2004 Lassen County
Weed Research Report

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This is a report of weed control experiments field tested in Lassen County in 2004. The report includes research involving pesticides. It does not contain recommendations for their use, nor does it imply that the uses discussed herein have been registered. Pesticides must be registered by appropriate federal and state agencies before they can be recommended.

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The author would like to specially thank all landowners who cooperated on experiments. These cooperators donated valuable land, time, and equipment to make this research possible.

Herbicides and Weeds Used the Report

Herbicides

Common Name	Product used in experiments
chlorsulfuron	Telar®
clopyralid	Transline™
dicamba	Banvel®
diflufenzopyr + dicamba	Distinct®
diuron	Karmex DF
glyphosate	Roundup Ultra®
hexazinone	Velpar®
imazamox	Raptor®
imazapic	Plateau®
imazethapyr	Pursuit®
metribuzin	Sencor 75DF®
paraquat	Gramoxone Max®
pro-carbazone-sodium	Olympus
triclopyr	Garlon 4A®
2,4-DB	Butyrac 200®
2,4-D + glyphosate	Landmaster II®
2,4-D ester	2,4-D LV4®

Weeds

Common Name	Scientific Name
Bulbous bluegrass	*Poa bulbosa* L.
Canada thistle	*Cirsium arvense* (L.) Scop.
common mallow	*Malva neglecta* Wallr.
dandelion	*Taraxacum officinale* Weber in Wiggers
downy brome	*Bromus tectorum* L.
foxtail barley	*Hordeum jubatum* L.
halogeton	*Halogeton glomeratus* (Stephen ex Bieb.) C.A. Mey
hare barley	*Hordeum leporinum* Link
Japanese brome	*Bromus japonicus* Thunb.
medusahead	*Taeniatherum caput-medusae* (L.) Nevski
perennial pepperweed or tall whitetop	*Lepidium latifolium* L.
redstem filaree	*Erodium cicutarium* (L.) L`Her. ex Ait.
Russian knapweed	*Centaurea repens* L.
prickly lettuce	*Lactuca seriola* L.
purslane	*Porulaca oleracea* L.
shepardspurse	*Capsella bursa-pastoris* (L.) Medik.
Scotch thistle	*Onopordum acanthium* L.
tansy mustard	*Descurainia pinnata* (Walt.) Britt.
tumble mustard	*Sisymbrium altissimum* L.

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Perennial Pepperweed (tall whitetop) Control in Irrigated Tall Fescue Pasture

Introduction: Perennial pepperweed is a common problem in irrigated tall fescue pasture within the Honey Lake valley. Although tall fescue is the preferred grass species in this area, it's sensitive to several herbicides commonly used to treat perennial pepperweed. This experiment examined tall fescue tolerance and perennial pepperweed control following treatment with several herbicides applied in late summer. Perennial pepperweed plants varied in growth stage since plants were grazed throughout the summer. Approximately 50% of the plants had flowered 1 month before treatment while others were in the rosette or flowering stage at the time of treatment.

Study Director: Rob Wilson

Cooperator: Jay Dow

Date and Time of Herbicide Applications:
Herbicides were applied September 10, 2003; Temperature 78 °F

Plot Size and Application Method: Plot size was 10 X 30 ft. The experiment was arranged in a randomized complete block design with four replications. Herbicides were applied at 20 gallons per acre using a 10 ft boom CO_2 backpack sprayer.

