAT		10 DAT	
1	Glufosinate Ammonium sulfate	3.5	pt/acre	58	a	60	a	57	a	57	ab	77	a	39	b
2	Saflufenacil MSO Ammonium sulfate	4	fl oz/acre	58	a	57	a	60	a	58	a	76	a	55	a
3	Diquat NIS	2	pt/acre	39	b	40	b	48	b	51	b	80	a	37	b
4	Flumioxazin MSO	3	oz/acre	58	a	58	a	60	a	57	ab	74	a	51	a
5	Propane burner			31	b	34	b	42	b	34	c	27	b	34	b
	Untreated Check			59	a	59	a	60	a	55	ab	75	a	51	a
LSD (P=.05)				5		7		6		5		8		7	

[1]Some treatments included in the study were used for experimental purposes and are NOT currently labeled for public use. Before using an herbicide, make certain is it properly labeled for the intended use.
[2]Means among columns followed by the same letter are not different at P=0.05.
[3]Abbreviations: Days after treatment, DAT, methylated seed oil, MSO, nonionic surfactant, NIS

Table 3. Average dry biomass 10 days after treatment.

	Treatment[1]	Rate	Unit	Dry biomass (lb/a)[2] Study "A"	Study "B"
1	Glufosinate Ammonium sulfate	3.5	pt/acre	609 a	449 a
2	Saflufenacil MSO[3] Ammonium sulfate	4	fl oz/acre	641 a	513 a
3	Diquat NIS	2	pt/acre	545 a	481 a
4	Flumioxazin MSO	3	oz/acre	641 a	609 a
5	Propane burner			192 b	64 b
	Untreated Check			577 a	513 a
	LSD (P=.05)			224	256

[1]Some treatments included in the study were used for experimental purposes and are NOT currently labeled for public use. Before using an herbicide, make certain is it properly labeled for the intended use.
[2]Means among columns followed by the same letter are not different at P=0.05.
[3]Abbreviations: Methylated seed oil, MSO, nonionic surfactant, NIS

Creeping Bentgrass Control in Central Oregon

Gustavo Sbatella and Sasha Twelker

Abstract

Glyphosate tolerant creeping bentgrass (*Agrostisstolonifera* L.) accidentally escaped from production fields in 2003 and is now found growing along irrigation ditches in Jefferson County. Two field studies were conducted to evaluate the efficacy of spring and fall applications of glufosinate and sethoxydim for creeping bentgrass control. The best creeping bentgrass control was obtained with two sequential applications of Finale® at 4 fl oz/gal and Poast® at 2 fl oz/gal followed by Finale® at 4 fl oz/gal, when applied in fall. Best control with the spring applications was achieved with single application and two sequential applications of Poast® at 2 fl oz/gal. Treatments applied in spring that did not provide 99 percent control 90 days after the application will be further evaluated next growing season to determine if plant that showed partial control recovered from the initial injury.

Introduction

In 2003, glyphosate tolerant creeping bentgrass (*Agrostisstolonifera* L.) accidentally escaped from production fields, and is now found growing along irrigation ditches in Jefferson County, Oregon. A mitigation program has been implemented to control and ultimately eradicate these plants. Since plants are growing along irrigation ditches, herbicide options for control are limited. A 24 C label allows the use of glufosinate (Finale®) and sethoxydim (Poast®) for creeping bentgrass in dry irrigation canals and drainage ditches, limiting herbicide applications to early spring and late fall. The objective of this study was to evaluate the efficacy of spring and fall applications of glufosinate and sethoxydim for creeping bentgrass control.

Materials and Methods

Two field studies were conducted at the Central Oregon Agriculture Research Station (COARC) located in Madras, Oregon, during 2012 and 2013. In one of the studies herbicides were applied in fall, from this point forward referred to as the "fall study", while application in the second study was in spring, from this point forward referred to as the "spring study". The study was designed as a randomized complete block with four replications. Plot size was 10 ft wide by 5 ft long. On April 14, 2012, six creeping bentgrass plugs (3"x 2") were planted per plot, fertilized and irrigated periodically. Herbicide treatments were applied with a hand sprayer at 7 fl ounces per plant. Application dates, environmental conditions, and creeping bentgrass diameter are detailed in Table 1. Glufosinate (Finale®) and sethoxydim (Poast®) application rates and spray adjuvants are detailed in Table 2 for the fall study and in Table 3 for the spring study. Herbicide efficacy was determined 40 and 90 days after the last treatment application (DAA) for both studies and also 365 DAA for the fall study.

Results and Discussion

Fall study. Two sequential applications of Finale® at 4 fl oz/gal and Poast® at 2 fl oz/gal followed by Finale® at 4 fl oz/gal, were highly effective in controlling creeping bentgrass plants of 21 inches in diameter when applied in fall as indicated by the 365 DAA evaluations (Table 2). ***Spring study***. Creeping bentgrass control 90 DAA was high with a single application and two sequential applications of Poast® at 2 fl oz /gal (Table 3). A single application of Finale® at 4 fl oz/gal provided 88 percent control 90 DAA and plants that were not totally controlled were recovering from the herbicide application. These plants will be further evaluated 365 DAA to determine the final level of control with this treatment. Creeping bentgrass control with Finale® at 4 fl oz/gal followed by Poast® at 2 fl oz/gal was 94 percent. Again although initial control was high, further evaluation will be required 365 DAA due to the capacity of creeping bentgrass to regrowth from stolons.

Acknowledgments

The authors will like to thank Darin Allred and Jeff Lowe from The Scotts Company for supporting this project.

Table 1. Applications dates, environmental conditions, and creeping bentgrass growth plant size at time of application.

	A		B	
	Fall	Spring	Fall	Spring
Application Date	10/22/12	6/12/13	11/2/12	6/28/13
Time of Day	1 PM	1 PM	11 AM	7 AM
Air temperature (F)	44	60	61	62
Relative Humidity (%)	80	42	41	83
Wind Speed (MPH)	6	4	3	4
Wind Direction	WSW	N	NNE	SSE
Plant diameter (inches)	21.3	16.5	21.3	16.5

Table 2. Creeping bentgrass percent (%) control of established plants with fall applications, 40, 90, and 365 days after treatment in Madras, Oregon.

	Treatment	Rate		Appl[2]	Days After Application[1] 40	90	365
1	Non-treated Check				0 c	0 b	0 b
2	Finale®	4	fl oz./gal	A	98 a	98 a	99 a
	Ammonium Sulfate	2	% w/v	A			
	Finale®	4	fl oz./gal	B			
	Ammonium Sulfate	2	% w/v	B			
3	Poast®	2	fl oz./gal	A	97 b	98 a	99 a
	Ammonium Sulfate	2	% w/v	A			
	COC[3]	1	% v/v	A			
	Finale®	4	fl oz./gal	B			
	Ammonium Sulfate	2	% w/v	B			
LSD (P=.05)					0.3	0.1	0.1

[1]Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls)
[2]Application time: A = 10/22/2012; B = 11/2/2012
[3]COC = crop oil concentrate

Table 3. Creeping bentgrass percent (%) control of established plants with spring applications, 40, 90 days after treatment in Madras, Oregon.

	Treatment	Rate		Appl[2]	Days after application[1] 40		90	
1	Non-treated Check				0	c	0	d
2	Finale®	4	fl oz./gal	A	96	b	83	c
	Ammonium Sulfate	2	% w/v	A				
3	Poast®	2	fl oz./gal	A	97	ab	99	a
	Ammonium Sulfate	2	% w/v	A				
	COC[3]	1	% v/v	A				
4	Poast®	2	fl oz./gal	A	99	a	99	a
	Ammonium Sulfate	2	% w/v	A				
	COC	1	% v/v	A				
	Poast®	2	fl oz./gal	B				
	Ammonium Sulfate	2	% w/v	B				
	COC	1	% v/v	B				
5	Finale®	4	fl oz./gal	A	99	a	94	b
	Ammonium Sulfate	2	% w/v	A				
	Poast®	2	fl oz./gal	B				
	Ammonium Sulfate	2	% w/v	B				
	COC	1	% v/v	B				
LSD (P=.05)					2		3	

[1]Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls)
[2]Application time: A = 6/12/2013; B = 6/28/2013
[3]COC = crop oil concentrate

Evaluation of Miticides for Two-Spotted Spider Mite Control in Carrots Grown for Hybrid Seed in Central Oregon, 2013

Marvin Butler, Rich Affeldt, Megan Buck, Ralph Berry and Rhonda Simmons

Abstract

Two-spotted spider mites are an important pest on hybrid carrot seed production in central Oregon. Concern about two-week knock down period and re-entry interval (REI) for Comite (propargite) prompted a search for other products that could be used. Agri-Mek (abamectin) at two rates was compared to Comite and a combination of the two products. Results indicated a significant difference in mite populations between treated and the untreated check 11 days after treatment (DAT), with no significant difference between treatments. Testing for percent germination indicated no difference between treatments and the untreated control.

Introduction

Two-spotted spider mites are a significant pest in hybrid carrot seed in central Oregon. Spider mite populations can increase dramatically during the time bees are present to pollinate the crop from late June until mid-August. During this time, no insecticide applications are made. Once bees are removed from the fields, a cleanup application to control insect pests often includes a combination of Orthene (acephate) and Comite (propargite). However, Comite is problematic due to the two weeks it takes for mites to die and the two week re-entry interval (REI) that prevents rouging crews from accessing the fields. There can be two weeks or less between the cleanup spray and swathing the fields for harvest so a product with a shorter REI is necessary.

The objective of this project was to compare efficacy for two-spotted spider mite control for a potential new product, Agri-Mek (abamectin), with Comite.

Methods and Materials

Research was conducted in a commercial hybrid carrot seed field near Madras, Oregon. Plots consisted of four female rows 10 ft x 20 ft replicated four times in a randomized complete block design. The entire plot area was covered with agricultural paper and held down on the edges with dirt during aerial application of Orthene plus Comite to the remainder of the field on August 10, 2013. Pre-application mite counts were taken August 13 and again on August 20. Mite counts were taken by counting the number of mites on 20 flower bracts per plot from secondary umbels, with a maximum of 25 mites counted per bract.

Treatment of plots was delayed until after the second pre-count to allow time for populations to increase. Treatments were applied August 22, using a CO_2-pressurized, hand-held boom sprayer at 40 psi and 10 gals per acre water. A non-ionic surfactant at 1 qt/100 gal was included with all treatments. A clean-up spray of Orthene at l lb/acre plus Brigade (bifenthrin) at 6.4 oz/acre to control lygus and other insect pests was applied to the entire plot area with the treatments.

Post-treatment mite counts were taken 5, 8 and 11 days after treatment (DAT). Prior to commercial swathing of the field, a random sampling of 8 secondary umbels per plot were collected for testing percent germination to determine if there was any detrimental effect from treatments applied. Germination testing was conducted by Agri Seed Testing, Inc. in Salem, Oregon.

Results and Discussion

Although there were no statistical differences between any of the treatments 5 DAT and 8 DAT, there was a statistical difference between treated and untreated plots 11 DAT (Table 1). There were no statistical differences between insecticide treatments. Testing for percent germination indicates no significant difference between treated and the untreated control. Although there was a significant difference between Agri-Mek SC at 3.5 fl oz/ac and 7 fl oz/ac (abamectin at 0.02 lbs a.i./acre and 0.04 lbs a.i. acre), it is likely an anomaly in the sampling procedure and does not raise concern over use of this product in seed carrots. This project will be conducted to generate a second year of data during the 2014 season.

Table 1. Number of mites per flower bract and percent seed germination following insecticide treatments to control two-spotted spider mites on hybrid seed carrots near Madras, Oregon, 2013.

	Mites/Flower Bract					Seed
Treatment (product/ac)	----Pre Counts----		----------Post Spray----------			Germination
	8/13	8/20	8/27	8/30	9/2	%
Untreated Check	98.5	101.3 b	54.8	30.5	50.3 a	78.3 ab
Agri-Mek SC 3.5 fl oz/ac	96.3	135.5 ab	47.0	25.0	15.5 b	83.2 a
Agri-Mek SC 7 fl oz/ac	118.5	128.0 ab	33.5	23.8	16.0 b	72.8 b
Comite 2.5 pt/ac	113.0	154.8 a	51.5	32.0	10.8 b	77.1 ab
Comite 2.5 pt/ac + Agri-Mek SC 3.5 fl oz/ac	89.0	136.0 a	32.0	15.0	15.8 b	78.8 ab
LSD	*NS*	34.5	*NS*	*NS*	29.6	*7.3*

Evaluation of Synthetic Honey Bee Brood Pheromone to Increase Pollination Efficiency in Carrot Seed Crop

Ramesh R. Sagili, Bruce Martens, Carolyn Breece, Rhonda Simmons and John H. Borden

Abstract

Honey bees are crucial to the pollination of hybrid vegetable seeds in central Oregon and consistent pollination of carrot seed umbels is an ongoing challenge. During the summers of 2010-2012, we tested the hypothesis that synthetic brood pheromone (SuperBoost®) has the potential to increase pollination efficiency in carrot seed crops. Pollen and non-pollen foragers returning to the hive as well as visitation of bees on umbels showed higher numbers in colonies treated with the brood pheromone. Results of this study suggest that treatment of honey bee colonies with brood pheromone (SuperBoost®) can be of significant benefit through increased yields for carrot seed growers.

Introduction

One of the biggest challenges facing growers of carrot seed is ensuring adequate pollination. Brood pheromone (BP) released by honey bee larvae is an excellent apicultural tool that has the potential to increase pollination by manipulating foraging stimulus of honey bee colonies. In this study we tested the potential of synthetic BP (SuperBoost®) to enhance pollination and yields in carrot seed crop. SuperBoost® is a commercial product based on the brood pheromone of the honey bee, *Apis mellifera.* It is a synthetic blend of 10 fatty acid esters formulated in a ratio that precisely mimics the natural composition of the brood pheromone. Worker honey bees contact milligram amounts of pheromone that exudes daily from one side of a plastic pouch that is suspended in a holder between the frames of a hive.

Specific objectives of this study: 1) Examine and compare synthetic brood pheromone-induced foraging activity of treated honey bee colonies with controls 2) Evaluate increase in crop yield resulting from increased pollination, as a result of synthetic brood pheromone use.

Materials and Methods:

Honey bee colonies each containing approximately 40,000 bees were used in this study. There were two treatments: 1) Brood Pheromone (SuperBoost®) and 2) Control. Isolated carrot fields with similar varieties, irrigation type and management were used to allocate treatments. For the years 2010, 2011 and 2012 we had 2, 4 and 4 replications respectively. Brood pheromone treatment colonies received one synthetic brood pheromone device (SuperBoost®) in the brood area whereas control colonies received a blank device without pheromone. After initiation of the experiment in each experimental field, we counted number of bees visiting both male and female flowers during a 5 minute transect. We repeated bee visitation counts several times during the study period. We also documented number of pollen and non-pollen foragers entering the colonies during 5 minute intervals to analyze foraging efficiency of bees. Further, final yields of the crop were also documented in the experimental fields after harvest to compare yields between treatments.

Results and Discussion

For both sexes of flower, there were significantly more bee visits in fields pollinated by colonies treated with brood pheromone than in control fields (male flowers $t = 2.9001$, df = 6, $P = 0.0273$; female flowers $t = 2.4660$, df = 6, $P = 0.0487$) (Table 1). Overall 53.7% and 46.3% of the crop was harvested from brood pheromone and control fields, respectively ($t = 3.5184$, df = 18, $P = 0.0025$) (Table 2).

We conclude that treatment of honey bee colonies with brood pheromone (SuperBoost®) can be of significant benefit to carrot seed growers. Stimulation of increased foraging by brood pheromone as shown in this study could result in increased yields. The cost of treatment is so low, that even a minimal gain in yield may result in a positive ROI (Return on Investment). Our results overall suggest that brood pheromone treatment can be applied successfully to enhance bee foraging and increase yields in hybrid carrot seed crop.

Table 1. Comparison of visits by honey bees to male and females carrot flowers in fields pollinated by colonies treated with brood pheromone (SuperBoost®) or by untreated control colonies, and (for all fields combined) to male or female flowers. N = 4 for each sex of flower and N = 8 for both sexes of flower.

Sex of Flower	Criterion evaluated	Mean number of visits ± SE	Mean percent visits ± SE
Male	Visits to flowers in brood pheromone fields	11,089 ± 1316	59.2 ± 4.5*
	Flower visits in control fields	7,630 ± 1012	40.8 ± 4.5
Female	Visits to flowers in brood pheromone fields	6,968 ± 971	59.7 ± 5.6*
	Flowers visits in control fields	5,227 ± 1374	40.3 ± 5.6
Both sexes	Visits to male flowers	18,735 ± 1645	61.6 ± 3.5**
	Visits to female flowers	12,195 ± 2300	38.5 ± 3.5

* Significant difference between paired mean percentages at $P \leq 0.05$.

** Significant difference between paired mean percentages at $P \leq 0.01$.

Table 2. Comparison of yields by weight and percentage between carrot seed fields pollinated by honey bee colonies treated with brood pheromone (SuperBoost®) or by untreated control colonies. N = 10.

Treatment	Mean yield (kg/ha) ± SE	Mean percent yield ± SE
Fields pollinated by colonies- treated with brood pheromone	325.2 ± 65.0	53.7 ± 1.5**
Fields pollinated by untreated-control colonies	280.8 ± 63.7	46.3 ± 1.5

**Significant difference between paired mean percentages at $P \leq 0.01$.

Quantifying Drift of Honey Bees (*Apis mellifera*) to Alfalfa Seed Crop in Central Oregon

Ramesh Sagili, Rhonda Simmons, and Carolyn Breece

Abstract

Pollinator movement in flowering fields has been an interest in areas where differences in quantity and quality of nectar and pollen sources could potentially cause pollinators to bypass intended crop for one that is more favorable. Two locations were selected for observation of honey bee (*Apis mellifera*) drift between carrot (*Daucus carota*) and alfalfa (*Medicago sativa*) seed crops. Honey bee colonies with paint marked bees were placed in carrot fields and bee visitations to flowers of both carrot and alfalfa seed crops were recorded. On average about 3-7 percent of marked honey bees drifted to alfalfa fields. Preliminary results suggest that the bee movement between carrots and alfalfa were not significant.

Methods and Materials

Two standard 10-frame Langstroth hives with roughly 10,000 bees were used for this preliminary drift estimation study. Approximately ninety percent of the bees in each of these experimental hives were marked with paint on their thorax two days before placement in the fields. These hives were transported from Corvallis and placed next to carrot fields when both carrots and alfalfa seed crops were in bloom.

After three days, bee visitations to flowers in both carrot and alfalfa fields were recorded. The study included two locations that differed in spatial distribution: 1) carrot and alfalfa fields adjacent to each other and 2) carrot and alfalfa fields with an isolation distance (aerial) of approximately one mile. Paint-marked bees that were foraging in both crops were counted by using clickers during a 5 minute transect. We repeated bee visitation counts several times during the short-study period beginning July 17, 2012 and ending July 25, 2012.

In addition to counting painted bees, unmarked bees foraging in these fields were also recorded during the study period. Unmarked bees were recorded to provide additional information in case there was an inadequate number of a marked bee in the respective fields.

Results and Discussion

On average about 7 percent of marked honey bees drifted to alfalfa fields where alfalfa and carrots were in adjacent fields. A drift of about 3 percent was observed between the isolated fields of carrot and alfalfa. Movement of bees was relatively higher when the fields of carrot and alfalfa were located adjacent to each other compared to fields that had isolation distance between them. A relatively higher number of foraging honey bees were found in the middle of the alfalfa fields compared to the edges. Honey bees appear to forage more in the middle of alfalfa fields to avoid competition and frenzy activity from leafcutter bees.

Preliminary results suggest that the bee movement between carrots and alfalfa were not significant. There are many limitations to this study such as sample size and the duration of the study, hence long term and larger studies are recommended if more robust and reliable information is desired.

Flower Species as a Supplemental Source of Pollen for Honey Bees (*Apis mellifera*) in Late Summer Cropping Systems

Rhonda Simmons, Ramesh Sagili, and Bruce Martens

Abstract

Honey bee forager preference of late summer flower species was examined in a one-acre field adjacent to the Central Oregon Agricultural Research Center's apiary in Madras, Oregon. Six flower species were selected based on potential pollen production and planted according to commercial recommendations. Honey bee visitations were recorded, pollen amount tabulated, and pollen grains separated for protein analysis. All species produced flowers by mid-July as carrot seed approached 70 percent maturity on average. Results indicated borage, alsike clover, and buckwheat to be the most preferred species for foragers when compared side by side. Desirable flowers had potential regrowth ability when mowed, allowing for precise flower synchronization. Overall, species planted provided good information for prospective nutritional supplement for honey bee pollinators.

Introduction

Balanced nutrition is critical for honey bee colony growth and immunity. Honey bees need a range of elements to fulfill their nutritional requirements for normal growth and development. Essential components include proteins (amino acids), carbohydrates, minerals, fats/lipids, vitamins, and water. In order to obtain essential requirements, nectar, pollen, and water are collected as needed by the colony. Lack of one or more of these components can lead to population decline, health of the colony, disease susceptibility, and ultimate loss of hive. There is an increasing amount of evidence showing that poor nutrition can be a major factor affecting honey bee health.

Central Oregon utilizes pollination services of over 14,000 hives from July through late August for vegetable seed production. The natural decline in availability of pollen during the end of vegetable seed production negatively impacts honey bee health due to poor nutrition. As vegetable seed crops approach maturity, foragers have difficulty locating sufficient pollen for their colony growth. Diversity of pollen sources is important for honey bee colony growth and immunity especially before overwintering. Vegetable seed pollination is the last pollination event for Oregon beekeepers and also coincides with the most critical time when bees need ample and diverse pollen. Supplemental feeding as a preparation for winter survival can improve health, making bees less susceptible to disease and pests.

The objective of this project was to determine potential flower species that could improve honey bee nutrition and thus improve honey bee health during pollination by providing supplemental nutrition. Assessment of flower species was based on flowering dates, honey bee flower visits, pollen protein analysis, and crop management.

Methods and Materials

This study began in April, 2013 and will continue until spring 2014 at the Central Oregon Agricultural Research Center apiary in Madras, Oregon. Six flower species were selected based on availability and desirable pollen production. Prairie Coneflower *(Ratibida columnifera),* Alsike Clover *(Trifolium hybridum),* Buckwheat *(Fagopyrum esculentum),* Borage (*Borago Officinalis),* Alyssum *(Alyssum maritimum), and* Sunflower *(Helianthus annuus)* were planted in 20 ft by 150 ft plots in 8-inch row spacing, using an Oyjord plot drill. Planting rates, depths, and dates are presented in Table 1. The trials were irrigated as needed with a 30-ft by 40-ft spacing, solid-set sprinkler (9/64-inch heads) irrigation system. No fertilizers were applied as soil tests showed adequate levels of nitrogen present in the soil profile.

Plant emergence for each species was recorded when 30 percent of plot was visible. Plots were hand weeded except for alsike clover which was sprayed with Raptor® at 4oz/acre and 1 pt/acre of Basagran®. Twenty-feet at the end of the plots were mowed using a flail mower, at 10-inch height in mid-July to test regrowth potential. Regrowth allows for better synchronization of flower bloom during the season.

Foraging bees were counted using hand-held tally counters over a 10 ft by 40 ft area as soon as all species of flowers were in consistent bloom. Area verses time was used due to high variability in number of flowers produced between species. Visitation was recorded as total number and percent nectar or pollen foragers and percent flower bloom was recorded each collection date. Front Porch Pollen traps were used in the pollen collection of this trial. The trap is set on the front of the hive; a plastic strip (or card) with asterisk shaped holes where the bees enter is placed as a barrier between the front of the trap and the entrance of the hive. When the card is in place, pollen is collected, when removed, the pollen collection stops. The simple removal of the card prevents opening the hive and collection is less invasive to the colony. Below the card is a wire mess floor that allows pollen removed from the legs by the asterisk openings to pass into a collection tray. Pollen was trapped for two days and then removed for 2 days, repeated over the course of 4 weeks with traps remaining off during the weekend. Pollen was collected, date recorded, and immediately placed into a freezer for later separation and analysis. Single pollen foragers were also collected using a hand held cordless vacuum aspirator (model 2820GA) designed by BioQuip to provide accurate identification of pollen. Pollen was separated in the lab by color and is currently awaiting nutrient analysis.

Results and Discussion

The natural decline in availability of pollen during the end of vegetable seed production season has been a concern for honey bees prior to overwintering. Several flower species were planted at the end of May to prevent frost sensitivity. Table 1 shows average bloom dates from 27 to 92 days after planting. All flower plots were in full bloom during the initial target stage (the last two weeks of vegetable seed production). Visitation counts of bees on flower species from August 12, 2013 until August 23, 2013 are presented in Fig. 1. Overall, borage, alsike clover, and buckwheat had more bee visitations during late season. Percentage of pollen foragers recorded on prairie coneflower ranged from 50-90 percent, alsike clover 40-70 percent, buckwheat 10-60 percent, borage 40-60 percent, alyssum 25-80 percent, and sunflower 10-50 percent. Prairie coneflower, clover, and borage provided a steady number of pollen foragers over the course of the observation period (Fig 2). Pollen selection and preference change was evident in pollen collection samples. Color of pollen changed weekly as seen in Fig 3. In addition, nectar foragers were present and consistently working all flower types.

Clover, buckwheat, borage, and alyssum regrew within 3 weeks of mowing and produced flowers where sunflower and prairie coneflower did not recover from mowing.

Unfortunately, a hail storm on August 25, 2013 damaged the trial and we were unable to collect data further into the season. This damage complicated another objective of the study which involved determining removal of supplemental crop to ensure species would not become future weed problems for growers. Plant damage and wind carrying shattered seed from plots, may obscure spring evaluations. Plots were chopped and tilled in October and winter wheat planted as a rotational crop. Regrowth of flower seeds in spring and herbicide selection to remove escaped plants will be evaluated in 2014.

Preliminary data shows several worthy supplemental pollen sources (borage, buckwheat, and alsike clover) that can be used to enhance honey bee health in late season crops. Conclusions regarding best floral species will be made after completion of protein analysis of all the collected pollen. Work will continue using a narrowed list to determine flower timing and effects of sequential planting in 2014.

Table 1. Planting rate, depth, date of planting, date of emergence, first flower, and date of 50% (percent) flowering for six species of flowers grown at COARC, Madras, Oregon.

Flower Type	Planting Rate	Planting Depth	Date of Planting	Date of Emergence	Date of 1st Flower	Date of 50% flowering
	(lb/acre)	(in)				
Prairie Coneflower	5	0.25	4/18/2013	5/1/2013	7/19/2013	8/5/2013
Alsike Clover	4	0.25	5/9/2013	5/15/13	7/19/2013	7/31/2013
Buckwheat	50	1.0	5/30/2013	6/3/2013	6/28/2013	7/3/2013
Borage	15	0.5	5/30/2013	6/6/2013	7/22/2013	8/7/2013
Alyssum	5	0.25	5/30/2013	6/3/2013	6/26/2013	7/4/2013
Sunflower	10	1.0	5/30/2013	6/5/2013	7/22/2013	8/4/2013

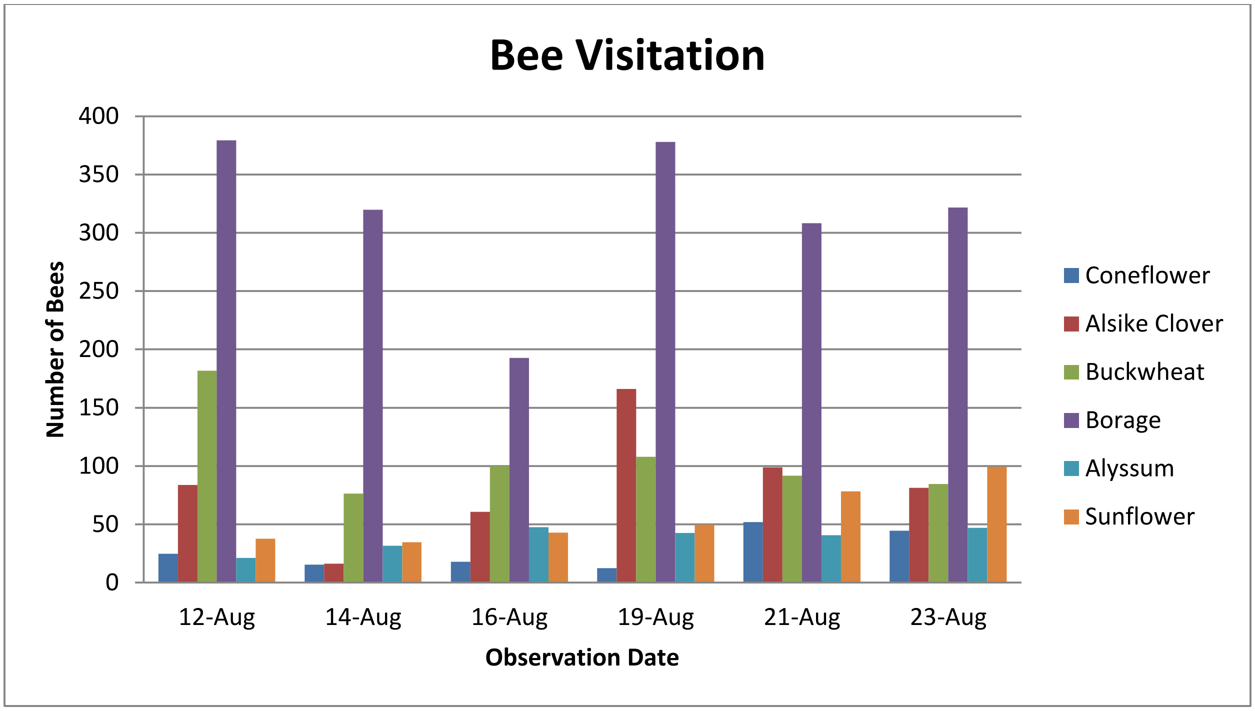

Fig. 1. Number of bees on flowers observed in a 10 ft by 80 ft plot area at COARC, 2013.

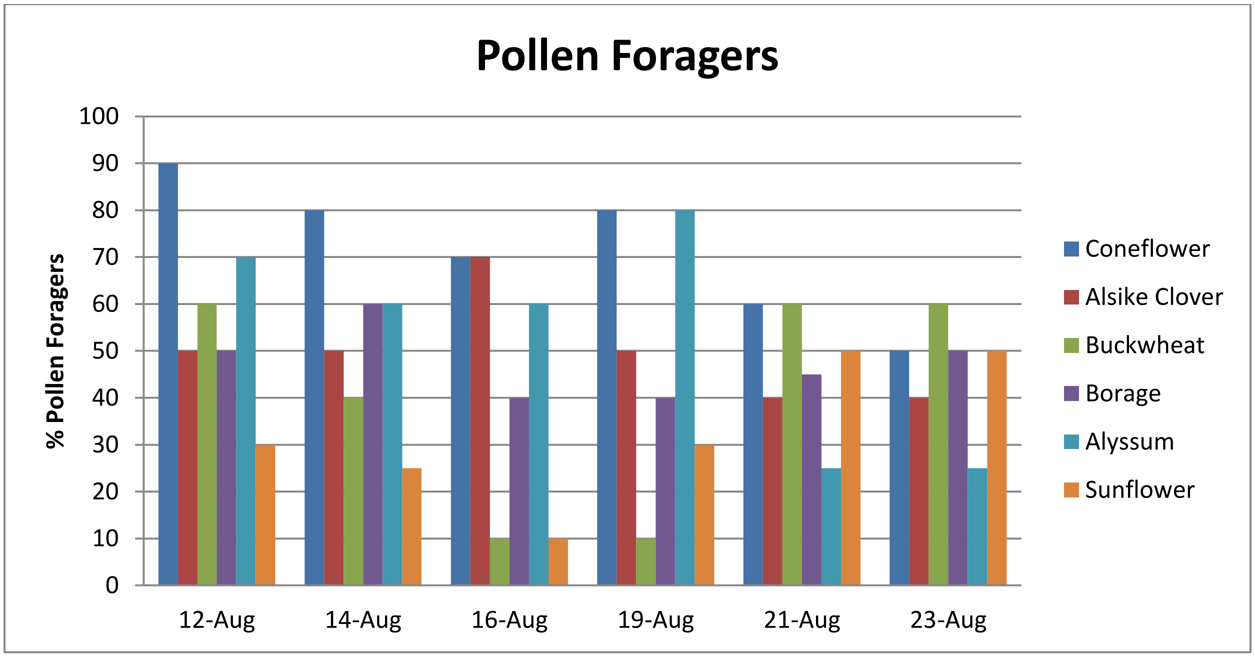

Fig. 2. Percent of bees foraging on pollen in a 10 ft by 80 ft plot area at COARC, 2013.

Fig. 3. Weekly change in pollen collection from July 26 to August 23, 2013.

Evaluation of Coragen Insecticide for Control of Mint Root Borer in Central Oregon, 2013

Marvin Butler, Rhonda Simmons, and Ralph Berry

Abstract

Pheromone traps that attract male mint root borer moths were placed in nine fields in the Culver area of central Oregon on June 26, 2013. Two fields with high moth populations were selected for application of Coragen (chloroantraniliprole). Coragen is registered for control of cutworms, loopers and mint root borer in peppermint. Results indicate application of Coragen at predicted peak moth flight (July 11-17) provided the greatest control of mint root borer, with predicted peak egg laying (July 23-27) providing similar, though somewhat less, control. This provides a reasonable window of opportunity (10-12 days) for growers to make an effective application.

Introduction

Coragen (chloroantraniliprole) is registered for control of foliar feeding cutworms in peppermint and has shown to have control on mint root borer (MRB) eggs and early instar larvae. The advantage of this product is it is highly effective in controlling target pest species at low use rates, with minimal impact on beneficial species. Low toxicity, two week persistence and ovicidal properties makes Coragen insecticide a good component for integrated pest management programs in peppermint.

Previous year's research showed significant control compared to the untreated check provided by applications of Coragen at peak moth flight and a double application of Coragen applied at peak moth flight plus peak egg hatch. The double application of Coragen appears to have provided control of both eggs and first instar larvae. Single, later applications of Coragen at peak egg laying and peak egg hatch were not significantly different from the untreated.

The objective of this project is to generate a second year of data evaluating application timing and number of applications for Coragen to provide optimal MRB control at the egg and first instar larval stages.

Material and Methods

Pheromone traps that attract male mint root borer moths were placed in a total of 8 fields on June 26, 2013, 6 near Culver and 2 near Prineville. The IPMP MRB degree-day development model was used to predict peak moth flight and approximate egg hatch. Traps were monitored weekly and based on these numbers, two fields with high moth populations were selected for treatment applications and soil sampling. Field 8 located near Highway 97 east of Culver and Field 1 located on Gerke road north of Prineville were selected (Table 1). Despite high numbers Field 5 near Culver was not selected due to planned removal of field.

Plots 20' x 20' were arranged in a randomized block design and replicated four times. Coragen treatments were applied using a CO_2 backpack sprayer at 20 gallons water per acre (Table 2 & 3), with timing of insecticides determined by local degree days using the MRB development model. The Culver location was commercially cut on August 14 and the Prineville location on August 17. Post-harvest applications were not applied at the Culver location due to a delay in watering back until September 18. This was a result of extensive thunderstorms that passed through the area during mid-August.

Square-foot samples 3-inch deep was collected from each plot, placed in a plastic bag and transferred to cold storage. Soil was sifted to check that larvae in the soil after rhizomes were removed for processing. Larvae were extracted using Berlese funnels for 4 days under 25 watts bulbs. Soil sampling dates at Culver were August 28, September 5, September 11, and September 20. Sampling dates at Prineville were September 4, September 10, September 19, and September 25.

Results and Discussion

The number of moths collected in pheromone traps was similar in the Culver and Prineville locations during weekly collections from July 3 through July 23. In general, the numbers of moths were down in 2013 compared to the 2012 season. Fields chosen for treatment with Coragen continued to be monitored during the weeks of July 30 and August 6, with no moths collected at either location. It appears from these data that the degree day model is accurately predicting what is being observed in the field.

Soil sample data indicate lower numbers of larvae than found during the 2012 season (Table 4 & 5). Despite these lower numbers, results support the effectiveness of Coragen compared to untreated plots. The exceptions are the late application at peak egg hatch (August 1) at Culver and the single post-harvest treatment (September 4) at Prineville.