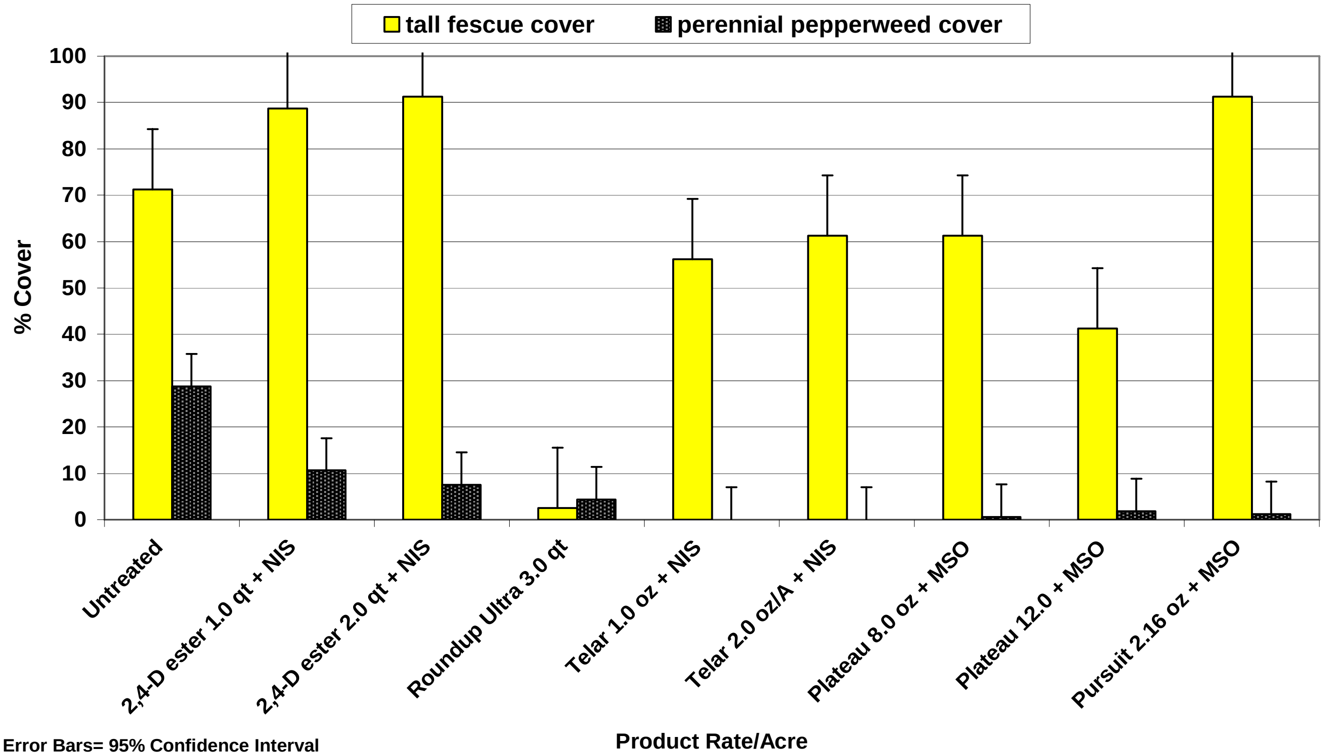
Weather, Precipitation, and Soil Type/Moisture: The soil is an alkali clay loam. The soil surface was dry and sub-surface moist at the time of application. The herbicide application was made before the first frost.

Plant Community Present at the Time of Application: The pasture was primarily tall fescue with sporadic orchardgrass, alfalfa, timothy, and wiregrass. Perennial pepperweed infested the entire study area and made up approximately 35% plant cover at the time of application. The majority of perennial pepperweed was in the flowering or post-flower stage and all plants were still green and growing.

Data Collected: Tall fescue and perennial pepperweed cover was measured in two 1 m^2 quadrats in each plot to determine herbicide effects on perennial pepperweed and tall fescue. The evaluation was made on May 21, 2004 shortly before the spring hay harvest. Perennial pepperweed was in the flowerbud stage.