These data support results from last year that indicate application of Coragen at 5 fl oz/ac (chloroantraniliprole at 0.07 lbs a.i./ac) at predicted peak moth flight (July 11-17) provided the greatest control of mint root borer, with predicted peak egg laying (July 23-27) providing similar, though somewhat less, control. This provides a reasonable window of opportunity (10-12 days) for growers to make an effective application. Later applications at predicted peak egg hatch (July 30-August 6) provide somewhat less control than the early treatments, and based on two years of data is considered too late to maximize control. Split applications appear to rely on the early treatment to provide similar results to the single, early application at peak moth flight (July 12-16), with little to no benefit from the post-harvest application. This corroborates an informal survey of commercial post-harvest application of fields where research was conducted during 2012.

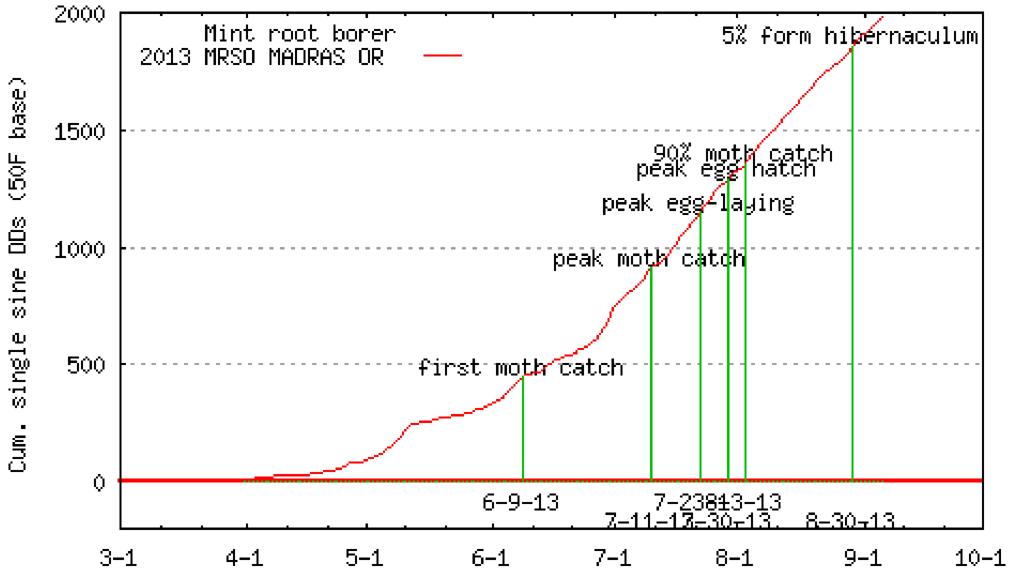

Fig. 1. Prediction model for Madras, Oregon, 2013. Predicted peak egg laying was July 23, peak egg hatch was July 30 and 90% moth catch was August 3.

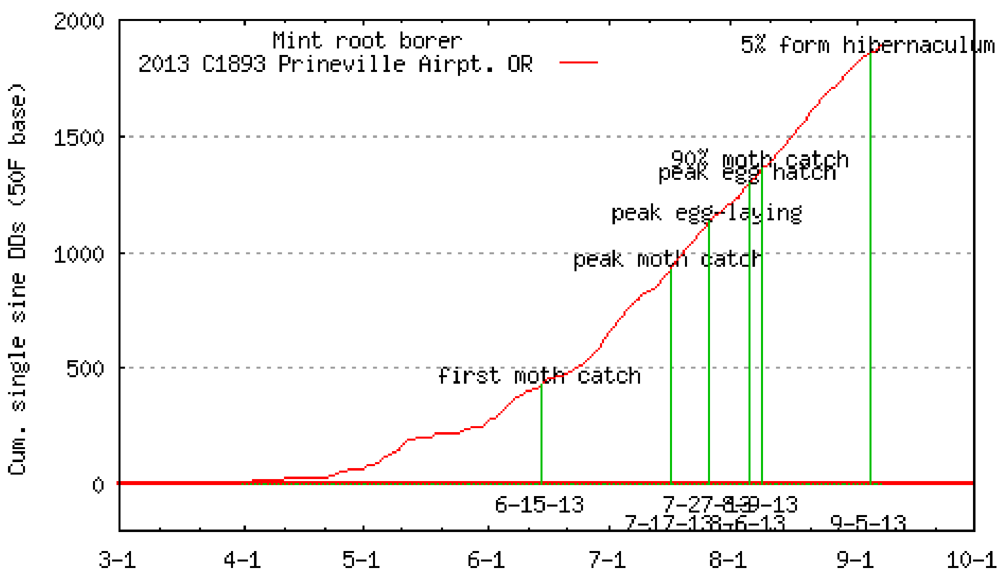

Fig. 2. Prediction model for Prineville, Oregon, 2013. Predicted peak egg laying was July 27, peak egg hatch was August 6 and 90% moth catch was August 9.

Table 1. MRB moths collected from pheromone traps placed in 8 fields on June 26, 2013.

Field	Location	Number of MRB Moths				
		3-Jul	10-Jul	16-Jul	23-Jul	Total
1	Northeast Prineville	12	6	5	5	28
2	Northwest Prineville	6	3	3	0	12
3	North Culver	11	5	2	4	22
4	Northwest Culver	9	6	1	0	16
5	West Culver	26	6	8	2	42
6	West Culver	12	9	3	0	24
7	Northeast Culver	6	9	1	0	16
8	East Culver	19	14	6	5	44

Table 2. Coragen treatment rate and timings based on accumulated degree-days at the Culver location.

Treatments	Application Rate (fl oz/acre)	Application Time (degree days)	Developmental Stage	Date Applied
1. Untreated	---	---		---
2. Coragen	5 oz	900	Peak moth flight	July 12, 2013
3. Coragen	5 oz	1100	Peak egg laying	July 23, 2013
4. Coragen	5 oz	1250	Peak egg hatch	August 1, 2013
5. Coragen	5 oz	900	Peak moth flight	July 12, 2013
+ Coragen	+ 5 oz	1250	Peak egg hatch	August 1, 2013

Table 3. Coragen treatment rate and timings based on accumulated degree-days at the Prineville location.

Treatments	Application Rate (fl oz/acre)	Application Time (degree days)	Developmental Stage	Date Applied
1. Untreated	---	---		
2. Coragen	5 oz	900	Peak moth flight	July 16, 2013
3. Coragen	5 oz	1100	Peak egg laying	July 26, 2013
4. Coragen	5 oz	1250	Peak egg hatch	August 5, 2013
5. Coragen	5 oz	900	Peak moth flight	July 16, 2013
+ Coragen	+ 5 oz	1250	Peak egg hatch	August 5, 2013
6. Coragen	5 oz	900	Peak moth flight	July 16, 2013
+ Coragen	+ 5 oz	Post-Harvest	Peak egg hatch	September 4, 2013
7. Coragen	5 oz	Post-Harvest	Peak egg hatch	September 4, 2013

Table 4. MRB larvae recovered from soil and rhizome samples at Culver (Field 8).

Treatments	Developmental Stage (degree days)	Mint Root Borer Larvae/Sq Ft Samples				
		Aug. 28	Sept. 5	Sept. 11	Sept. 20	Ave.
1. Untreated	---	1.0 a	1.0 a	0.8	0.5	0.8 a
2. Coragen	Peak moth flight (900)	0.0 b	0.0 b	0.0	0.0	0.0 c
3. Coragen	Peak egg laying (1100)	0.3 b	0.3 b	0.3	0.0	0.2 bc
4. Coragen	Peak egg hatch (1250)	0.5 ab	0.5 ab	1.0	0.3	0.5 ab
5. Coragen	Peak moth flight (900)					
+ Coragen	Peak egg hatch (1250)	0.0 b	0.0 b	0.3	0.3	0.1 bc
LSD		*0.7*	*0.6*	*NS*	*NS*	*0.4*

Table 5. MRB larvae recovered from soil and rhizome samples at Prineville (Field 1).

Treatments	Development Stage (degree days)	Mint Root Borer Larvae/Sq Ft Samples				
		Sept 4	Sept 10	Sept 19	Sept. 25	Ave
1. Untreated	---	1.5 a	1.3 a	2.0 a	1.0 a	1.4 a
2. Coragen	Peak moth flight (900)	0.5 b	0.3 b	0.3 c	0.0 c	0.3 d
3. Coragen	Peak egg laying (1100)	0.5 b	0.8 ab	1.3 ab	0.3 bc	0.7 bc
4. Coragen	Peak egg hatch (1250)	0.5 b	1.5 a	0.8 bc	0.5 abc	0.8 bc
5. Coragen	Peak moth flight (900)					
+ Coragen	Peak egg hatch (1250)	0.8 ab	1.0 ab	0.8 bc	0.5 abc	0.8 bc
6. Coragen	Peak moth flight (900)					
+ Coragen	Post-Harvest	0.3 b	0.8 ab	0.8 bc	0.0 c	0.4 cd
7. Coragen	Post-Harvest	0.8 ab	1.5 a	1.3 ab	0.8 ab	1.1 ab
LSD		*0.9*	*1.2*	*0.8*	*0.6*	*0.4*

Weed Control Programs in Mint Based on Spring Applied Herbicides to Minimize Rotational Restrictions

Gustavo Sbatella and Sasha Twelker

Abstract

Weed control options in mint based on spring applications with minimal crop restrictions were tested in central Oregon in 2013. Treatments were applied in two sequential applications due to a lack of residual weed control of the tested herbicides. Treatment evaluations were limited to crop injury because weed pressure in the experimental plots was low. The highest level of crop injury was observed 7 days after the last application in all treatments that included Bromoxynil, a herbicide for broadleaf control. Crop injury never exceeded 14 percent, and there were no differences recorded between the 1 and 1.5 pt /acre rates of Bromoxynil. These levels of injury did not persist and the mint fresh weight yields were not affected.

Introduction

The sequence in a crop rotation can be affected by residual effects of herbicides used in the previous crop (Ramson et al. 2002). Weed control programs for mint in central Oregon usually include herbicides that provide residual control such as clomazone (Command 3ME®), terbacil (Sinbar®), sulfentrazone (Spartan®) and flumioxazin (Chateau®), diuron (Karmex®), oxyfluorfen (Goal 2XL®) and napronamide (Devrinol®) (Pacific Northwest Weed Management Handbook 2011). As a consequence of herbicide carry over, planting options after a mint harvest are restricted. The potential for injury in the following crop increases if local environmental conditions such as drought and below average temperatures are present, slowing herbicide breakdown. Therefore, it is important to evaluate weed control programs based on spring applications capable of providing good weed control with limited residual effects providing flexibility and crop safety to the crop rotation. Herbicides currently labeled for mint that meet these requirements include bromoxynil (Buctril®), bentazon (Basagran®), clopyralid (Stinger®), clethodim (Select Max®), sethoxydim (Poast®) and quizalofop (Assure II®) (Pacific Northwest Weed Management Handbook 2011). None of these herbicides would work as a “stand alone” program due to the lack of residual control, making a second sequential application necessary. In spring of 2012, a series of treatments were tested as potential alternatives that resulted in different levels of crop injury. The objective of this study was to reevaluate these weed control programs in the spring of 2013, as weed control options in mint for central Oregon.

Materials and Methods

In 2013, a field study was conducted in Jefferson County, Oregon at a mint production field belonging to Mr. Jim Kaiser. The study design was a randomized complete block with four replications. Plot size was 10 ft wide by 30 ft long. Herbicides were applied with a backpack sprayer calibrated to deliver 20 gallons of spray solution per acre at 30 psi pressure using XR 8002 Teejet® nozzles. Application dates, environmental conditions, and crop stage are detailed in Table 1. Crop injury was based on visual evaluations using a scale from 0 percent (no injury) to 100 percent. Visual evaluations for crop injury were done 7 days after the first application and 7 and 30 days after the second. Plots were mechanically harvested, and the fresh weight of a 60 ft^2 section was recorded.

Results and Discussion

The evaluation of the herbicide applications was limited to crop injury due to the low weed pressure on the field. Mint injury after the first herbicide application was observed in all treatments that included Bromoxynil, but these levels were relatively low and ranged between 2 to 4 percent (Table 2). Injury increased after the second application and similarly to what was observed after the first application, it was in treatments that included Bromoxynil. The level of crop injury didn't differ between the 1 and 1.5 pt/acre of Bromoxynil. One month after the applications, the level of crop injury was similar to 7 days after the first application. These results suggest that mint plants recovered from the herbicide injury. This assumption was further confirmed when no differences were recorded among the harvested fresh weight of the herbicide treatments.

Acknowledgments

The authors would like to thank Jim Kaiser and Curt Crossman for their collaboration on this project.

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Table 1. Application dates, environmental conditions, and crop height for both application timings.

	A	B
Application Date	5/31/2013	6/8/2013
Time of Day	7:00 AM	8:00 AM
Air Temperature	48	61
Relative Humidity	67	57
Wind Speed	1.5	5
Wind Direction	SE	S
Crop Stage	18"	20"

Table 2. Percent crop injury 7 days after first application, 7 and 30 days after second application and harvested fresh weight (Ton/a) for individual treatments.

Trt	Treatment[1]	Rate (pt./acre)	Application time	% Injury[2] 7 DAA_1		% Injury[2] 7 DAA_2		% Injury 30 DAA_2		Fresh Weight[3] (Ton/a)	
1	Bentazon	4	A	0	a	0	b	0	d	16.2	a
	Quizalofop	0.8	A								
	Bentazon	4	B								
2	Bentazon	4	A	0	a	0	b	0	d	16.7	a
	Quizalofop	0.8	A								
	Bentazon	2	B								
3	Bromoxynil	1.5	A	4	a	13	a	9	a	15.7	a
	Quizalofop	0.8	A								
	Bromoxynil	1.5	B								
4	Bromoxynil	1.5	A	4	a	11	a	4	a	15.2	a
	Quizalofop	0.8	A								
	Bromoxynil	1	B								
5	Bentazon	4	A	2	a	8	ab	1	a	17.2	a
	Bromoxynil	1.5	A								
	Quizalofop	0.8	A								
	Bentazon	4	B								
	Bromoxynil	1.5	B								
6	Bentazon	4	A	2	a	6	ab	5	a	16.6	a
	Bromoxynil	1.5	A								
	Quizalofop	0.8	A								
	Bentazon	2	B								
	Bromoxynil	1	B								
7	Clopyralid	0.3	A	3	a	14	a	5	a	15.2	a
	Bromoxynil	1.5	A								
	Quizalofop	0.8	A								
	Bromoxynil	1.5	B								
8	Clopyralid	0.3	A	3	a	9	a	4	a	15	a
	Bromoxynil	1.5	A								
	Quizalofop	0.8	A								
	Bromoxynil	1	B								
9	Untreated Check			0	a	0	b	0	a	19.4	a
	LSD (P=.05)			2		6		6		3.1	

[1]All treatments included crop oil concentrate at 1 % v/v
[2]Abbreviations: DAA_1, Days after first application, DAA_2, Days after second application
[3]Means followed by different letters are significantly different at p= 0.05

Combining Pre-Emergence and Spring Applied Herbicide Treatments in Mint with Minimal Crop Restrictions for Small Grains

Gustavo Sbatella and Sasha Twelker

Abstract

A field study was conducted in Culver, Oregon in 2013, in order to evaluate the viability of combining pre-emergence herbicides with minimal cropping restrictions for small grains, with post-emergence applications during the spring. The pre-emergence treatments included were oxyflourfen, pendimethalin, sulfentrazone, and trifluralin. All pre-emergence treatments provided similar weed reduction (37 percent) before the post-emergence application in May. Weed control improved to 90 percent across all treatments after the post-emergence application and remained until harvest. Prickly lettuce and dandelion were the most difficult species to control with these weed control programs.

Introduction

Mint weed control programs in central Oregon usually include herbicides that provide long residual control. As a consequence planting options after mint harvest are restricted due to herbicide carry over. The potential for injury in the following crop increases if local environmental conditions slow herbicide breakdown. In order to address this problem several weed control programs based on spring applications capable of providing good weed control with limited residual effects for central Oregon were evaluated in the years 2012 and 2013. These programs were based on the use of bromoxynil (Buctril®), bentazon (Basagran®), clopyralid (Stinger®), clethodim (Select Max®), sethoxydim (Poast®) and quizalofop (Assure II®). All these programs required sequential applications of the herbicides due to the lack of residual control increasing the chances of crop injury. In order to reduce weed pressure, broaden the weed control spectrum and reduce the need of two sequential applications of post-emergence herbicides in spring it is necessary to compliment weed control treatments with pre-emergence applications early in the season. Available herbicide options with replant restrictions that would allow planting small grains after mint harvest include oxyflourfen (Goal 2XL®), pendimethalin (Prowl H_2O®), sulfentrazone (Spartan®), and trifluralin (Treflan®). Several of these herbicides are viable options only if they are applied early in December in order to avoid cropping restrictions following mint in fall.

The objective of this study was to evaluate which pre-emergence herbicides labeled for use in mint can provide early weed control and can be used to complement post emergence spring applications with minimum cropping restrictions following mint.

Materials and Methods

A field study was conducted in Culver, Oregon during 2013, in an irrigated mint field belonging to Mr. Jim and Mike Cloud. The study design was a randomized complete block with four replications. Plot size was 10 ft wide by 30 ft long. Herbicides were applied with a backpack sprayer calibrated to deliver 20 gallons of spray solution per acre at 30 psi pressure using XR

8002 Teejet® nozzles. Application dates, environmental conditions, and crop stage are detailed in Table 1. Weed counts from a 6 ft^2 area were done in May before the spring application and before harvest in August. The list of pre-emergence herbicides treatments, rates, time of application and adjuvants used are detailed in table 2. All treatments included the application of Paraquat® at 2 pt/acre plus a NIS at 0.25 % v/v as tank mix partner when crop was dormant and in May again all treatments were followed with an application of Basagran® at 4 pt/acre + Stinger® at 0.3 pt/acre + Assure II® + COC at 1 % v/v. Plots were mechanically harvested, and the fresh weight of a 60 ft^2 section was recorded. Soil samples from each treatment were collected following harvest. Currently soil samples are been placed in trays and planted to wheat in the greenhouse facilities at COARC, to detect potential carry over from the tested treatments that can affect wheat growth.

Results and Discussion

The early weed control provided by the pre-emergence herbicides was similar between treatments and averaged a 37 percent reduction when compared to the non-treated checks. The weed species accounted during the first count were prickly lettuce (*Lactuca serriola* L.), dandelion (*Taraxacum officinale* Weber in Wiggers), kochia (*Kochia scoparia* (L.) Schrad.)and western salsify (*Tragopogon dubious* Scop.). The pre-harvest weed counts indicated that the post applications were effective in maintaining the weed pressure low, averaging 90 percent control across treatments. Prickly lettuce and dandelions were the only weed species present at harvest, suggesting that these two species were the most difficult to control. No differences in fresh mint yields were observed between treatments, indicating good crop safety.

The potential carryover of the tested treatments will be determined once the plant grow-out tests have been completed.

Acknowledgments

The authors would like to thank Jim and Mike Cloud for their collaboration on this project.

Table 1. Application dates and environmental conditions for all applications.

	A	B	Post
Application Date	1/15/2013	3/25/2013	5/30/2013
Time of Day	1:30 PM	12:30 PM	8:00 AM
Air Temperature	42	48	48
Relative Humidity	55	45	70
Wind Speed	2	4	1
Wind Direction	E	NNE	NNW

Table 2. Weed counts (plants/6 ft^2) and harvested mint fresh weights (Ton/a) for individual treatments.

Treatment[1]	Rate	Unit	Time[2]	Weeds[3] per 6 ft^2 May		Weeds[3] per 6 ft^2 August		Fresh Weights Tn/a	
Goal 2XL®	6	pt/a	A	4	b	0	b	11	a
Goal 2XL®	2	pt/a	A	3	b	2	b	12	a
Spartan®	12	oz/a	A	3	b	1	b	11	a
Spartan®	6 + 6	oz/a	AB	2	b	1	b	11	a
Prowl H_20®	3	pt/a	B	3	b	1	b	10	a
Treflan®	1.25	pt/a	B	4	b	2	b	10	a
Non treated check			B	8	a	12	a	11	a

[1]All treatments included the application of Paraquat at 2 pt/a plus a NIS at 0.25 % v/v as tank mix partner.
[2]Application timings, A: 1/15/2013; B: 3/25/2013
[3]Means followed by different letters are significantly different at p= 0.05

Central Oregon Potato Extension Program

Rhonda Simmons and Marvin Butler

Abstract

To monitor pest populations and assess potential risk due to transmitted diseases both aphid and tuberworms were collected. The collection methods included twelve water pans for aphid collection and 10 delta traps for tuberworm collection. Aphid and potato tuberworm counts were conducted weekly in Jefferson County from June 18 to September 25, 2013. Weekly findings were sent as reports to growers, fieldmen and industry representatives. Aphid numbers were relatively low throughout the season, averaging four to twenty-four aphids per trap before they began to increase toward the end of the growing season. The potato tuberworm moth was identified in the area on August 27 and was found in very low numbers until traps were removed at harvest on September 17, 2013. Early blight prediction modeling and crop water use data provide helpful information for seed potato management. Weekly monitoring continues to be a significant source of information for integrated pest management in central Oregon potato fields.

Introduction

Aphids are important pests to identify and control in potato crops and can affect yield by removing nutrients from plants, stunting growth, or transmitting disease. Aphids are known vectors for several viruses, with the most important for our area being potato virus Y (PVY). The potato tuberworm is one of the most important pests that infest potato worldwide. Potato tuberworm moth appeared in the area in 2013 and has the potential to impact production due to larvae mining in tubers.

Early blight in potato caused by *Alternaria solani* has been recognized as a problem and the timely application of protectant fungicides is a very effective control method. Early blight prediction models predict the first seasonal rise in the number of spores of the early blight fungus based on the accumulation of 300 physiological days (P-days) from green row. Once 300 P-days have accumulated, the first fungicide for early blight control should be applied. This usually occurs when rows have closed.

Potato is a moisture sensitive crop with a shallow active root zone compared to cereals and forages. Availability of moisture in the root zone is crucial for high yields and is influenced by soil properties such as texture and percent organic matter. Moisture demand increases as the crop begins to develop after emergence and peaks seven to nine weeks later during the tuber bulking growth stage.

The object of this continued project is to monitor green peach aphids, other aphids grouped together, and potato tuberworm as well as generate early blight prediction model and weekly water use data information. The weekly newsletter continues to provide growers and industry real time data to assist with insect and disease management.

Methods and Materials

Pan traps are used to determine when aphid populations are increasing and when field monitoring becomes necessary. Twelve yellow water traps were used to collect winged aphids in commercial potato fields throughout central Oregon from June 18 to September 11. Trapped aphids were collected from water using a soft paint brush and transferred into vials filled with alcohol. Vials were transported to the OSU-COARC laboratory and identified as green peach aphid or other aphids. Date and location were used to identify aphid movement in area.

Ten pheromone delta traps were placed at the edge of commercial potato fields from June 18 to September 17. Delta traps consist of a triangle shaped trap, removable sticky liner bottom, and a lure impregnated with the pheromone of the female potato tuberworm moth. Sticky liners were removed weekly and inspected for presence of male moths. Confirmation of an initial moth find was verified by the OSU-HAREC Irrigated Entomology Program Laboratory, Hermiston, Oregon.

The early blight prediction model uses accumulated P-Days to indicate threshold for early blight risk and initiate preventative application of fungicides. The minimum, optimum, and maximum growth temperatures of the potato plant and the diurnal fluctuation of the air temperature were used to calculate P-Days. P-Days are calculated based on June 1 and June 10 emergence in central Oregon.

A weekly newsletter was sent to potato industry participants from June 25 to September 11 that included the early blight prediction model, weekly water use, weekly aphid identification and population numbers, and notification of potato tuberworm moth presence. Location of trap sites and population numbers were identified for grower use. Weekly reports were posted onto the OSU-COARC website and can be found at http://oregonstate.edu/dept/coarc/aphid-trap-reports, providing immediate access for our targeted audience.

Results and Discussion

Aphid populations in central Oregon were between 4 and 24 aphids per trap in 2013 (Fig. 1). Overall, aphid populations were low all season long with a small peak on July 23 and another increase at the end of the season on September 3. Green peach aphid numbers were very low ranging from 0 to 3.6 aphids per trap. Identification and reporting remains a helpful tool in controlling vectors.

In 2013, first identification of potato tuberworm moth occurred on August 27 and was confirmed by the OSU-HAREC Entomology Lab. Tuberworms were found each week (at least one but no greater than 3) until trap removal on September 17 prior to harvest. The increasing presence of potato tuberworm is of great importance and knowledge of control methods is crucial. Control methods include prompt harvest after vine kill and keeping soil moist as vines die to prevent cracking of the soil and exposure of tubers. Trapping continues to be a tool for seed producing areas in control of monitoring pests capable of transmitting diseases.

Early blight prediction models reached 302 P-Days on July 18 for June 1 emergence and 300 P-Days on July 27 for June 10 emergence. Using P-Days is crucial for efficient control of potato early blight disease. The yearly survey assists in the prediction of crop water use which is important to proper crop management throughout the growing season and during maturation to assist with harvest and prevent storage rot.

Providing weekly reports allows growers and producers to use preventative measures at times that can be most advantageous and economically rewarding. Thinking forward to the 2014 season, beet leaf hopper and potato psyllid are growing concerns for potato production and monitoring is suggested for these additional pests. Surveys conducted during the 2014 growing season will likely include yellow water pan traps for aphids, potato tuberworm delta traps, beet leafhopper and psyllid sticky traps.

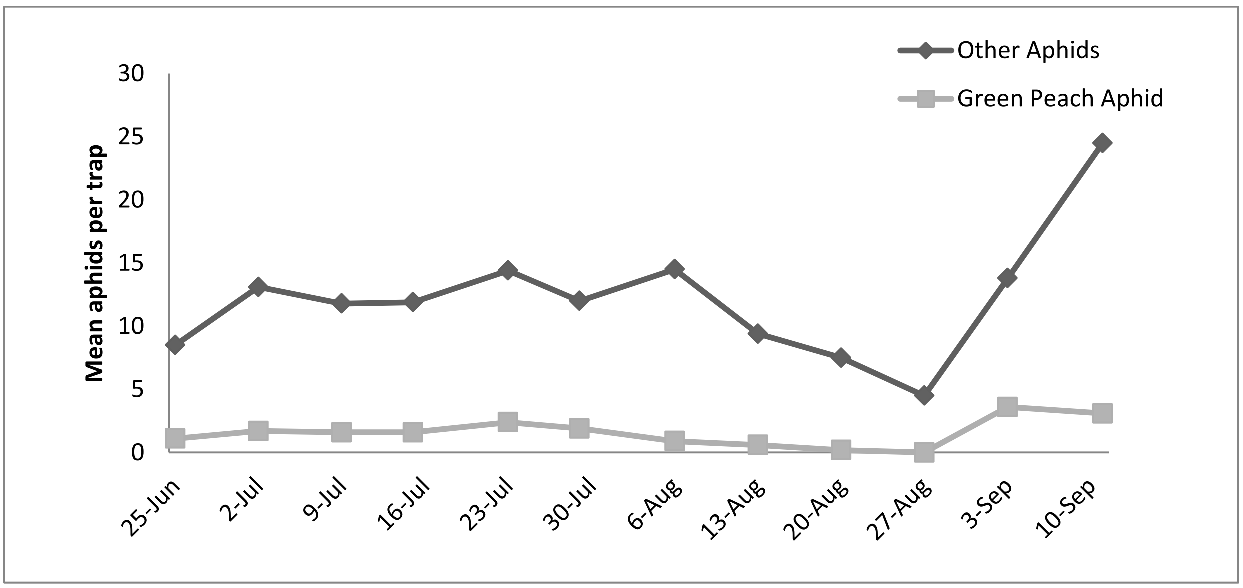

Fig. 1. Average population of aphids per trap in commercial fields in Jefferson County, Oregon 2013.

Evaluation of Conventional and Roundup Ready Alfalfa Varieties in Central Oregon, 2013

Marvin Butler and Rhonda Simmons

Abstract

An alfalfa variety trial was established in August, 2011 at the Central Oregon Agricultural Research Center (COARC), located in Madras, Oregon. It is a four-year project that generates yield, protein and relative feed value (RFV) that includes ADF and NDF data under 4-cut management. Ten conventional varieties (including 2 industry standards) and seven Roundup Ready® alfalfa varieties are being evaluated in side by side replicated plots. Total yield for conventional varieties ranged from 7.2 to 9.3 tons/acre and total yield for Roundup Ready® varieties ranged from 9.1 to 9.6 tons/acre. Total yield trended higher for the Roundup Ready® varieties across harvest dates compared to conventional varieties. Overall quality for conventional and Roundup Ready® varieties were good with relative feed values increasing through the season, and highest for the fourth cutting. Relative feed value trended consistently higher across Roundup Ready® varieties compared to conventional varieties

Introduction

Alfalfa is an important crop for central Oregon, with alfalfa hay produced in the three counties used for feed on local ranches and marketed to livestock producers, dairies, marketed through feed stores in Oregon, the Pacific Northwest and Canada, and exported to Pacific Rim countries. Alfalfa is important as a rotational crop to break disease and insect cycles, with the added benefit of being able to fix nitrogen for its own use and subsequent crops.

Yield, protein and relative feed value data were analyzed to provide a thorough varietal performance evaluation under central Oregon conditions. Neutral Detergent Fiber (NDF) is used to predict intake because it is slowly digested and is part of the diet that fills the rumen and forces the animal to quit feeding. Acid Detergent Fiber (ADF) predicts digestibility, as it represents the very slowly digested fiber that is tolerant to strong acids. Total Digestible Nutrients (TDN) is calculated using ADF and represents feed energy. Relative Feed Value (RFV) provides a single value to describe forage quality, and has become a common tool for determining overall hay quality (intake and energy value). Forage grade alfalfa hay can be categorized into 5 major grades: supreme, premium, good, fair, and poor. Addendum 1 provides quality standards for RFV, with the higher the RFV the more digestible and palatable the feed.

The objective of this study is to generate quality and yield data for pre-release and recently released alfalfa varieties under central Oregon conditions. Two industry standard varieties, Vernal and Plumas, are included with the conventional varieties for comparison. This timely information is expected to provide alfalfa seed companies, field consultants, hay growers and the agricultural community-at-large with data important to decision-making in central Oregon and throughout eastern Oregon.

Materials & Methods

Ten conventional and seven Roundup Ready®alfalfa cultivars were planted August 31, 2011. Conventional and Roundup Ready® cultivars were placed in separate side-by side trials, with a 60-ft border between. The entries were planted in 5 ft by 20 ft plots in a randomized block design, replicated 4 times. Planting rate was 25 lbs/acre of pure live seed, with an Oyjord plot drill on 8-inch row spacing.

The trials were irrigated using solid-set sprinklers (9/64-inch Rainbird nozzles) on a 30-ft by 40-ft spacing. The conventional trial was sprayed with Velpar® Alfamax™ at 1.75 lbs/acre, Firestorm® at 1.25 pts/acre, Hellfire® at 10 oz/acre, and non-ionic surfactant at 2 pts/100gal on February 18, 2013 The Roundup Ready®trial was sprayed with Roundup PowerMAX®at44oz/acre plus Quest® at 2 pts/100galon April 3, 2013 per label recommendation.

Seventeen foot plots, after 3 ft alleyways were cut, were harvested using a small-plot, forage harvester. Total fresh weight was taken in the field, with subsamples placed into a paper bag, weighed, and dried at 145°F until no further change in weight occurred. Fresh weight yields were adjusted to represent oven-dry weights based on sub-samples weight change due to drying. Dried samples were ground using a Wiley mill, and sub-samples from all four replications combined and sent to Dairy One Forage Testing Laboratory located in Ithaca, New York to determine crude protein, Acid Detergent fiber (ADF), Nutrient Detergent Fiber (NDF), Total Digestible Nutrients (TDN) and Relative Feed Value (RFV).

After each of the four harvests, the trial area was swathed, dried for 4 days, and hay removed to expedite irrigation and regrowth. Harvest dates were June 4, July 10, August 15, and October 8, 2012. The fourth cutting was harvested 6 days after the first frost and may have contributed to a slight decrease in yield for both conventional and Roundup Ready varieties.

Results and Discussion

Yields during 2013 for each of the four cuttings and season total yields for conventional varieties ranged from 7.2 (Vernal) to 9.3 tons/acre, with no significant difference between the top 7 yielding varieties (Table 1). Individual cutting and season total yields for Roundup Ready®varieties ranged from 9.1 to 9.6 tons/acre, with no significant differences between varieties (Table 2).

First cutting conventional variety quality analysis determined using RFV ranged from 128 to 152 (Plumas), while Roundup Ready® varieties ranged from 128 to 142 (Table 3). Based on the RFV grading system provided in Addendum 1, both conventional and Roundup Ready® varieties largely performed within the Good rating. Quality data cannot be statistically analyzed due to subsamples from the four replications being combined into one sample to reduce cost.

Second cutting RFV quality was largely within the Good rating, with conventional varieties ranging from 129 to 148 and Roundup Ready® varieties ranging from 135 to 151 (Table 4).

Third cutting RFV results for conventional varieties ranged from 141 to 166 (Vernal) and Roundup Ready® varieties were between 145 and 161 (Table 5). Three conventional varieties and four Roundup Ready® varieties were rated Premium.

RFV ratings continued to increase through the fourth cutting across varieties, with conventional varieties between 153 and 185 (Vernal) and Roundup Ready® varieties between 167 and 191(Table 6). One conventional and three Roundup Ready® varieties were rated Supreme.

Overall, total yields for Roundup Ready® varieties were higher (9.1 to 9.6 tons/acre) than conventional varieties (7.2 to 9.3 tons/acre), and more tightly grouped within the upper range. Relative feed value trended consistently higher across Roundup Ready® varieties compared to conventional varieties. Evaluation of individual varietal performance is important in making management decisions about which variety is best suited for a specific production situation.

Alfalfa varietal yield and quality data provided by this research project conducted at the Central Oregon Agricultural Research Center in Madras provides valuable information to assist, seed companies, fieldmen and growers in making decisions related to optimizing alfalfa production and enhancing the economic benefit throughout the region. Our thanks to alfalfa seed companies and industry representatives directly involved in this project.

Information related to fall dormancy, winter survival index, pest resistance, and other agronomic ratings for conventional and Roundup Ready® alfalfa varieties included in this performance evaluation is provided in Addendums 2 and 3.

Table 1. Conventional alfalfa variety yields for each of four cuttings and the season total at COARC, Madras, OR, 2013.

Variety	1st Cutting Yield	2nd Cutting Yield	3rd Cutting Yield	4th Cutting Yield	Total Yield
	- - - - - - - - - -	- - - - - - - - - -	(tons/acre)	- - - - - - - - - -	- - - - - - - - - -
Pioneer 54V09	3.8 a	2.0 a	2.1	1.4 a	9.3 a
445NT	3.2 b	2.0 a	2.1	1.5 a	8.8 ab
6422Q	3.2 b	2.1 a	2.1	1.4 a	8.8 ab
WL 354HQ	3.3 b	2.1 a	1.9	1.5 a	8.8 ab
Mountaineer 2.0	3.4 ab	2.0 a	1.8	1.5 a	8.7 ab
Pioneer 54Q25	3.3 b	2.1 a	1.9	1.4 a	8.7 ab
WL 363HQ	3.2 b	2.0 a	1.9	1.4 a	8.5 ab
Plumas	3.0 b	1.9 a	2.0	1.5 a	8.4 b
FGI 48W202	3.0 b	1.9 a	2.0	1.4 a	8.3 b
Vernal	3.0 b	1.5 b	1.6	1.1 b	7.2 c
Average	*3.2*	*2.0*	*2.0*	*1.4*	*8.6*
LSD	*0.5*	*0.4*	*NS*	*0.2*	*0.9*

Table 2. Roundup Ready® alfalfa variety yields for each of four cuttings and the season total at COARC, Madras, OR, 2013.

Variety	1st Cutting Yield	2nd Cutting Yield	3rd Cutting Yield	4th Cutting Yield	Total Yield
	- - - - - - - - - -	- - - - - - - - - -	(tons/acre)	- - - - - - - - - -	- - - - - - - - - -
FGI R48W224	3.7	2.5	1.9	1.5	9.6
Pioneer 54R014	3.6	2.4	2.0	1.5	9.5
433TRR	3.5	2.7	1.9	1.3	9.4
DKA 43-22RR	3.4	2.6	1.7	1.6	9.3
R470K215	3.7	2.6	1.7	1.3	9.3
FGI R58HG236	3.4	2.5	1.8	1.5	9.2
4R200	3.5	2.5	1.7	1.4	9.1
Average	*3.5*	*2.5*	*1.8*	*1.5*	*9.4*
LSD	*NS*	*NS*	*NS*	*NS*	*NS*

Table 3. First cutting alfalfa variety quality evaluation June 4, 2013 at COARC, Madras, OR.