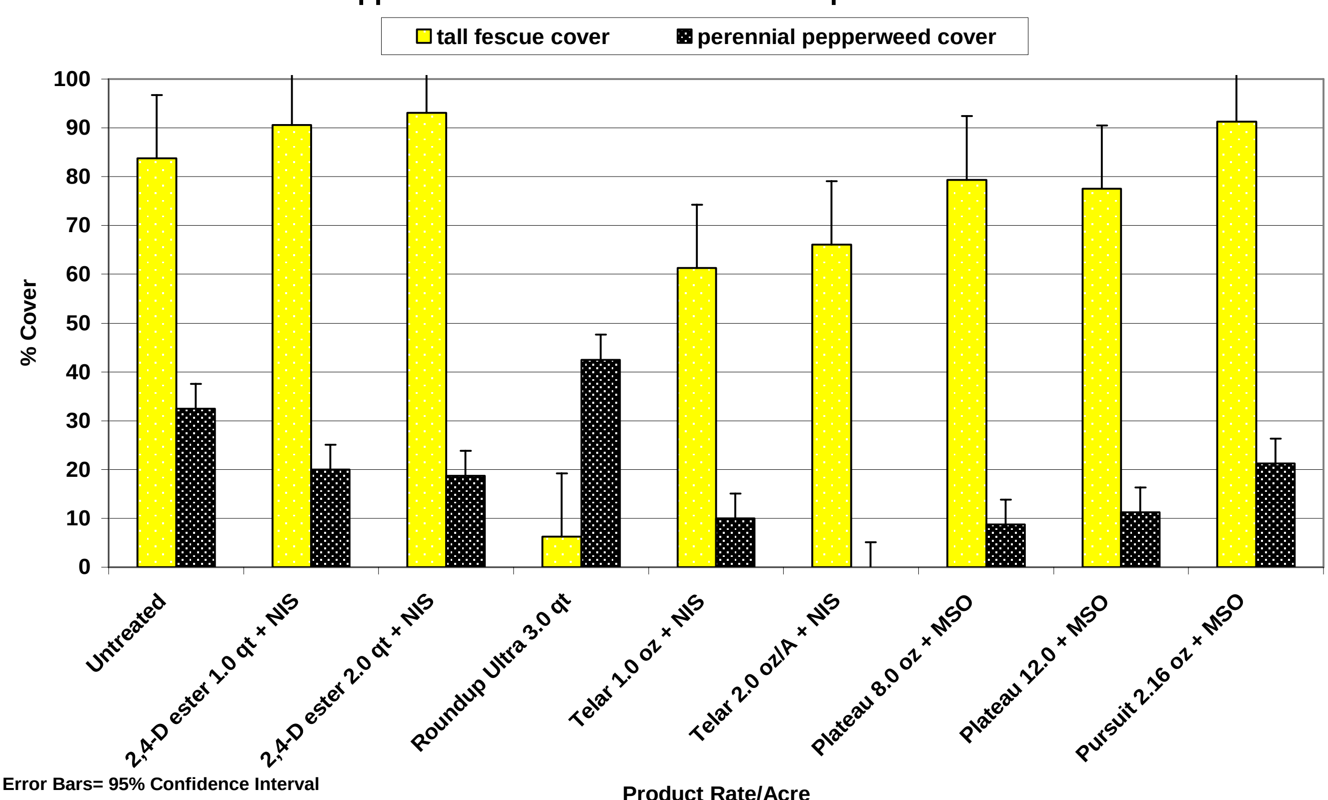
Results: All herbicide treatments greatly reduced perennial pepperweed cover the spring following treatment, but several treatments injured tall fescue (Figure 1). The untreated control averaged 30% perennial pepperweed cover, while herbicides reduced perennial pepperweed cover below 10% by May 2004. Roundup Ultra at 3.0 qt/A caused the greatest injury to tall fescue killing over 90% of the plants. Telar and Plateau at all rates also caused significant injury to tall fescue reducing both tall fescue density and cover. Pursuit DF at 2.16 oz/A and 2,4-D ester (4L) at 2.0 qt/A did not injure tall fescue and provided acceptable control of perennial pepperweed for the 2004 first-cutting hay harvest, but perennial pepperweed started to re-invade both treatments by September 2004 (Figures 1 & 2). Telar at 2.0 oz/A was the only treatment to maintain over 95% control of perennial pepperweed at the September 2004 evaluation. Void of tall fescue, Roundup plots became a solid mat of perennial pepperweed, dandelion, chickory, and curly dock rosettes by the September 2004 evaluation. It's interesting to note that perennial pepperweed plants re-sprouted much quicker from herbicide treatment in this trial compared to the dryland trials discussed in this report. The reason for poor residual control is unknown, but it's likely due to nitrogen fertilization and flood irrigation in the pasture throughout the 2004 growing season.

Figure 1. The Effect of Herbicides Applied in Late Summer 2003 on Perennial Pepperweed and Tall Fescue Cover May 2004



Error Bars= 95% Confidence Interval
NIS= non-ionic surfactant; MSO= methylated seed oil

Figure 2. The Effect of Herbicides Applied in Late Summer 2003 on Perennial Pepperweed and Tall Fescue Cover September 2004



Error Bars= 95% Confidence Interval
NIS= non-ionic surfactant; MSO= methylated Seed oil

Perennial Pepperweed (Tall Whitetop) Control with Herbicides Applied at the Rosette and Flower-bud Stage

Introduction: Perennial pepperweed is currently Lassen Counties' # 1 weed problem. The invasive plant spreads via underground roots and seed forming near monoculture populations within wildlife areas, rangeland, irrigated cropland, and waste areas. This experiment examined several herbicide treatments applied at the rosette and flower-bud stage to determine the best application time/herbicide combination for perennial pepperweed control. The plot area was mowed in early April (prior to perennial pepperweed green up) to reduce the amount of litter and facilitate better spray coverage at each herbicide application. Results from this year's evaluation (2 years following treatment) suggest most herbicides are not capable of providing long-term control with a single application.

Study Director: Rob Wilson

Cooperator: CDFG Honey Lake Wildlife area

Date and Time of Herbicide Applications:
Rosette Application- April 16th, 2002 at 8:00 am; Temperature 44 degrees F
Flower-bud Application- May 30th, 2002 at 10:30 am; Temperature 85 degrees F

Plot Size and Application Method: Plot size was 10 X 30 ft. The experiment was arranged in a randomized complete block with four replications. Herbicides were applied at 20 gallons per acre using a 10 ft boom CO_2 backpack sprayer.

Weather, Precipitation, and Soil Type/Moisture: The study site historically receives approx. 6 inches of precipitation a year; the soil is a sodic, clay loam. The soil surface was dry and sub-surface was moist at the time of the rosette application; soil surface and sub-surface were dry at the time of the flower-bud application.

Plant Community Present at the Time of Application: The first three replications were heavily infested with perennial pepperweed. The fourth replication was moderately infested with perennial pepperweed and had considerable tall wheatgrass cover.