Variety	Crude Protein	ADF	NDF	TDN	RFV
Conventional	- - - - - - - - - -	- - - - - - -	(% dry matter)	- - - - - - -	- - - - - - -
Plumas	21.1	33.7	38.4	62	152
WL 363HQ	19.4	34.4	40.5	61	143
FGI 48W202	20.9	35.3	40.1	61	142
Mountaineer 2.0	19.6	35.6	41.3	60	138
Pioneer 54Q25	19.8	35.5	41.4	60	137
Vernal	20.0	35.5	41.6	61	137
WL 354HQ	20.3	36.2	42.0	60	134
445NT	19.2	36.1	42.6	59	133
6422Q	20.8	35.9	43.0	62	132
Pioneer 54V09	18.8	36.9	43.7	61	128
Roundup Ready®					
4R200	18.5	34.2	40.8	61	142
433TRR	20.8	34.5	41.0	63	141
R470K215	20.2	34.4	41.4	63	140
FGI R58HG236	19.9	35.0	42.9	62	134
FGI R48W224	19.6	35.6	43.1	62	132
DKA 43-22RR	19.9	36.4	43.1	60	131
Pioneer 54R014	18.1	36.4	44.1	59	128

Table 4. Second cutting alfalfa variety quality evaluation July 10, 2013 at COARC, Madras, OR.

Variety	Crude Protein	ADF	NDF	TDN	RFV
Conventional	- - - - - - - - - - - - - - - -	- - - -	(% dry matter)	- - - -	- - - - - - - - - - - - - - - -
445NT	22.9	34.9	38.7	58	148
WL 354HQ	22.2	35.0	39.1	59	147
WL 363HQ	23.2	34.6	39.1	60	147
FGI 48W202	20.7	36.2	39.1	56	144
Mountaineer 2.0	20.9	36.9	40.0	57	140
Pioneer 54Q25	22.1	36.5	40.2	58	140
Plumas	24.7	36.6	41.2	60	136
6422Q	21.5	37.5	41.4	58	134
Vernal	20.2	37.5	41.6	57	133
Pioneer 54V09	20.9	39.1	42.2	55	129
Roundup Ready®					
Pioneer 54R014	23.4	35.2	37.9	60	151
DKA 43-22RR	22.9	35.6	38.3	60	148
FGI R58HG236	21.4	35.3	38.6	57	148
FGI R48W224	22.6	35.5	39.4	59	145
433TRR	20.7	36.7	40.7	58	138
4R200	20.9	37.1	40.8	57	137
R470K215	21.2	36.1	41.8	58	135

Table 5. Third cutting alfalfa variety quality evaluation August 15, 2013, COARC, Madras, OR.

Variety	Crude Protein	ADF	NDF	TDN	RFV
Conventional	- - - - - - - - - - - - - - -	- - - -	(% dry matter)	- - - -	- - - - - - - - - - - - - - -
Vernal	24.1	29.6	36.9	64	166
FGI 48W202	24.4	33.2	37.7	59	156
Pioneer 54Q25	23.9	34.6	37.7	61	153
Plumas	23.9	34.7	38.5	59	150
6422Q	23.9	34.0	39.0	61	149
Pioneer 54V09	23.9	35.4	39.0	61	146
WL 354HQ	23.0	35.1	39.5	58	145
445NT	22.6	36.5	39.6	58	142
Mountaineer 2.0	22.8	36.4	39.8	60	142
WL 363HQ	21.7	36.1	40.1	57	141
Roundup Ready®					
433TRR	24.8	33.0	36.5	61	161
FGI R48W224	22.6	31.3	37.2	57	161
FGI R58HG236	23.2	32.7	37.5	58	157
DKA 43-22RR	23.7	34.0	38.3	58	152
R470K215	22.3	35.3	38.8	57	147
Pioneer 54R014	23.2	34.6	39.6	58	146
4R200	23.1	35.3	39.4	57	145

Table 6. Fourth cutting alfalfa variety quality evaluation October 8, 2013, COARC, Madras, OR.

Variety	Crude Protein	ADF	NDF	TDN	RFV
Conventional	- - - - - - - - - - - - - - - -	- - - - - -	(% dry matter)	- - - - - -	- - - - - - - - - - - - - - - -
Vernal	25.1	29.1	33.3	64	185
Pioneer 54Q25	24.2	29.5	34.3	63	179
Pioneer 54V09	24.9	30.2	34.2	64	178
Mountaineer 2.0	23.4	29.7	34.7	63	177
Plumas	24.9	30.0	34.5	64	177
WL 354HQ	24.1	30.1	34.6	64	176
6422Q	23.8	31.8	34.0	60	175
445NT	23.0	30.6	36.0	63	168
WL 363HQ	22.5	32.1	36.2	62	164
FGI 48W202	22.6	33.0	38.4	62	153
Roundup Ready®					
433TRR	22.9	27.6	32.9	65	191
R470K215	21.3	28.3	33.3	63	187
FGI R58HG236	22.2	29.9	33.4	62	183
4R200	23.9	30.4	33.9	61	179
FGI R48W224	22.8	31.5	33.8	60	177
Pioneer 54R014	23.2	30.0	34.4	62	177
DKA 43-22RR	22.0	31.1	36.1	60	167

Acknowledgements

Support for this trial was sponsored by Forage Genetics Inc., America's Alfalfa, W-L Seed Co., Helena Chemical Company-Culver, Eureka Seed, Cropland Genetics, Inc., and Monsanto.

Addendum 1. Relative Feed Value (RFV) grading criteria used for determining forage quality.

Forage Grade and Description	If the ADF is:	If the NDF is:	Then the Relative Feed Value is:
1 Supreme	Under 30	Under 40	Over 180
2 Premium	31-35	41-45	151-180
3 Good	36-40	47-53	126-150
4 Fair	41-42	54-60	101-125
5 Poor	43-45	61-65	Under 100

Addendum 2. Fall dormancy, winter survival index, pest resistance, and other agronomic ratings for the conventional alfalfa varieties.
Blanks in the grid indicates that the variety is susceptible or has not been adequately tested.

Variety	FD[1]	WSI[2]	BW[3]	VW	FW	Anth1	PRR	SAA	PA	BAA	SN	APH1	APH2	NRKN	MFE	CGT	SE	ST	Tech
6422Q	4	1	HR	HR	HR	HR	HR		R		R	HR			H				C
WL 363HQ	5	1	HR	HR	HR	HR	HR		HR		HR	HR		HR	H				C
WL 354HQ	4	1	HR	HR	HR	HR	HR	HR	HR		R	HR	HR		H				C
Ameristand 445NT	4		HR	R	HR	HR	HR	HR	R		HR	R		HR	M				C
FGI 48W202																			
Mountaineer 2.0	5	2	HR	R	HR	HR	HR	R	HR		HR	R		R	H				C
Pioneer 54V09	4		HR	HR	R	HR	HR	R	HR		HR	R	MR	HR					C
Pioneer 54Q25	4		HR	HR	HR	HR	HR	R	R		HR	R		HR					C
Vernal	2		R		MR									MR					C
Plumas	4	2	HR	R	HR	HR	HR	R	R		HR	HR		R	H				C

Addendum 3. Fall dormancy, winter survival index, pest resistance, and other agronomic ratings for the Roundup Ready alfalfa varieties.

Variety	FD[1]	WSI[2]	BW[3]	VW	FW	Anth1	PRR	SAA	PA	BAA	SN	APH1	APH2	NRKN	MFE	CGT	SE	ST	Tech
R470K215																			R
433TRR	3	2.5	HR	R	R	HR	HR		R			HR							R
FGI R58HG236																			R
FGI R48W224																			R
DKA 43-22RR	4	2	HR	HR	HR	HR	HR				HR	HR		R	H				R
Pioneer 54R01	4	2	HR	HR	HR	HR	HR	R	R		R	HR		R	H				R
4R200	4	2	HR	HR	HR	HR	HR	MR	R	MR	HR	HR		R	H				R

Blanks in the grid indicates that the variety is susceptible or has not been adequately tested.

FD = Fall Dormancy[1], WSI = Winter Survival Index[2], BW = Bacterial Wilt, VW = Verticillium Wilt, FW = Fusarium Wilt, Anth1 = Anthracnose Race 1, PRR = Phytopthora Root Rot, SAA = Spotted Alfalfa Aphid, PA = Pea Aphid, BAA = Blue Alfalfa Aphid, SN = Stem Nematode, APH1 = Aphanomycese Race 1, APH2 = Aphanomycese Race 2, NRKN = Northern Root Knot Nematode, MFE = Multi-Foliate Expression
CGT = Continuous Grazing Tolerance, SE = Standability Expression, ST = Salt Tolerance (G – germination, F – forage), Tech = Technology (C – conventional, H – Hyrbrid, R – Roundup Ready)
[1]Fall Dormancy Rating: 1 = most dormant to 11 = least dormant
[2]Winter Survival Index: 1 = Superior, 2 = Very Good, 3 = Good, 4 = Moderate, 5 = Low, and 6 = Non-Winter Hardy
[3]Resistance Ratings: S = susceptible, LR = low resistance, MR = moderate resistance, R = resistance, HR = high resistance , MR = moderate resistance, R = resistance, HR = high resistance

Spring Wheat Broadleaf Weed Control in Central Oregon

Gustavo Sbatella and Sasha Twelker

Abstract

Broadleaf weeds growing in wheat are frequently composed of a variety of species that differ in their time of emergence and susceptibility to herbicides. Weld® and Carnivore® are herbicides that combine MCPA and bromoxynil with other active ingredients for broadleaf weed control. A study was conducted at the Central Oregon Research Center near Madras, Oregon to evaluate the effectiveness of Weld® and Carnivore® for broadleaf control on spring wheat crops. Herbicides were applied at different rates, and with or without the addition of spray adjuvants. Results of the study suggest Carnivore® and Weld® at 1.5 pints/acre performed similarly to 2, 4–D, the comparison standard in control of tansy and tumble mustard. The high levels of control recorded during the early evaluation for tumble mustard suggests that this species was more sensitive to the active ingredients tested in this study than tansy mustard. No crop injury was recorded in any of the tested treatments, indicating a high level of crop safety.

Introduction

Broadleaf weeds growing in wheat fields can adversely affect crop production in many ways. Weeds compete with wheat for light, water, and minerals, resulting in smaller crop yields. Weeds also interfere with crop harvest by raising moisture levels and contaminating the harvested grain. Weedy plant communities that infest wheat fields are frequently composed of a variety of species that differ in their time of emergence and susceptibility to herbicides, adding complexity to crop management. Weld® and Carnivore® are herbicides that combine MCPA (2-methyl-4-chlorophenoxyacetic acid) and bromoxynil with other active ingredients for broadleaf weed control. These herbicides are currently manufactured by WinField Solutions®. The objective of this study was to evaluate the effectiveness of Weld® and Carnivore® for broadleaf control on spring wheat crops. Herbicides were applied at different rates, and with or without the addition of spray adjuvants.

Materials and Methods

A study was conducted in an irrigated spring wheat field at the Central Oregon Agriculture Research Center (COARC) in Madras, Oregon, during 2013. The study design was a randomized complete block with four replications. Plot size was 10 ft wide by 30 ft long. Herbicides were applied with a backpack sprayer calibrated to deliver 20 gallons of spray solution per acre at 40 psi pressure using XR 8002 Teejet® nozzles. The application dates, environmental conditions, crop height, and weed growth stages are detailed in Table 1. Herbicides in the study included MCPA + bromoxynil + fluroxypyr (Carnivore®), MCPA + bromoxynil + clopyralid (Weld®), and 2, 4-D ester as the comparison standard. Herbicides Weld and Carnivore were sprayed alone or tank mixed with Interlock® or Masterlock®. These adjuvants are both deposition aid, canopy penetration and drift control agents. Herbicide use rates and spray adjuvants are detailed in Table 2. Herbicide efficacy was evaluated 15 and 30 days after treatment (DAT).

Results and Discussion

The weed population present in the study area consisted of tansy and tumble mustard. Tumble mustard control was high and uniform with all tested treatments at 15 and 30 DAT (Table 2). Control of tansy mustard although above 89 percent was variable between treatments 15 DAT. This variability was no longer observed 30 DAT. Weld at 1.5 pints/acre + Interlock was the treatment with the lowest percent control (91 percent) of tansy mustard 30 DAT. No crop injury was recorded for any of the tested treatments, indicating a high level of crop safety. Results from the study suggest that variability in tansy and tumble mustard control can be expected when using different active ingredients and the use of Carnivore® or Weld® provided good weed control.

Acknowledgments

The authors would like to thank Greg Dahl from WinField Solutions® for his support on this project.

Table 1. Applications dates, environmental conditions, spring wheat growth stage and average weed size at time of application.

Application Date	4/24/2013
Time of Day	10:00 am
Air Temperature	48°
Relative Humidity	32
Wind Speed	3
Wind Direction	W
Crop Stage	3-4 tillers height 7-8”
Weeds Heights	2-3”

Table 2. Broadleaf weed control as percent compared to the untreated check, 15 and 30 days after treatment.

	Treatment[1]	Rate	Unit	Percent Control			
				15 DAT		30 DAT	
				Tansy Must	Tumble Must	Tansy Must	Tumble Must
1	Weld®	1.5	pt/a	93 a	98 a	96 a	98 a
2	Weld® Interlock®[2]	1.5 4	pt/a fl oz/a	89 a	98 a	91 a	98 a
3	Weld® Masterlock®[2]	1.5 6.4	pt/a fl oz/a	95 a	98 a	97 a	98 a
4	Carnivore®	1.5	pt/a	91 a	98 a	97 a	98 a
5	Carnivore® Interlock®	1.5 4	pt/a fl oz/a	95 a	97 a	97 a	98 a
6	Carnivore® Masterlock®	1.5 6.4	pt/a fl oz/a	95 a	98 a	98 a	98 a
7	2,4 –D ester NIS[2]	1.3 0.25	pt/a % v/v	97 a	98 a	98 a	98 a
8	Untreated Check			0 b	0 b	0 b	0 b
	LSD			7	1	7	1

[1]Abbreviations: DAT: Days After Treatment; NIS: Non Ionic Surfactant; MUST: mustard
[2]Adjuvant

Impact of Herbicide Applications for Exotic Annual Grass Control on Fuel Load Production

Gustavo Sbatella and Sasha Twelker

Abstract

Exotic annual grasses such as downy brome, medusahead, and Ventenata can produce fine fuel loads that create favorable conditions for wild fire. This study assesses the effectiveness of imazapic (Plateau®) and propoxicarbazone sodium (Canter R+P®) in various application timings in reducing annual grass fuel load production. The study was conducted near South Junction, Oregon, in two sites with a reported invasive annual grass infestation – one site was burned, and one site unburned. Preliminary results suggest that herbicides have the potential to reduce fuel loads from annual weedy grasses, particularly in recently burned fields. The total biomass at the burned site (929 pounds per acre) in the beginning of the study was 40 percent less than the unburned site (1527 pounds per acre). The fire had a major impact in reducing the amount of litter available with 191 pounds per acre in the burned site against 1243 pounds per acre in the unburned. Treatment effects differed between locations. Six months after the initial applications, at the burned site, total biomass was reduced 53 percent with Plateau® at 6 oz/acre and 44 percent with Canter R+P® at 1.2 oz/acre with spring application. Litter was reduced with Plateau® applied in spring of 2012 by 86 percent while a 92 percent reduction was achieved with a spring and fall application of Plateau®. The vegetation sampling performed in the unburned site six and twelve months after the applications indicated that herbicides helped control annual weedy grasses; although, the effect on the produced biomass was not significant enough to reduce the production of litter or total biomass. These results suggest that herbicides can be used as tools to reduce the production of fine fuels, although the magnitude in the reduction is going to be determined by the history of previous wildfires.

Introduction

Exotic annual grasses such as downy brome (*Bromus tectorum*), medusahead (*Taeniatherum caput-medusae*), and Ventenata (*Ventenata dubia*) can produce large amounts of fine fuel loads creating favorable conditions for wild fires. These fuel loads change the fire regime and help perpetuate invasive grasses dominance in plant communities. One way to alter this cycle is by reducing the amount of fine fuel which can be achieved by mowing or grazing, however these practices have their limitations. For instance, mowing is restricted by terrain conditions and grazing is limited by the rapid loss of the palatability of the grasses. Herbicides imazapic and propoxicarbazone sodium have been particularly effective in controlling or suppressing exotic annual grasses, depending on rates and time of application. The main limitation for extensive use of these herbicides, particularly in rangelands, is the cost. However, if the fuel load from exotic annual grasses is reduced, the risk of wild fires will also decrease as the result of herbicide applications. This could help create lower fire risk sections or corridors in order to protect more sensitive areas such as installations, roadsides, buildings, animal shelters, etc. The cost of herbicide application for these areas would be compensated by the value of the saved resources and reduction in the cost of controlling frequent wild fires. The use of herbicides would only be justified if a significant reduction of the fuel load is achieved. The objective of this study was to quantify the impact of herbicides and application timings on invasive annual grass fuel load production.

Materials and Methods

The study was conducted near South Junction, Oregon, in two sites with a reported invasive annual grass infestation. In the first site, from this point forward referred to as the "non-burned site," no fires had been recorded during the last four years. In the second site, fire was recorded in the summer of 2011, from this point forward referred to as "burned site." The study design was a randomized complete block design replicated four times with a plot size of 10 ft by 60 ft. Herbicides were applied with a backpack sprayer calibrated to deliver 20 gallons of spray solution per acre at 40 psi pressure using XR 8002 Teejet® nozzles. Application dates and environmental conditions are detailed in Table 1. Herbicide treatments consisted of imazapic (Plateau®) and propoxicarbazone sodium (Canter R+P®) applied at different rates and timings (Table 5). An electrical fence was built around the perimeter of the studied area to avoid grazing. The impact of the treatments on fuel load production were determined by sampling the vegetation of a 5.4 ft^2 area in each plot, during the spring and fall of 2012, and spring 2013. The harvested vegetation was separated into three categories: actively growing grasses (annual and perennial), forbs and fuel load (laying dead plant matter). Samples were then oven dried and weighed.