Data Collected: Evaluations were made in three 1 m^2 quadrats in each plot to determine herbicide effects on perennial pepperweed and tall wheatgrass. Perennial pepperweed shoot density and tall wheatgrass cover were measured on June 26, 2002 (2 MAT), July 29, 2002 (3 MAT), September 19, 2002 (5 MAT), June 25, 2003 (14 MAT), and May 13, 2004 (25 MAT) in plots sprayed at the rosette stage. In plots sprayed at the flowerbud stage, perennial pepperweed density and tall wheatgrass cover were evaluated on July 29, 2002 (2 MAT), September 19, 2002 (4 MAT), June 25, 2003 (13 MAT), and May 13, 2004 (25 MAT).

Results: Overall, herbicide treatments applied at the flower-bud stage provided better pepperweed control compared to treatments applied at the rosette stage (Figure 1 & 2). Telar, 2,4-D, and Plateau applied at the rosette stage significantly reduced perennial pepperweed density by > 50% 13 MAT, but Telar was the only treatment to significantly reduce perennial pepperweed cover 25 MAT (Figure 1). Roundup was not effective when applied at the rosette stage. Telar and Plateau at all rates were the best treatments applied at the flower-bud stage reducing perennial pepperweed density and cover by more than 90% compared to the control 13 MAT (Figure 2). Telar at 2.0 oz/A and Plateau at 12 oz/A reduced perennial pepperweed cover by > 90% compared to the control 25 MAT. 2,4-D provided good control of perennial pepperweed 5 MAT, but perennial pepperweed densities rebounded 13 MAT suggesting yearly

2,4-D applications are needed to control perennial pepperweed (Figure 2). Unlike the rosette application, Roundup applied at the flower-bud stage provided good control of perennial pepperweed 13 MAT, but perennial pepperweed cover rebounded 25 MAT. Roundup was the only treatment that significantly reduced tall wheatgrass cover (Table 1 &2). See Table 1 for a complete listing of herbicide treatments applied at the rosette stage and Table 2 for all herbicide treatments applied at the flower-bud stage.

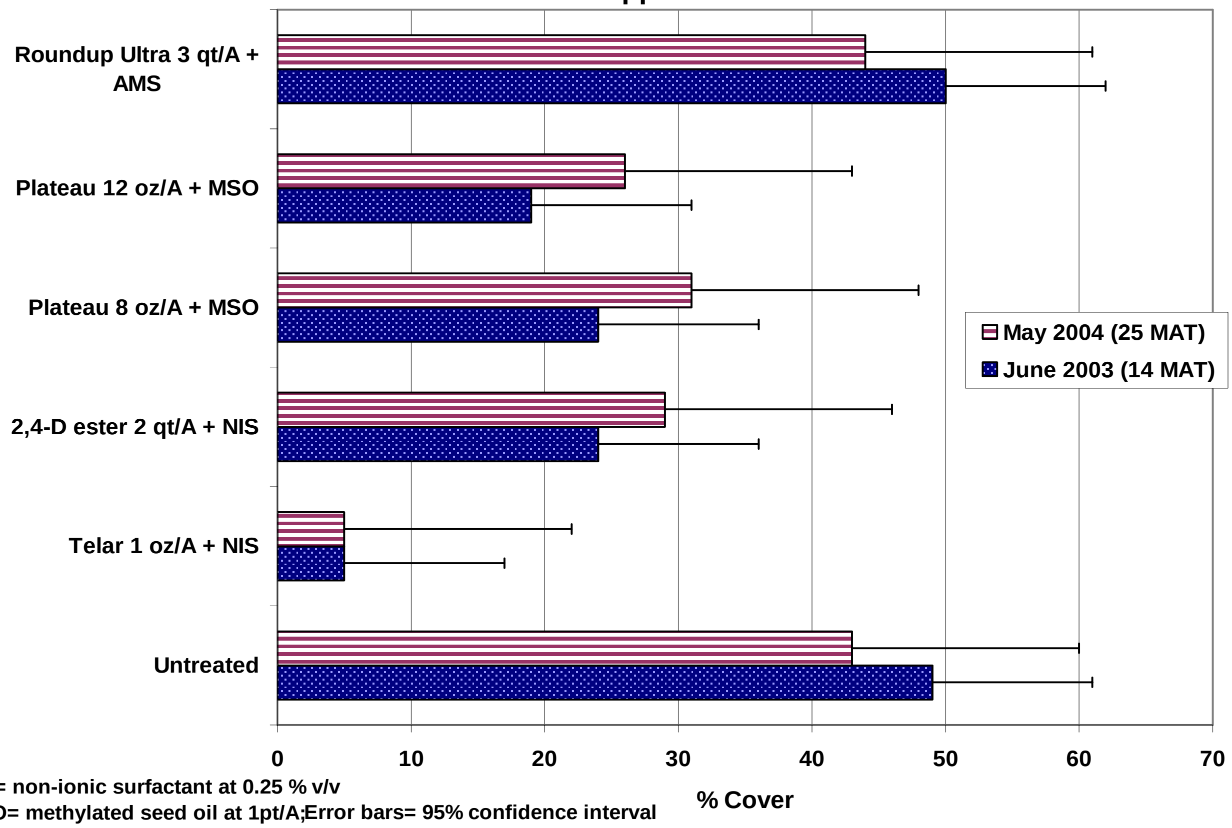
Table 1. The effect of herbicides applied at the rosette stage on perennial pepperweed density and tall wheatgrass cover.

Herbicide Treatment	Product Rate	06/25/03 14 MAT		05/13/04 25 MAT	
		P. Pepper-weed % cover	T. wheat-grass % cover	P. Pepper-weed % cover	T. wheat-grass % cover
1. Untreated Control	-----	49a	16b	43a	23ab
2. Telar- 75 DF non-ionic surfactant	1.0 oz/A 0.25 % v/v	5c	33a	5b	31a
3. 2,4-D- 4 SC non-ionic surfactant	2.0 qt/A 0.25 % v/v	24b	19b	29a	18ab
4. Plateau- 2 SL methylated seed oil ammonium sulfate	8.0 fl oz/A 1.0 pt/A 10 lb/100 gal	24b	17b	31a	18ab
5. Plateau- 2 SL methylated seed oil ammonium sulfate	12.0 fl oz/A 1.0 pt/A 10 lb/100 gal	19b	37a	26a	34a
6. Round-up- 4L ammonium sulfate	3.0 qt/A 10 lb/100 gal	50a	5c	44a	7b

Table 2. The effect of herbicides applied at the flowerbud stage on perennial pepperweed density and tall wheatgrass % cover.

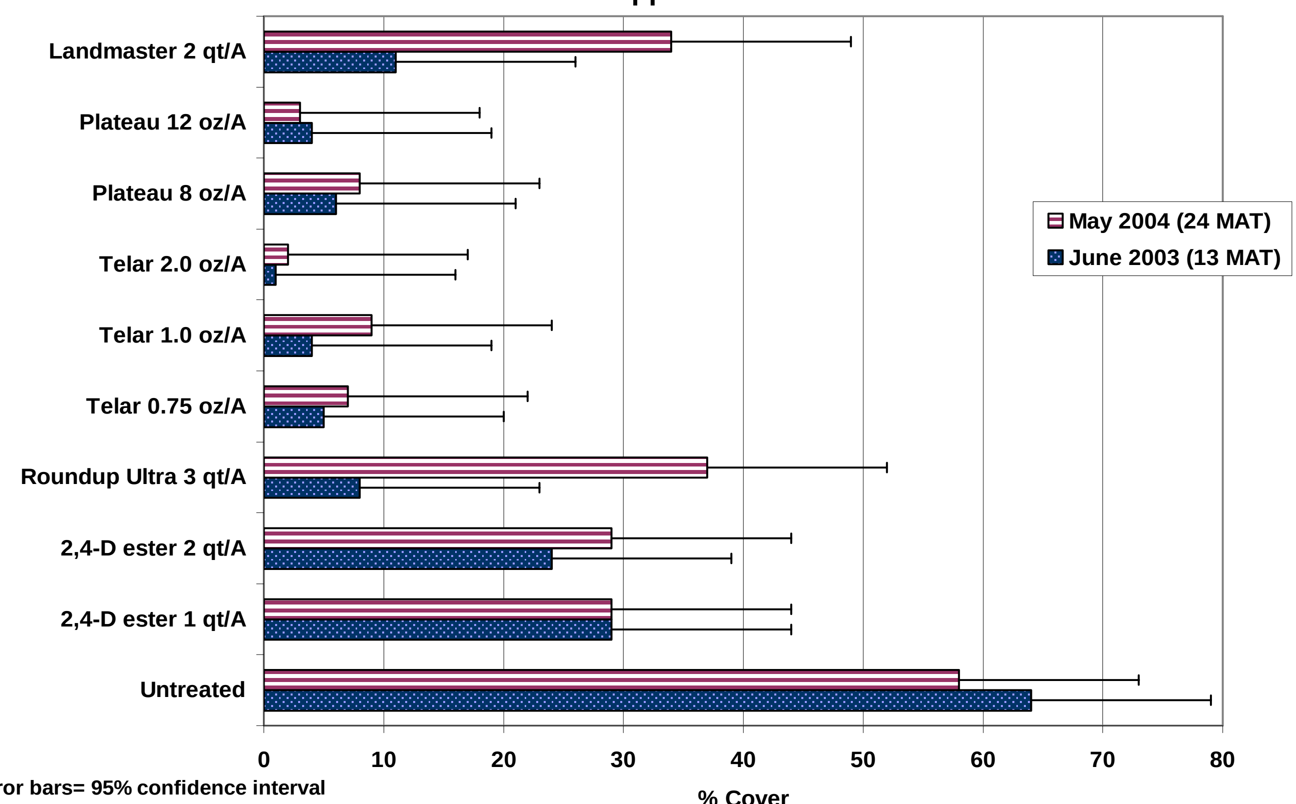
Herbicide Treatment	Product Rate	06/25/03- 13 MAT		05/13/04- 24 MAT	
		perennial pepperweed % cover	tall wheatgrass % cover	Perennial pepperweed % cover	Tall wheatgrass % cover
1. Untreated Control	-----	64a	10e-h	58a	16b-e
2. 2,4-D- 4 SC non-ionic surfactant	1.0 qt/A 0.25 % v/v	29cd	29abc	29b	30ab
3. 2,4-D- 4 SC non-ionic surfactant	2.0 qt/A 0.25 % v/v	24de	24a-f	29b	29ab
4. Distinct- 70 DF non-ionic surfactant ammonium sulfate	6.0 oz/A 0.25 % v/v 5 lb/100 gal	55ab	17c-g	42ab	28abc
5. Round-up- 4 L ammonium sulfate	3.0 qt/A 10 lb/100 gal	8ef	0h	37b	4e
6. Telar- 75 DF non-ionic surfactant	0.75 oz/A 0.25 % v/v	5f	39a	7c	35a
7. Telar- 75 DF non-ionic surfactant	1.0 oz/A 0.25 % v/v	4f	21b-f	9c	21a-e
8. Telar- 75 DF non-ionic surfactant	2.0 oz/A 0.25 % v/v	1f	36ab	2c	34a
9. Plateau- 2 SL methylated seed oil ammonium sulfate	8.0 fl oz/A 1.0 pt/A 10 lb/100 gal	6f	27a-d	8c	24a-d
10. Plateau- 2 SL methylated seed oil ammonium sulfate	12.0 fl oz/A 1.0 pt/A 10 lb/100 gal	4f	26a-e	3c	23a-d
11. Landmaster II- 2.2L non-ionic surfactant ammonium sulfate	3.0 qt/A 0.25 % v/v 10 lb/100 gal	11ef	3gh	34b	10de
12. Olympus- 70 DF non-ionic surfactant	0.9 oz/A 0.25 % v/v	46bc	9fgh	54a	10de
13. Olympus- 70 DF non-ionic surfactant	1.8 oz/A 0.25 % v/v	41bcd	25a-f	50ab	24a-d
14. Garlon- 4 EC Round-up- 4 L non-ionic surfactant	0.5 % v/v 0.5 % v/v 0.25 % v/v	32cd	11d-h	42ab	11cde