Results and Discussion

The effect of the fire on the plant community was evident by the differences in biomass for all plant categories recorded at the beginning of the study (Table 2). The total biomass at the burned site (929 pounds per acre) was 40 percent less than the non-burned site (1527 pounds per acre). The fire had a major impact in reducing the amount of litter available with 191 pounds per acre at the burned site against 1243 pounds per acre at the non-burned. The effects of the fire were also evident on both annual and perennial grasses, where biomass at the burned site was 2.5 times higher than the non-burned.

Six months after the spring application, the impact of the herbicide treatments differed between sites. A significant reduction in total biomass when compared to the non-treated was observed with the use of Plateau® at 6 ounces per acre, or Canter R+P® at 1.2 ounces per acre in the burned site (Table 3). Although every treatment had an impact on the produced litter, the most significant biomass reduction, 53 percent, was observed with the application of Plateau®. The control of annual weedy grasses was also more effective with Plateau®, as suggested by the lowest recorded biomass among treatments. All tested treatments reduced the biomass of the perennial grasses. A possible explanation for this is that a significant portion of the perennial grass biomass came from Bulbous bluegrass (*Poa bulbosa*), a species that has shown to be affected by the tested herbicides.

At the non-burned site, treatments affected both perennial and annual weedy grasses but impacts were not significant enough to affect litter and total biomass production (Table 4). At this site, annual weedy grass control was more effective with Plateau® at 6 ounces per acre, and Canter R+P® at 0.6 ounces per acre, as indicated by the harvested biomass. The main perennial grass species at the non-burned site was intermediate wheatgrass (*Thinopyrumintermedium*) and was only affected by Canter R+P® at 1.2 ounces per acre. No forbs were recorded at this site.

The impacts on the plant community differed between sites again in spring of 2013, and were dependent upon herbicide and time of application. For instance, in the burned site total biomass was affected by Plateau® at 6 oz/acre when applied in spring and with a sequential spring and fall application of Plateau® at the same rate (Table 4). Total biomass was reduced because in these two treatments the amount of litter was 83 and 46 pounds per acre, a significantly less amount when compared to the other treatments and the non-treated check. All herbicides affected perennial grass biomass production and the same consideration regarding bulbous bluegrass being the most abundant species applies also for this period. Regarding annual grass control again was Plateau® at 6 oz/acre most effective treatment, but when applied in fall of 2013 and in sequential spring and fall applications. The impact of the treatments on forbs at the burn site deserves a special mention because forbs biomass was always higher when Plateau® was sprayed. Alfalfa was the main forb species at this site, and since Plateau® has no activity on this species, the weed control provided by this herbicide favored alfalfa growth. Meanwhile, the application of Canter R + P ®affected alfalfa growth resulting in less forb biomass when this herbicide was used.

At the non-burned site, although the treatments impacted perennial and weedy grass biomass, the effects did not result in changes in the amount of litter or total biomass produced (Table 6). At this site, the application of Plateau® at 6 oz/acre applied in spring and fall resulted in a substantial increase in the perennial grass biomass (495 lb/acre) when compared to the non-treated check (285 lb/acre). Similarly to the burned site weedy grass was most effectively controlled with Plateau® at 6 oz/acre when applied in fall of 2013 and in sequential spring and fall applications. No forbs were recorded at this site. These results suggest that herbicides have the potential to be used to reduce fuel loads from annual weedy grasses in recently burned fields. Meanwhile, the tested herbicides will have no impact when a significant fuel load is present before the application. Plateau® was in general more effective than Canter R + P® in reducing weedy grass biomass and the impacts on perennial grasses were determined by grass species.

Acknowledgments

The authors would like to thank the Agriculture Research foundation for funding this project. We would also like to thank Dan Comingore and Bob Darling for their collaboration on this project.

Table 1. Application dates and environmental conditions.

	A		B	
	Non-burned	Burned	Non-burned	Burned
Application Date	4/7/12	4/7/12	11/5/12	11/5/12
Time of Day	10 am	12 pm	8 am	12 pm
Air temperature (F)	49	51	50	65
Relative Humidity (%)	63	48	84	55
Wind Speed (MPH)	2	5	2	4
Wind Direction	NNW	N	SE	NE

Table 2. Average biomass (lb/acre) by category for both sites at the beginning of the study in the spring of 2012.

Site	Biomass lb/acre[1] Weedy Grass		Perennial Grass		Litter		Total	
Burned	352	a	330	a	191	a	929	a
Non-burned	137	b	132	b	1243	b	1527	b

[1]Means among columns followed by the same letter are not different at P=0.05.

Table 3. Average biomass (lb/acre) by category for the burned site in the fall of 2012.

Treatment	Rate (oz/acre)	Biomass lb/acre Weedy Grass		Perennial Grass		Litter		Total	
Plateau®	6	21	b	6	b	607	b	679	b
Canter R+P®	1.2	60	a	17	b	743	ab	854	b
Canter R+P®	0.6	72	a	27	b	964	ab	1064	ab
Untreated		97	a	150	a	1292	a	1565	a

[1]Means among columns followed by the same letter are not different at P=0.05

Table 4. Average biomass (lb/acre) by category for the non-burned site in the fall of 2012.

Treatment	Rate (oz/acre)	Biomass lb/a[1] Weedy Grass		Perennial Grass		Litter		Total	
Plateau®	6	12	b	518	ab	843	a	1386	a
Canter R+P®	1.2	26	ab	389	b	707	a	1140	a
Canter R+P®	0.6	9	b	577	a	882	a	1476	a
Untreated		39	a	476	ab	840	a	1372	a

[1]Means among columns followed by the same letter are not different at P=0.05

Table 5. Average biomass (lb/acre) by category for the burned site in the spring of 2013.

Treatment	Rate (oz/acre)	Time[2]	Biomass lb/acre									
			Litter		Perennial Grass		Weedy Grass		Forbs		Total	
Plateau®	6	A	83	c	35	a	66	ab	87	ab	271	bc
Plateau®	6	B	455	a	59	a	21	bc	91	ab	627	ab
Plateau®	6	A-B	46	c	27	a	3	c	50	abc	127	c
Canter R+P®	1.2	A	463	a	18	a	103	ab	13	bc	596	ab
Canter R+P®	1.2	B	426	a	34	a	85	ab	8	bc	553	ab
Canter R+P®	0.6	A-B	365	ab	8	a	83	ab	2	c	458	ab
Untreated			567	a	152	b	163	a	10	bc	893	a

[1]Means among columns followed by the same letter are not different at P=0.05
[2]Abbreviations: A= spring 2012, B= fall 2012

Table 6. Average biomass (lb/acre) by category for the non-burned site in the spring of 2013.

Treatment	Rate (oz/acre)	Time[2]	Biomass lb/acre[1]							
			Litter		Perennial Grass		Weedy Grass		Total	
Plateau®	6	A	327	a	451	ab	25	ab	803	a
Plateau®	6	B	266	a	458	ab	16	b	740	a
Plateau®	6	A-B	356	a	495	a	2	c	853	a
Canter R+P®	1.2	A	406	a	428	ab	41	ab	875	a
Canter R+P®	1.2	B	411	a	396	ab	25	ab	832	a
Canter R+P®	0.6	A-B	377	a	434	ab	29	ab	840	a
Untreated			533	a	285	b	59	b	877	a

[1]Means among columns followed by the same letter are not different at P=0.05
[2]Abbreviations: A= spring 2012, B= fall 2012

Ventenata (*Ventenata dubia*) Control in Rangelands for Central Oregon with Fall Applications

Gustavo Sbatella and Sasha Twelker

Abstract

Ventenata an invasive annual grass is found infesting rangelands in central Oregon. In order to limit the spread of this weed, the implementation of integral control approach is necessary, and chemical control is an important tool. A field study was conducted in Ashwood, Oregon to evaluate ventenata control with fall applications of imazapic, propoxicarbazone sodium, and sulfosulfuron. Ventenata control was high six months after the applications with imazapic applied at 6 oz/acre and sulfosulfuron at 2 oz/acre. Results from this study suggest that these two herbicides can be used for ventenata control in rangelands in central Oregon, but further evaluations are necessary to verify performance under different environmental conditions.

Introduction

Extensive areas of the Pacific Northwest are infested with downy brome and medusahead, but another annual invasive grass, ventenata (*Ventenata dubia*) is becoming a concern because this species can out-compete perennial grasses. Ventenata is capable to infest a wide range of habitats similarly to downy brome and medusahead. In rangelands the grazing potential of ventenata infested areas is affected because, similarly to medusahead, the silica content in ventenata makes this species poorly palatable. In central Oregon, downy brome, medusahead and ventenata can be found coexisting in rangelands and in some areas ventenata is displacing the two other species. The mechanisms which allow ventenata to displace the other two species are so far unknown, but current hypothesis included different germination patterns, response to moisture and species selection through grazing. The implementation of an integrated program for ventenata control is important to limit the spread of this weed. Herbicides are important tools for chemical control of weeds. The objective of this study was to evaluate ventenata control in infested rangelands with herbicides applied in fall.

Materials and Methods

A field study was conducted in Ashwood, Oregon, looking at different herbicides applied in fall for ventenata control in rangelands. The study design was a randomized complete block design with four replications. Plot size was 10 ft wide by 30 ft long. The treatments consisted of imazapic (Plateau®), propoxicarbazone sodium (Canter R+P®) and sulfosulfuron (Outrider®). Herbicide efficacy was determined by visual evaluation six months after the application, in the spring of 2013. Herbicides were applied with a backpack sprayer calibrated to deliver 20 gallons of spray solution per acre at 40 psi pressure using XR 8002 Teejet® nozzles. Application date and environmental conditions are detailed in Table 1. Herbicide rates and adjuvants are detailed in Table 2.

Results and Discussion

Ventenata control differed between treatments with high levels of control recorded with Plateau® at 6 oz/acre (91 percent), and Outrider® at 2 oz/acre (94 percent) when applied in fall. Ventenata control was poor with Canter R+P® at 1.2 oz/acre, and Outrider® at 1 oz/acre. Results from this study suggest that fall applications of Plateau® and Outrider® can be useful tools as part of integrated program for ventenata control in rangelands. Further evaluations are necessary to evaluate the performance of these treatments under different environmental conditions and application timings.

Acknowledgments

The authors would like to thank Floyd Paye for his collaboration on this project.

Table 1. Application date, environmental conditions, for all application timings.

Application Date	11/3
Time of Day	9 AM
Air temperature (F)	48
Relative Humidity (%)	42
Wind Speed (MPH)	4
Wind Direction	S

Table 2. Ventenata percent control compared to the untreated checks, 180 days after the last application.

	Treatment[1]	Rate	Unit	% Control[2]	
1	Plateau®	6	oz/acre	91	a
2	Canter R + P®	1.2	oz/acre	30	b
3	Outrider®	1	oz/acre	35	b
4	Outrider®	2	oz/acre	94	a
7	Untreated Check			0	c
	LSD (P=.05)			9	

[1]Some treatments included in the study were used for experimental purposes and are NOT currently labeled for public use. Before using an herbicide, make sure it is properly labeled for the intended use.
[2]Means among columns followed by the same letter are not different at P=0.05.

Diffuse Knapweed Control with Herbicides Containing Aminocyclopyrachlor

Gustavo Sbatella and Sasha Twelker

Abstract

Diffuse knapweed (*Centaurea diffusa*) is an invasive weed species found infesting grasslands, forests, right-of-ways, and rangelands in central Oregon. Aminocyclopyrachlor is a growth regulator herbicide developed by DuPont Crop Protection® that has shown to be effective at controlling a broad range of annual and perennial broadleaf weeds. A field study was initiated in the spring of 2012 near Antelope, Oregon to evaluate the efficacy of using aminocyclopyrachlor when combined with a sulfonylurea or other growth regulator to control diffuse knapweed. The final evaluation performed 365 days after the application showed excellent diffuse knapweed control with aminocyclopyrachlor combined with a sulfonylurea or 2, 4-D.The level of control was comparable to the control provided by Milestone® which was used as the standard.

Introduction

Diffuse knapweed is a member of the sunflower family that usually grows as biennial, but can also grow as an annual or a short-lived perennial. Plants grow 1 to 2 feet in height, are prolific seed producers and prefer semi-arid to arid conditions. Diffuse knapweed can become tumbleweed when it dries allowing seeds to disperse over long distances. This effective mechanism of seed dispersal explains why diffuse knapweed is found infesting a variety of environments including grasslands, forests, right-of-ways, and rangelands where it can out-compete native vegetation. Aminocyclopyrachlor is a growth regulator herbicide developed by DuPont Crop Protection® that has shown to be effective controlling a broad range of annual and perennial broadleaf weeds. The objective of this study was to evaluate diffuse knapweed control efficacy of aminocyclopyrachlor when combined with a sulfonylurea or other growth regulator.

Materials and Methods

A field study was conducted near Antelope, Oregon during 2012, in a section of rangeland infested with diffuse knapweed. The study design was a randomized complete block design with four replications. Plot size was 10 ft wide by 30 ft long. The area of study was fenced to avoid cattle trample in the plots. Herbicides were applied when diffuse knapweed was at the rosette stage with a backpack sprayer calibrated to deliver 20 gallons of spray solution per acre at 40 psi pressure using XR 8002 Teejet® nozzles. Application date, environmental conditions, weed growth stage are detailed in Table 1. Herbicides included in the study included aminocyclopyrachlor + chlorsulfuron (Perspective®), aminocyclopyrachlor + 2, 4-D ester and aminopyralid (Milestone®) as the comparison standard. Herbicide rates and spray adjuvants are detailed in Table 2. Herbicide efficacy was evaluated 60, 90 and 365 days after treatment (DAT).

Results and Discussion

The 60 and 90 DAT evaluations showed a high level of diffuse knapweed control with the majority of the treatments, but the lowest control was recorded with Perspective® at 2.5 oz/acre (Table 2). The difference in control with Perspective® at the lower rate was significantly lower when compared to the rest of the treatments during the first growing season after the application. The final evaluation performed in spring of 2013, a year after the applications showed an excellent diffuse knapweed control with all treatments. These results indicate that aminocyclopyrachlor when combined with a sulfonylurea or 2, 4-D can provide excellent diffuse knapweed in central Oregon.

Acknowledgments

The authors would like to thank Norm McKinley from DuPont Crop Protection® for supporting this project and Mary and Lowell Forman for their collaboration on the project.

Table 1. Application dates, environmental conditions, and diffuse knapweed growth stage at time of application.

Application Date	4/18/2012
Time of Day	1:00 pm
Air Temperature (F)	55
Relative Humidity (%)	50
Wind Speed (MPH)	11
Wind Direction	W
Weeds Heights	Rosette

Table 2. Diffuse knapweed percent control compared to the untreated check, 60, 90 and 365 days after treatment.

	Treatment[123]		Rate	60 DAT		90 DAT		365 DAT	
1	Perspective®	2.5	oz/acre	93	b	92	b	98	a
	NIS	0.25	% v/v						
2	Perspective®	4.5	oz/acre	98	a	98	a	98	a
	NIS	0.25	% v/v						
3	Aminocyclopyrachlor	4	fl oz/acre	98	a	98	a	98	a
	2,4-D Ester	1	pt/acre						
	NIS	0.25	% v/v						
4	Aminocyclopyrachlor	8	fl oz/acre	97	a	96	a	98	a
	2,4-D Ester	2	pt/acre						
	NIS	0.25	% v/v						
5	Milestone®	7	fl oz/acre	98	a	98	a	98	a
	NIS	0.25	% v/v						
6	Untreated Check			0	c	0	c	0	b
	LSD (P=.05)			3		4		0.1	

[1]Some treatments included in the study were used for experimental purposes and are NOT currently labeled for public use. Before using an herbicide, make sure is properly labeled for the intended use.
[2]Abbreviations: DAT - Days After Treatment; NIS - Non Ionic Surfactant.
[3]Means followed by the same letter are not significantly different.

Spotted Knapweed Control with Herbicides Containing Aminocyclopyrachlor, 2013

Gustavo Sbatella and Sasha Twelker

Abstract

Spotted knapweed (*Centaurea maculosa*) is an invasive weed species that spreads rapidly and aggressively invading pasture, rangeland and fallow land. Aminocyclopyrachlor is a growth regulator herbicide developed by DuPont Crop Protection® that has shown to be effective at controlling a broad range of annual and perennial broadleaf weeds. A field study was initiated in spring of 2012 near Madras, Oregon to evaluate the efficacy of using aminocyclopyrachlor when combined with a sulfonylurea (Perspective®) or other growth regulator at different rates to control spotted knapweed. Evaluations performed in spring of 2013, a year after the application showed excellent spotted knapweed control with Perspective® at 4.5 oz/acre, aminopyralid + 2, 4-D at 4 or 8 fl oz/acre similar to Milestone applied at 7 fl oz/acre.

Introduction

Spotted knapweed is a biennial or short-lived perennial member of the sunflower family. This invasive weed species spreads rapidly and aggressively invading pasture, rangeland and fallow land. Spotted knapweed is a prolific seed producer and the seeds can remain viable in the soil for more than five years, becoming the seed source for re-infestations after vegetative plants have been eliminated. Plant roots also exudates allelophatic compounds that affect the growth of desirable vegetation. Aminocyclopyrachlor is growth regulator herbicide developed by DuPont Crop Protection® that has shown to be effective controlling a broad range of annual and perennial broadleaf weeds. The objective of this study was to evaluate spotted knapweed control efficacy of aminocyclopyrachlor when combined with a sulfonylurea or other growth regulator.

Materials and Methods

A field study was initiated 6 miles northwest of Madras, Oregon during 2012, in non-crop land infested with spotted knapweed. The study design was a randomized complete block with 4 replications. Plot size was 10 ft wide by 30 ft long. Herbicides were applied when spotted knapweed was at the rosette stage, with a backpack sprayer calibrated to deliver 20 gallons of spray solution per acre at 40 psi pressure using XR 8002 Teejet® nozzles. Application date, environmental conditions and weed growth stage are detailed in Table 1. Herbicides included in the study included aminocyclopyrachlor + chlorsulfuron (Perspective®), aminocyclopyrachlor + 2, 4-D ester and aminopyralid (Milestone®) as the comparison standard. Herbicide rates and spray adjuvants are detailed in Table 2. Herbicide efficacy was evaluated 60, 90 and 365 DAT.