Figure 1. The Effect of Herbicides Applied at the Rosette Stage in 2002 on Perennial Pepperweed Cover



NIS= non-ionic surfactant at 0.25 % v/v
MSO= methylated seed oil at 1pt/A;Error bars= 95% confidence interval

Figure 2. The Effect of Herbicides Applied at the Flower-bud Stage in 2002 on Perennial Pepperweed Cover



Error bars= 95% confidence interval
See Table 2 for a complete treatment listing including surfactants

Scotch Thistle Control in Non-crop Areas

Introduction: Scotch thistle is a continual weed problem in dryland range and non-crop areas throughout Northeast California. Scotch thistle's high seed production, long seed viability, and ability to grow in arid conditions make it a difficult to control. This experiment examined several herbicides applied at two application times for Scotch thistle control. Treatments were applied in 2003 and were repeated in 2004 at a different location.

Study Director: Rob Wilson

Cooperator: Bob Thompson

Date and Time of Herbicide Application: **2003 Rosette application-** April 16, 2003 at 11:00 am; air temperature 50°F. **2003 Late Bolting application-** June 18, 2003 at 10:00 am; air temperature 80°F. **2004 Rosette application-** April 09, 2004 at noon; air temperature 68°F. **2004 Bolting application-** June 07, 2004 at 10:00 am; air temperature 70°F.

Plot Size and Application Method: Plot size was 10 X 30 ft. The experiment was arranged in a randomized complete block with three replications. Herbicides were applied at 20 gallons per acre using a 10 ft boom CO_2 backpack sprayer.