Results and Discussion

The 60 and 90 DAT evaluations indicated similar levels of spotted knapweed control among the tested treatments with the exception of Perspective® applied at 2.5 oz/acre. Control with this treatment was the lowest and ranged between 80 and 83 percent (Table 2). A year after the application, a high level of spotted knapweed control persisted with aminopyralid + 2, 4-D at 4 or 8 fl oz/acre and Milestone at 7 fl oz/acre. Control with Perspective® at 2.5 oz/acre 365 DAT was 72 percent, but control significantly improved when the application rate was increased to 4.5 oz/acre. These results suggest that aminocyclopyrachlor when combined with a sulfonylurea at the highest tested rate or 2, 4-D can effectively control spotted knapweed in central Oregon.

Acknowledgments

The authors would like to thank Norm McKinley from DuPont Crop Protection® for supporting this project and Mr. Floyd Paye for his collaboration on the project.

Table 1. Application dates, environmental conditions, and spotted knapweed growth stage at time of application.

Application Date	5/8/2012
Time of Day	11:00 am
Air Temperature (F)	66
Relative Humidity (%)	48
Wind Speed (MPH)	3
Wind Direction	NNW
Growth Stage	Rosette

Table 2.Spotted knapweed percent control compared to the untreated check, 60, 90 and 365 days after treatment.

	Treatment[123]		Rate	60 DAT		90 DAT		365 DAT	
1	Perspective®	2.5	oz/acre	80	b	83	b	72	b
	NIS	0.25	% v/v						
2	Perspective®	4.5	oz/acre	94	a	97	a	91	a
	NIS	0.25	% v/v						
3	Aminocyclopyrachlor	4	fl oz/acre	98	a	97	a	95	a
	2,4-D Ester	1	pt/acre						
	NIS	0.25	% v/v						
4	Aminocyclopyrachlor	8	fl oz/acre	99	a	98	a	98	a
	2,4-D Ester	2	pt/acre						
	NIS	0.25	% v/v						
5	Milestone®	7	fl oz/acre	98	a	98	a	97	a
	NIS	0.25	% v/v						
6	Untreated Check			0	c	0	b	0	b
	LSD (P=.05)			5		8		13	

[1]Some treatments included in the study were used for experimental purposes and are NOT currently labeled for public use. Before using an herbicide, make sure is properly labeled for the intended use.
[2]Abbreviations: DAT, Days After Treatment; NIS, Non Ionic Surfactant.
[3]Means followed by the same letter are not significantly different.

Canada Thistle Control with Herbicides Containing Aminocyclopyrachlor

Gustavo Sbatella and Sasha Twelker

Abstract

Canada thistle (*Cirsium arvense*) plants can grow 10 to 12 feet in a season, spreading fast in circular patches and reducing forage for animals. Aminocyclopyrachlor is a growth regulator herbicide developed by DuPont Crop Protection® that has shown to be effective at controlling a broad range of annual and perennial broadleaf weeds. A field study was conducted near Madras, Oregon to evaluate the efficacy of using aminocyclopyrachlor when combined with a sulfonylurea or other growth regulator to control Canada thistle. Final evaluations performed 365 days after the application indicate that aminocyclopyrachlor, when combined with a sulfonylurea or 2, 4-D, can effectively control Canada thistle, providing a new alternative for control in central Oregon.

Introduction

Canada thistle is a noxious perennial weed that can be found infesting crops, pastures, rangeland, roadsides and non-crop areas. Canada thistle is difficult to control once established because of its capability of reproducing by seeds or by rhizomes. Thistle plants can grow 10 to 12 feet in one season, in fast spreading circular patches. In pastures and rangelands, Canada thistle reduces forage available for animals. Aminocyclopyrachlor is a growth regulator herbicide developed by DuPont Crop Protection® that has shown to be effective at controlling a broad range of annual and perennial broadleaf weeds. The objective of this study was to evaluate the Canada thistle control efficacy of aminocyclopyrachlor when combined with a sulfonylurea or other growth regulator.

Materials and Methods

A field study was initiated six miles northwest of Madras, Oregon during 2012, on non-crop land infested with Canada thistle. The study design was a randomized complete block with four replications. Plot size was 10 ft wide by 30 ft long. Herbicides were applied at thistle bolting, with a backpack sprayer calibrated to deliver 20 gallons of spray solution per acre at 40 psi pressure using XR 8002 Teejet® nozzles. Application date, environmental conditions, and weed growth stage are detailed in Table 1. Herbicides used in the study included aminocyclopyrachlor + chlorsulfuron (Perspective®), aminocyclopyrachlor + 2, 4-D ester, and aminopyralid (Milestone®) as the comparison standard. Herbicide rates and spray adjuvants are detailed in Table 2. Herbicide efficacy was evaluated 60, 90, and 365 days after treatment (DAT).

Results and Discussion

High levels of thistle control were observed for all treatments with values of 92 percent and up 60 and 90 DAT (Table 2). The 90 DAT evaluations showed thistle control with Perspective® or aminocyclopyrachlor with 2, 4-D ester applied at the highest rate performed similarly to Milestone®, which was used as the standard. Canada thistle control 365 DAT remained high and was excellent with all treatments. The minor differences in control recorded the previous year between rates were no longer evident in 2013. These study suggest that aminocyclopyrachlor, when combined with a sulfonylurea or 2, 4-D ester has the potential to effectively control Canada thistle in central Oregon.

Acknowledgments

The authors would like to thank Norm McKinley from DuPont Crop Protection for his support and Floyd Paye for his collaboration on the project.

Table 1. Application dates, environmental conditions, and thistle growth stage at time of application.

Application Date	6/21/2012
Time of Day	9:00 am
Air Temperature (F)	63
Relative Humidity (%)	50
Wind Speed (MPH)	3
Wind Direction	NNW
Weed Growth Stage	Bud Stage

Table 2. Canada thistle percent control compared to the untreated check, 60, 90 and 365 days after treatment.

	Treatment[123]		Rate	60 DAT		90 DAT		365 DAT	
1	Perspective®	2.5	oz/acre	93	a	92	a	97	a
	NIS	0.25	% v/v						
2	Perspective®	4.5	oz/acre	97	a	97	a	98	a
	NIS	0.25	% v/v						
3	Aminocyclopyrachlor	4	fl oz/acre	93	a	94	a	98	a
	2,4-D Ester	1	pt/acre						
	NIS	0.25	% v/v						
4	Aminocyclopyrachlor	8	fl oz/acre	96	a	96	a	98	a
	2,4-D Ester	2	pt/a						
	NIS	0.25	% v/v						
5	Milestone®	7	fl oz/acre	98	a	98	a	98	a
	NIS	0.25	% v/v						
6	Untreated Check			0	b	0	b	0	b
	LSD (P=.05)			5		6		0.7	

[1]Some treatments included in the study were used for experimental purposes and are NOT currently labeled for public use. Before using an herbicide, make certain is it properly labeled for the intended use.
[2]Abbreviations: DAT - Days After Treatment; NIS - Non Ionic Surfactant.
[3]Means among columns followed by the same letter are not different at P=0.05.

Whitetop (*Cardaria draba*) Control with Aminopyralid Tank Mixes

Gustavo Sbatella and Sasha Twelker

Abstract

The aggressive nature of Whitetop (*Cardaria draba)* allows it to outcompete and displace native species. Chemical control of this perennial weed depends on the type of herbicide used and the plant's growth stage at the time of application. Often, one herbicide application is not enough to completely control its spread. This central Oregon study evaluates the efficacy of using aminopyralid tank mixes for control of Whitetop. Whitetop control observed 60 days after treatment (DAT) were satisfactory, Whitetop control with Opensight® + Escort® and Perspective® was above 90 percent. A year after the applications Whitetop control had declined with all treatments. Whitetop control was 92 percent with Perspective at 3.3 oz/acre, while the lowest control was with Milestone at 7 oz/acre + Telar at 1 oz/acre. Dry conditions extended during the duration of the study affecting the soil activity of some of the herbicides and limiting the long term control of Whitetop.

Introduction

Whitetop is a perennial weed member of the mustard family. Plants have an aggressive growth pattern and reproduce by seed or spread by rhizomes. It is found growing in open, moist, sunny areas, in pastures, rangeland, ditch banks, roadsides and waste areas. The aggressive nature of this plant allows it to outcompete and displace native species. Chemical control of Whitetop depends on the type of herbicide used and the plant's growth stage at the time of application. Since it is a perennial weed, often one herbicide application will not completely control Whitetop. Aminopyralid is a growth regulator herbicide developed by Dow AgroSciences® for control of broadleaf weeds on grassland. Aminopyralid is effective in controlling numerous invasive species particularly among the asteracea (sunflower) family. The objective of this study was to evaluate the efficacy of aminopyralid tank mixes for Whitetop control.

Materials and Methods

A field study was initiated 14 miles northeast of Madras, Oregon during 2012 in rangeland infested with Whitetop. The study design was a randomized complete block with 4 replications. Plot size was 10 ft wide by 30 ft long. Herbicides were applied at bloom stage, using a backpack sprayer calibrated to deliver 20 gallons of spray solution per acre at 40 psi pressure using XR 8002 Teejet® nozzles. Application date, environmental conditions and weed growth stage are detailed in Table 1. Herbicides included in the study included aminopyralid + metsulfuron (Opensight®), metsulfuron (Escort®), chlorsulfuron (Telar®), aminopyralid (Milestone®), and aminocyclopyrachlor + chlorsulfuron (Perspective®). Herbicide rates and spray adjuvants are detailed in Table 2. Herbicide efficacy was evaluated 60, 180 and 365 days after treatment (DAT).

Results and Discussion

Levels of Whitetop control observed 60 DAT should be considered satisfactory, taking into consideration the limited amount of precipitation recorded after the application. Under these conditions, Whitetop control 60 DAT with Opensight® + Escort® and Perspective® was above 90 percent (Table 2). Control with the rest of the treatments ranged between 84 and 89 percent. Whitetop control recorded 180 DAT was similar or slightly higher than at 60 DAT for all treatments, with the exception of Telar at 1 oz/acre and Telar with Milestone at 0.7 and 5 oz/acre where control was lower, 80 and 69 percent respectively. A year after the applications, Whitetop control had declined with all treatments. The highest control recorded during this evaluation was with Perspective at 3.3 oz/acre (92 percent), while the lowest control was with Milestone at 7 oz/acre + Telar at 1 oz/acre. Dry conditions extended during the duration of the study possibly affecting the soil activity of some of the herbicides and limiting the long term control of Whitetop. Results suggest that under these conditions a second application may be necessary to achieve a higher level of control.

Acknowledgments

The authors will like to thank Vanelle Peterson from Dow AgroSciences® for supporting this project. Mr. Floyd Paye and Mr. Floyd Bauer for their collaboration on the project.

Table 1. Application dates, environmental conditions, and Whitetop growth stage at time of application.

Application Date	5/10/2012
Time of Day	3:00 pm
Air Temperature (F)	57
Relative Humidity (%)	15
Wind Speed (MPH)	6
Wind Direction	NNE
Weed Growth Stage	Bloom

Table 2. Whitetop percent control compared to the untreated check, 60, 180 and 365 days after treatment.

	Treatment[1,2]	Rate		60 DAT	180 DAT	365 DAT
1	Opensight®	3.3	oz./acre	89 a	89 a	80 ab
	NIS	0.25	% v/v			
2	Opensight®	3.3	oz./acre	89 a	91 a	79 ab
	SYL-TAC®	4	fl oz/a			
3	Escort®	1	oz./acre	85 a	96 a	81 ab
	NIS	0.25	% v/v			
4	Opensight®	3.3	oz./acre	91 a	98 a	81 ab
	Escort®	0.5	oz/a			
	NIS	0.25	% v/v			
5	Telar®	1	oz./acre	85 a	80 b	76 b
	NIS	0.25	% v/v			
6	Milestone®	5	fl oz./acre	86 a	69 c	79 ab
	Telar®	0.7	oz./acre			
	NIS	0.25	% v/v			
7	Milestone®	7	fl oz./acre	84 a	92 a	74 b
	Telar®	1	oz./acre			
	NIS	0.25	% v/v			
8	Perspective®	3.3	oz/acre	94 a	98 a	92 a
	NIS	0.25	% v/v			
9	Untreated Check			0 b	0 d	0 d

[1]Some treatments included in the study were used for experimental purposes and are NOT currently labeled for public use. Before using an herbicide, make sure is properly labeled for the intended use.
[2]Abbreviations: DAT - Days After Treatment - NIS, Non Ionic Surfactant.

Use of Herbicides for Control of Western Juniper (*Juniperus occidentalis*) in Early Stages of Sagebrush Community Encroachment

Gustavo Sbatella and Sasha Twelker

Abstract

The objective of this study is to determine if herbicides can provide an effective way to control Western Juniper in sagebrush communities in the early stages of encroachment. For this purpose two field studies on a randomized complete block with four replications are been conducted near Prineville, Oregon. Each plot consists of ten trees with height no larger than six feet tall. In a first study the active ingredients picloram, fluroxypyr, aminocyclopyrachlor, metsulfuron, triclopyr, imazapyr and glyphosate were tested with a foliar coverage application. Evaluations performed 120 days after treatment (DAT), showed that picloram (98 percent), picloram + fluroxypyr (98 percent) and glyphosate + imazapyr (93 percent) were the treatments with the highest percent of Western juniper tree damage. Lower levels of damage were observed when aminocyclopyrachlorwas combined with metsulfuron (78 percent) or with triclopyr (86 percent). In the second study picloram, hexazinone, aminocyclopyrachlor and triclopyr were tested with spot and basal bark as applications methods. The highest level of tree damage was recorded with picloram when applied either as spot treatment (90 percent) or as basal bark (98 percent). Tree damage with spot application of hexazinone was 67 and 70 percent for aminocyclopyrachlor plus triclopyr when applied as a basal bark treatment. These levels of herbicide damage observed in the Western juniper trees only 120 DAT are to be considered highly satisfactory independently of active ingredient or application method. Further evaluations are programmed for next year that will provide more definitive conclusions regarding treatment performance.

Introduction

The range of Western Juniper has dramatically expanded since the late 1800’s, occupying 3.7 million acres in Oregon (Miller et al. 2005). Once Western Juniper becomes established in a community, it competes with the native vegetation for space, light, and nutrients; more importantly, however, it uses a tremendous amount of water that is no longer available to the existing native plant communities. In regions of low annual precipitation such as central and eastern Oregon, water use and interception by the Western Juniper has a dramatic effect on the amount of water available for other species (Barrett, 2007). As result of the diminished supply available to the dominant plant community, the existing shrubs, grasses, and forbs are significantly reduced. The change in composition of the existing plant community has a correspondingly negative effect on the livestock and wildlife that depend on them. The encroachment of sagebrush plant communities by Western Juniper is an important factor contributing to the degradation of the sage grouse habitat. Western Juniper not only competes for water with existing plants, but also provides perches for the bird species that prey on sage grouse, further negatively affecting survival, productivity, and recruitment.

There are three distinct stages in the encroachment of juniper into sagebrush communities (Miller et al. 2005). In phase I, the Western Juniper trees are generally less than six feet tall, and shrubs and grasses persist as the dominant species. In phase II, Juniper trees are co-dominant with shrubs and grasses, and by the end of this phase the percent area cover by Western Juniper can reach 20 percent. In phase III, Western Juniper trees are dominant and dictate the ecological process affecting the plant community. This phase is characterized by dramatic decline in the species richness of the understory. Control of Western Juniper in phase I of the encroachment is critical because the negative impacts on the plant community are still minimal. The reestablishment of plant communities in phases II or III of the Western Juniper is much more costly.

Options for Western Juniper control in phase I include mechanical removal (chainsaw, machinery) prescribed fire, and herbicides (Barrett, 2007). One advantage offered by the application of herbicides is that large areas can be treated quickly, but the use of herbicides for Western Juniper control to date has been limited. Currently there is little or no information regarding the effectiveness of active ingredients such as metsulfuron, triclopyr, imazethapyr, hexazinone and aminocyclopyrachlor for Western Juniper control in central Oregon.

The objective of this study is to determine if herbicides might provide an effective way to control Western Juniper in sagebrush communities in the early stages of encroachment.

Materials and Methods

A study is being conducted 8 miles east of Prineville, Oregon, on a site currently in phase 1 of Western juniper encroachment. Foliar coverage and spot-basal bark herbicide applications techniques are been tested in two separate studies. Each study was designed as a randomized complete block design replicated four times with a total of 10 Western juniper trees in each plot. Individual trees were tagged for identification and height, trunk and foliage diameters at the base of the tree were measured. Herbicides in the foliar application study were applied with a single nozzle backpack sprayer calibrated to deliver 20 gallons of spray solution per acre at 40 psi pressure using XR 8002 Teejet® nozzles. In the spot-basal bark study, herbicides were applied using a spot gun with an adjustable graduated cylinder for the spot applications and a single nozzle backpack sprayer for the basal bark applications. In this last study mechanical removal was included as a treatment for comparison. Application dates and environmental conditions are detailed in Table 1. Active ingredients tested in the foliar application study include: picloram, fluroxypyr, aminocyclopyrachlor, metsulfuron, triclopyr, imazapyr and glyphosate, rates and adjuvants are detailed in Table 2. Active ingredients tested in the spot-basal application study include: picloram, hexazinone, aminocyclopyrachlor and triclopyr, rates and adjuvants are detailed in Table 3. Treatments were visually evaluated for foliar chlorosis 120 days after treatment (DAT) on a scale of 0 no injury to 100 total chlorosis.

Data was subject to ANOVA using the GLM procedure from SAS. Means were separated using Fischer's Protected LSD test at a 0.05.

Results and Discussion

Foliar coverage application: The visual evaluation performed in the fall of 2013, 120 DAT, showed that the highest percent of foliar chlorosis on Western juniper trees was recorded with applications of picloram (98 percent), picloram + fluroxypyr (98 percent) and glyphosate + imazapyr (93 percent). Lower levels of chlorosis were observed when aminocyclopyrachlorwas combined with metsulfuron (78 percent) or with triclopyr (86 percent). These levels of herbicide damage observed in the Western juniper trees only 120 DAT are to be considered highly satisfactory, even for the treatments that included aminocyclopyrachlor,which is a more slowly acting active ingredient. The need of enough spray volume to obtain a good foliar coverage, the spraying time required to ensure a good coverage and the risk of accidental exposure for the applicator are factors to be considered with this application method.