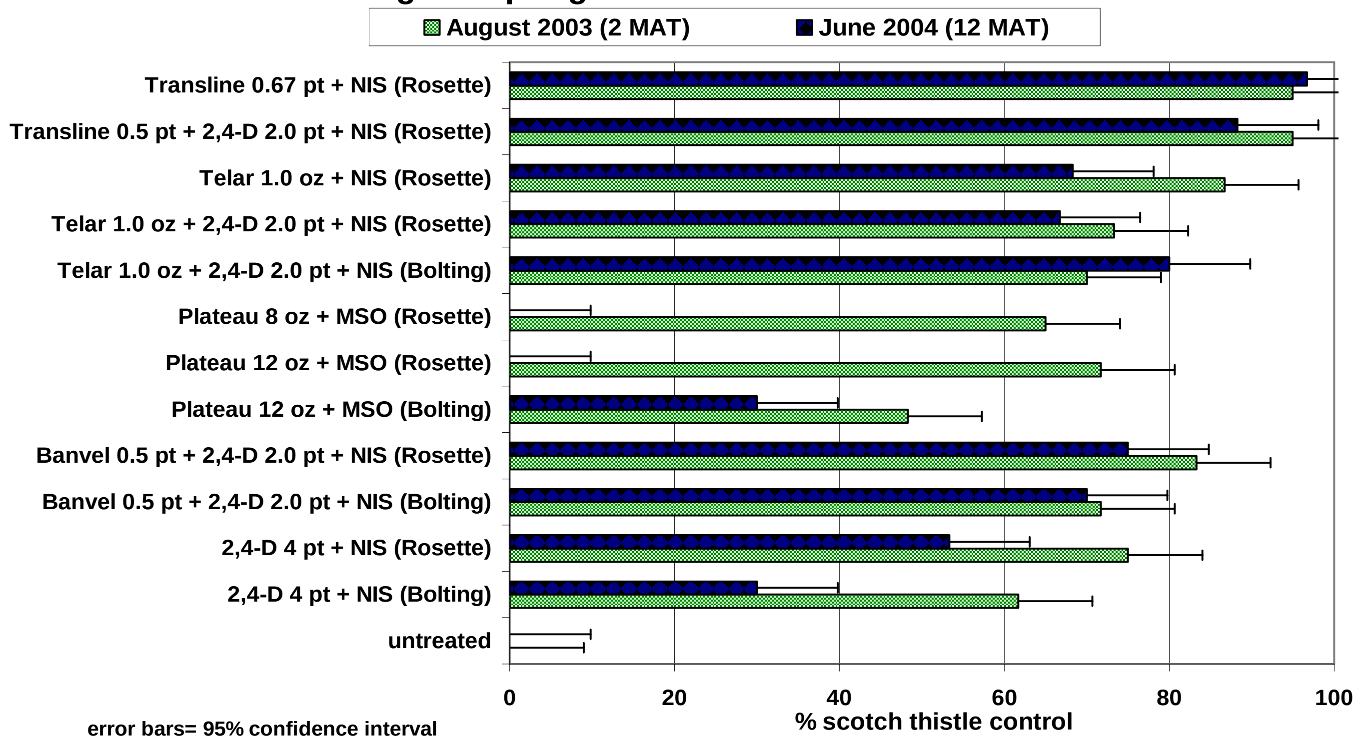
Soil Type and Moisture: sandy loam. The soil surface and sub-surface were moist at the time of the rosette applications and dry at the time of the bolting application.

Plant Community Present at the Time of Application: The site is heavily infested with Scotch thistle. Other vegetation included medusahead, downy brome, bulbous bluegrass, alfalfa, fescue, and sporadic squarosse knapweed. Scotch thistle rosette diameters ranged from 6 inches to 2 feet at the time of the rosette application. Bolting scotch thistle plants were 2-5 ft tall and approximately 20% of the stems had flower-buds at the time of the bolting application in 2003. None of the plants had produced flower-buds at the 2004 bolting application.

Data Collected: Percent control evaluations were made on June 18, 2003, July 30, 2003, and July 29, 2004. Scotch thistle density and % cover were not measured due to irregular Scotch thistle density in several plots.