Spot-basal bark application: The highest percent of foliar chlorosis on Western juniper trees was recorded when picloram was applied either as spot treatment (90 percent) or as basal bark (98 percent). Tree chlorosis with spot application of hexazinone was 67 percent. This active ingredient requires moisture for soil incorporation and plant uptake; therefore these initial levels of chlorosis are high if we take in account the limited amount of moisture available after the application. Tree chlorosis when aminocyclopyrachlor was combined with triclopyr was 70 percent. The same consideration as the foliar treatment should be made for the basal bark application of aminocyclopyrachlor in regards to the speed on which the molecule acts. The advantages of using the spot or basal bark application method are that high volumes of spray solutions are not required, the exposure for the applicator is minimal and numerous trees can be sprayed in a relative short period of time.

Acknowledgments

The authors would like to thank the Oregon Beef Council for funding this project. We would also like to thank Dr. Tim Deboodt for his collaboration on this project.

Literature Cited

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Miller, R. F., J. D. Bates, T. J. Svejcar, F. B. Pierson and L. E. Eddleman. 2005. Biology, Ecology and Management of Western Juniper. Oregon State University.Technical Bulletin 152.

Table 1. Application dates and environmental conditions for the herbicide applications.

	Foliar	Spot-basal
Application Date	6/22/2013	6/21/2013
Time of Day	8:00 am	10:00 am
Air Temperature (F)	49	52
Relative Humidity (%)	78	68
Wind Speed (MPH)	3	5
Wind Direction	W	NW

Table 2. Herbicides applied as foliar coverage for Western juniper control and percent chlorosis recorded 120 DAT.

	Treatment[1]	Rate	Unit	Chlorosis[2]	
1	Picloram	4	qt/100 gal	98	a
	Syl-Tac	0.5	% v/v		
2	Picloram + fluroxypyr	6	fl oz./acre	98	a
	Syl-Tac	0.5	% v/v		
3	Aminocyclopyrachlor + metsulfuron	3	qt/acre	76	c
	MSO	1	% v/v		
4	Aminocyclopyrachlor + triclopyr	3	fl oz./acre	86	b
	MSO	1	% v/v		
5	Imazapyr + Glyphosate	1 + 5	% v/v	93	ab
	COC	1	% v/v		
6	Untreated Check	1	lb./acre	0	d
	LSD (P=.05)			8	

[1]Abbreviations: methylated seed oil, MSO; crop oil concentrate, COC.
[2]Means followed by different letters are significantly different at p=0.05

Table 3. Herbicides applied as spot-basal bark applications for Western juniper control and percent chlorosis recorded 120 DAT.

	Treatment[1]	Rate	Unit	Chlorosis[2]	
1	Picloram	0.2	fl oz./ tree	90	a
2	Picloram	20	% v/v	98	a
	NIS	0.5	% v/v		
3	Hexazinone	0.13	fl oz./ ft. height	67	b
4	Aminocyclopyrachlor	5	% v/v	70	b
	Triclopyr	15	% v/v		
5	Untreated Check	1 + 5	% v/v	0	c
	LSD (P=.05)			11	

[1]Abbreviations: non-ionic surfactant, NIS.
[2]Means followed by different letters are significantly different at p=0.05

COARC Research Garden and Learning Center, 2013

Carol Tollefson, Linda Samsel, Marvin Butler

Abstract

The Central Oregon Agricultural Research and Learning Center is an ongoing project in its 7th year of production. The garden provides a hands-on teaching location for local outreach, community programs, and K-12 science field trips. In addition to local programming, the garden provides an opportunity for local OSU Master Gardeners to work and provide services to the local community.

Introduction

The Central Oregon Agricultural Research Garden and Learning Center was established in 2008 on a half-acre parcel of land located at the entrance to the Central Oregon Agricultural Research Center (COARC). The garden provides an opportunity for COARC and central Oregon Extension programming to extend services and opportunities to the local community in addition to the agricultural community. The garden includes woody ornamental, herbaceous perennials, ornamental grasses, fruit trees and raised garden beds. Garden signs throughout the garden display specific plant species and other information, including: common name, botanical name, plant height, width, water usage and sun/shade needs.

Events and Activities

Seeds of Science

As part of an ongoing partnership with the Jefferson County School District and Oregon Open Campus, COARC hosted approximately 150 fifth-grade students from the Jefferson County 509J School District. Students were provided with opportunities to learn about Bird Habitat and Ecology, Bee’s, The Importance of Pollinators in Agriculture, Worms and Composting, Beneficial Insects and Seed Biology at individual teaching stations located in the garden. In addition, students participated in planting a vegetable garden. Staff at COARC maintained and harvested the vegetable garden, donating all vegetables grown to a local charity.

Pruning Class

During spring of 2013, COARC hosted a two and a half hour pruning class. The class consisted of one hour of classroom instruction and one and a half hours of hands instruction in the garden. In the classroom section, participants were provided with opportunities to learn why and when they should prune along with basic pruning principles. During the hands on section, participants split into small groups and actively pruned and observed pruning techniques for ornamental trees and fruit trees along with berries, shrubs and low growing plants under the guidance of Master Gardeners and COARC staff.

Kids Club
COARC hosted Jefferson County Kids Club summer agricultural camp participants for a field trip. During the fieldtrip, COARC staff presented information about the research center, agriculture equipment, worms and composting, the on-site weather station and invasive weed species.

Master Gardeners
The Central Oregon Master Gardener program serves Crook, Deschutes and Jefferson Counties. This gives Jefferson County the benefits associated with a tri-county Master Gardener Program, including increased participation from Master Gardeners from outside Jefferson County. The Master Gardener Program is a voluntary, educational program which trains volunteers in the basics of designed botany and entomology; integrated pest management and pesticide safety; soils, fertilizers and composting; ornamental, herbaceous plants and woody plants; vegetable, indoor and container gardening; sustainable landscaping; and plant pathology. Master Gardeners are available at the Central Oregon Agricultural Research Center weekly throughout the spring and summer months. Volunteers are available to provide informational and technical assistance and to answer questions from the local community in gardening and horticulture. Additionally, volunteers identify insects and diseases based upon sample submissions from the community. For those interested in volunteering or for more information about the Master Gardener program, more information is available at: http://extension.oregonstate.edu/deschutes/horticulture/mg

Future Plans

Goals
During 2014, COARC will continue to develop the Central Oregon Agricultural Research Garden and Learning Center as an outdoor laboratory to engage in teaching, research and conservation. COARC plans to offer two gardening classes and will host two field trips during 2014, including the Seeds of Science field trip which is planned for expansion to the Culver School District. In addition, during 2014 COARC will partner with the Jefferson County Kids Club to form a year-round agriculture club. This will allow youth to learn about local and regional agriculture along with gardening and the inputs that go into both agriculture and gardening. The garden will also continue to provide educational opportunities for the public through hands on learning, exhibits and classes in addition to other agriculture and gardening experiences.

JeffCoSeed.com Website and Crop Sign Project, 2013

Carol Tollefson, Katie Ralls, Linda Samsel

Abstract

The JeffCoSeed.com website and crop sign project was launched in June, 2013. The JeffCoSeed website and crop sign project is a cooperative venture between the Central Oregon Agricultural Research Center (COARC) and the Jefferson County Seed Growers Association to educate the public about local agriculture. The project includes placement of 24 crop signs on various fields throughout Jefferson County. The signs list the crop name, the JeffCoSeed.com website, economic value of agriculture in central Oregon and a QR code to scan with a smartphone linking to the website. The website includes pages offering information about the significance of various specialty and other crops in central Oregon, the importance of burning and smoke management and testimonials by local farmers and their families, In addition, there is a Farm Fair page allowing for online vendor sign-ups. The website allows the Seed Council to communicate with the local community and to provide vital information and updates to the local community and those traveling through the area. The goal of this project is to educate the community and tourists traveling through central Oregon about local, high value agricultural crops and their economic value to central Oregon.

Introduction

The JeffCoSeed.com website and crop sign project was launched in June 2013. The project is a cooperative venture between COARC and the Jefferson County Seed Growers Association to educate the public about local agriculture. The project includes placement of 24 crop signs on various fields throughout Jefferson County. The signs list the crop name, the JeffCoSeed.com website, economic value of agriculture in central Oregon and a QR code to scan with a smartphone linking to the website. The website also includes a page with a map showing the location of the crop signs and what is planted in the marked fields. This ongoing project provides the Jefferson County Seed Council a platform to educate the community and tourists about local, high value agricultural crops and their economic value to central Oregon.

Google Analytics

Analysis of Google Analytics Reports from June - December 31, 2013 show the website had 408 unique visitors and 525 overall visitors. In September, 2013 the site showed the heaviest traffic with 80 unique and 98 overall visitors. Traffic on the website has remained consistent through the winter season with 62 unique and 81 overall visitors to the site during December, 2013.

Traffic to the website includes visitors from 20 different countries in addition to the United States. The highest number of visits comes from within the state of Oregon, with the majority of traffic from outside of central Oregon. Data indicates increases in website traffic during September and December, which may correspond with increased traffic in central Oregon around holidays.

Future Plans

COARC will continue to maintain the JeffCoSeed crop signs, moving them from harvested fields and resetting them to newly planted fields. This will allow a continual educational opportunity to the local community and tourists to central Oregon. The website is maintained by COARC and will continue to be used to communicate the value of local agriculture as well as special events and opportunities such as the Central Oregon Farm Fair and Trade Show that is held each February in Madras, Oregon. During 2014, COARC will print bookmarks displaying the JeffCoSeed.com website and QR code for distribution at local visitor centers and seed companies.

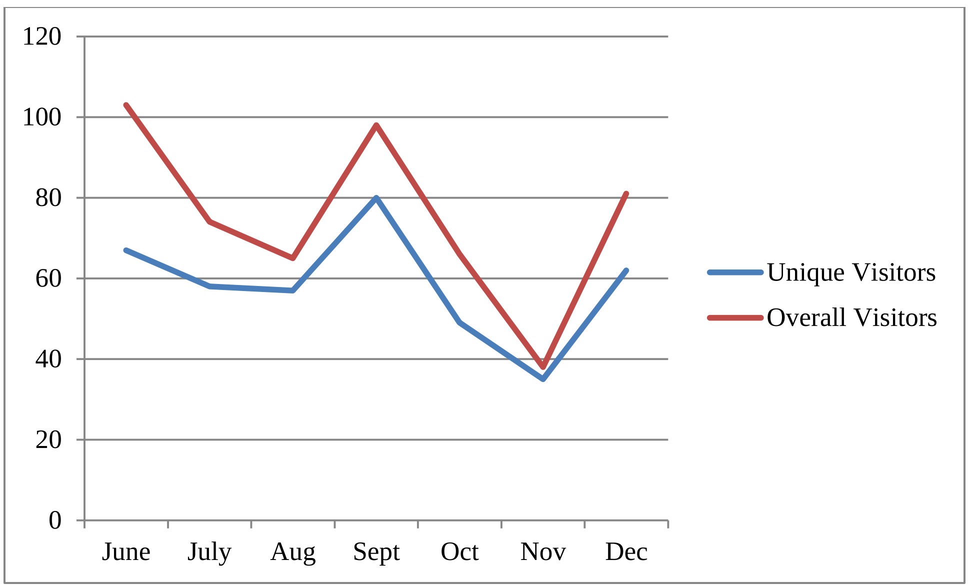

Figure 1. Unique and Overall Visitors June-Dec, 2013

Pilot Balloon Observations, 2013
Jefferson County Smoke Management

Linda Samsel and Marvin Butler

Abstract

Pilot Balloon (Pibal) 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. Pibals are used to track upper level wind direction and speed. Pibals are released daily from the Central Oregon Agricultural Research Center (COARC) between 10:30 am and 3:30 pm. Pibal releases at potential burn sites allow for more accurate decision-making under marginal conditions. The Pibal is essential in minimizing adverse smoke impacts on local communities.

Introduction

The Pibal program began in 1998, and incorporates the weather balloon data into information the Jefferson County Smoke Management Coordinator receives from the Oregon Department of Agriculture (ODA) Weather Center. Pibal data compiled with Real-Time Weather Data, courtesy of the US Bureau of Reclamation AgriMet Network, can be found on the Jefferson County Smoke Management website. The objective is to provide real time wind patterns, wind speed and wind direction information for the Smoke Management Coordinator to determine whether burning will be allowed.

Materials and Methods

During the field-burning season from July 29 to September 27, 2013, daily balloon releases occurred on demand throughout the day. The release times and locations were requested daily by the Smoke Management Coordinator. Air temperature, relative humidity, and surface wind direction and speed are documented at the time of the Pibal releases using the AgriMet weather station at the Central Oregon Agricultural Research Center. Wind directions and speeds are determined at one-minute intervals for a period of ten minutes using an observation Theodolite System and a twenty-six inch diameter helium filled balloon (Pibal). The Pibal is used to verify the forecast for the upper level wind direction, speed and mixing height. The software program, Pibal Analyzer, developed by the Oregon Department of Agriculture (ODA) analyzes Pibal information, which includes three components. The first is the Pibal Sounding, a spreadsheet translating the azimuth (azimuth are angles used to define the apparent position of an object in the sky, relative to a specific observation point) and elevation readings from the wind direction and average wind speed. The second is the Hodograph, which charts the wind direction. The Profile page, the third component, graphs the wind speed. The Pibal soundings are entered into the Pibal Analyzer and transmitted to the Jefferson County Smoke Management website for the Smoke Management Program Coordinator. The Coordinator then uses this data in conjunction with the aircraft soundings and the ODA Weather Center forecast to determine the field burning status for the day.

Results and Discussion

The open field-burning season was 61 days long, with a total of 10,903 acres burned that included 3,597 acres of grass and 7,306 acres of wheat. Daily balloon releases in the late morning and throughout the day were used to refine the weather forecast; it was a valuable tool for determining the mixing height for smoke during the optimal burn times. The pibal provided the only method to detect the stable air layers. The pibal is particularly helpful on marginal burn days to assist the Smoke Management Coordinator in making the decision whether to allow burning when conditions were either changing or hard to discern. It is on these marginal days, when the conditions are unclear, that the most risk for smoke intrusion into populated areas exists. Using the pibal at the site of the potential burn prior to making the final decision was proved to be a valuable tool again during the 2013 season.

WEATHER INFORMATION: 2013 WATER YEAR, POWELL BUTTE, OREGON (SOURCE: AGRIMET)

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
AIR TEMPERATURE (°F)												
Avg. Maximum	64	52	41	43	48	55	59	69	75	87	84	73
Avg. Minimum	34	33	25	23	25	28	30	37	44	49	50	44
Mean	49	42	33	32	36	41	45	53	61	70	67	59
AIR TEMP (no. of days)												
Max. 90°F or Above	0	0	0	0	0	0	0	0	2	12	1	2
Max. 32°F or Below	0	0	0	4	7	0	0	0	0	0	0	0
Min. 32°F or Below	14	15	26	25	23	18	20	8	1	0	0	2
Min. 0°F or Below	0	0	0	0	0	0	0	0	0	0	0	0
SOIL TEMP (°F at 4 in.)												
Avg. Maximum	53	46	38	34	37	43	48	59	68	77	72	65
Avg. Minimum	51	45	37	33	36	40	45	55	64	71	68	62
SOIL TEMP (°F at 8 in.)												
Avg. Maximum	53	47	39	35	37	42	47	58	66	75	70	65
Avg. Minimum	52	46	39	34	36	41	46	58	64	72	69	64
PRECIPITATION (in.)												
Monthly Total	1.15	1.11	0.17	0.38	0.07	0.55	0.43	2.29	1.34	0.0	0.37	1.47
EVAPORATION (in.)												
Daily Avg.	0.11	0.05	0.03	0.04	0.05	0.09	0.16	0.21	0.26	0.36	0.25	0.18
WIND SPEED (mph)												
Daily Avg.	4.6	4.7	5.3	5.5	4.6	4.7	6.4	5.1	4.7	4.9	4.3	5.2
SOLAR RADIATION (langley)												
Daily Avg.	292	159	114	162	227	331	473	530	611	700	499	380
HUMIDITY (% relative humidity)												
Daily Avg.	55	73	74	64	66	63	58	57	56	35	54	60

GROWING SEASON	**Last Day Before July 15**	**First Day After July 15**	**Total Number of Days Between Temp. Mins.**
Air Temp Min.			
32°F or Below	June 14	Sept 27	105
28°F or Below	May 25	Oct. 14	142
24°F or Below	May 1	Oct. 29	181

WEATHER INFORMATION: 2013 WATER YEAR, MADRAS, OREGON (SOURCE: AGRIMET)

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
AIR TEMPERATURE (°F)												
Avg. Maximum	64	58	46	43	48	55	60	70	76	89	84	74
Avg. Minimum	37	32	25	21	26	30	32	40	46	51	52	47
Mean Temp.	50	42	34	30	36	42	47	55	61	71	68	60
AIR TEMP (no. of days)												
Max. 90°F or Above	0	0	0	0	0	0	0	0	2	14	2	2
Max. 32°F or Below	0	0	2	5	0	0	0	0	0	0	0	0
Min. 32°F or Below	10	19	26	26	25	18	13	2	0	0	0	0
Min. 0°F or Below	0	0	0	0	0	0	0	0	0	0	0	0
SOIL TEMP (°F at 4 in.)												
Avg. Maximum	58	47	39	34	40	47	56	66	73	79	73	65
Avg. Minimum	51	43	38	33	36	42	49	58	63	70	67	61
SOIL TEMP (°F at 8 in.)												
Avg. Maximum	57	48	40	35	39	46	53	64	70	76	72	65
Avg. Minimum	54	46	39	35	38	43	50	60	66	72	68	63
PRECIPITATION (in.)												
Monthly Total	0.67	1.63	2.20	0.3	0.0	0.54	0.26	0.89	0.73	0.0	1.43	1.29
EVAPORATION (in.)												
Daily Avg.	0.13	0.07	0.04	0.03	0.06	0.10	0.18	0.23	0.26	0.36	0.26	.20
WIND SPEED (mph)												
Daily Avg.	6.4	6.0	7.0	4.5	5.5	5.4	7.9	6.0	5.2	5.8	4.7	6.5
SOLAR RADIATION (langley)												
Daily Avg.	279	143	107	156	229	344	512	587	560	506	520	385
HUMIDITY (% relative humidity)												
Daily Avg.	56	81	78	76	70	64	58	57	58	37	56	62

GROWING SEASON	**Last Day Before July 15**	**First Day After July 15**	**Total Number of Days Between Temp. Mins.**
Air Temp Min.			
32°F or Below	May 25	Oct. 2	130
28°F or Below	May 1	Oct. 14	166
24°F or Below	May 1	Oct. 30	182