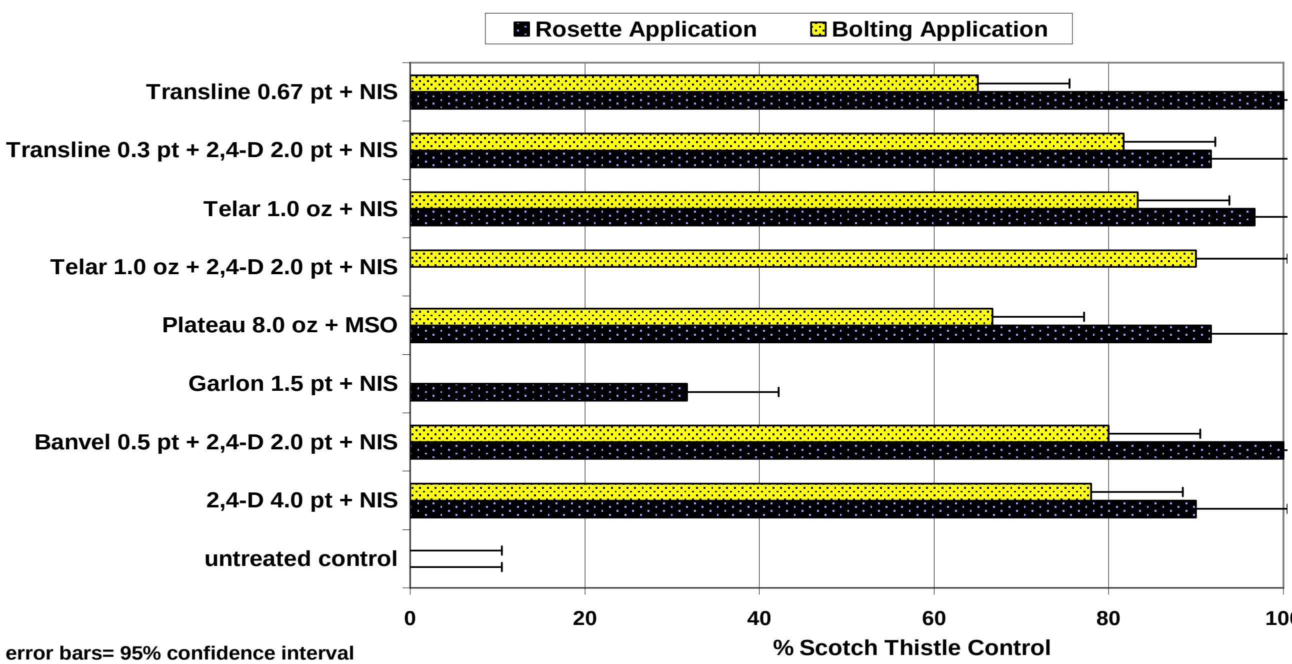
Results Summary: Both years of data suggest treating at the rosette stage is the best time to control Scotch thistle (Figures 1 & 2). Transline, Banvel + 2,4-D, and Telar applied at the rosette stage providing $\geq$ 80 % control of Scotch thistle compared to untreated plots the year of treatment. Herbicides applied at the bolting stage provided mediocre control. Plants treated with 2,4-D, Plateau, and Transline at bolting regularly outgrew herbicide treatment and produced viable seed. Banvel + 2,4-D, Telar, and Telar + 2,4-D were the best treatments for controlling Scotch thistle in the bolting stage, although none of the bolting treatments provided over 90% control compared to untreated plots. Interestingly, plots treated with Banvel, Transline, or Telar in 2003 maintained the same control of Scotch thistle in spring of 2004 suggesting elimination of seed production one year can significantly reduce the seedbank (Figure 1). In 2004, only two rosettes were found in plots treated with Transline at 0.67 pt/A in 2003.

Figure 1. The Effect of Herbicides Applied at the Rosette or Bolting Stage in Spring 2003 on Scotch Thistle Control



error bars= 95% confidence interval
NIS= non-ionic surfactant at 0.25% V/V; MSO= methylated seed oil at 1.0 qt/A
Rates are listed as Product Rate per Acre

Figure 2. The Effect of Herbicides Applied in Spring 2004 at the Rosette or Bolting Stage on Scotch Thistle Control August 2004



error bars= 95% confidence interval
NIS= non-ionic surfactant at 0.25% V/V; MSO= methylated seed oil at 1.0 qt/A
Rates are listed as Product Rate per Acre

Weed Control in Established Alfalfa/Orchardgrass Mix

Introduction: Alfalfa/grass hay is becoming more and more popular due to increased demand from horse owners. Although alfalfa grass mixtures are relatively weed resistant, winter annual and perennial weeds can become a problem causing significant price reduction. Weeds in alfalfa/grass mixtures are difficult to control due to a lack of herbicide choice. This experiment examined potential herbicide options for early spring weed control in alfalfa/orchardgrass. The experiment was replicated twice (once in 2003 and once in 2004) at multiple locations in Lassen and Siskiyou Counties. It is important to note that several herbicides used in this experiment are not labeled in California for use in alfalfa/grass forage.

Study Director: Rob Wilson

Cooperator: Tim Garrod (Bird Flat site); Matt Maddox (Quail Valley Ranch site)

Date and Time of Herbicide Application: **Bird Flat Fall treatments**- November 18, 2003 at 10:00 am; Temperature 55°F. **Bird Flat Spring treatments**- March 12, 2004 at 11:00 am; Temperature 60°F. **Quail Valley spring treatments**- March 24, 2004 at 10:00 am; Temperature 55°F.

Plot Size and Application Method: Plot size was 10 X 30 ft. The experiment was arranged in a randomized complete block with three replications. Herbicides were applied at 20 gallons per acre using a 10 ft boom CO_2 backpack sprayer.

Soil Type/Moisture: **Bird Flat-** Sandy loam. The soil surface was dry and sub-surface was moist at the time of application in 2003 and 2004. **Quail Valley**- Clay loam. The soil surface and sub-surface was moist at the time of application.

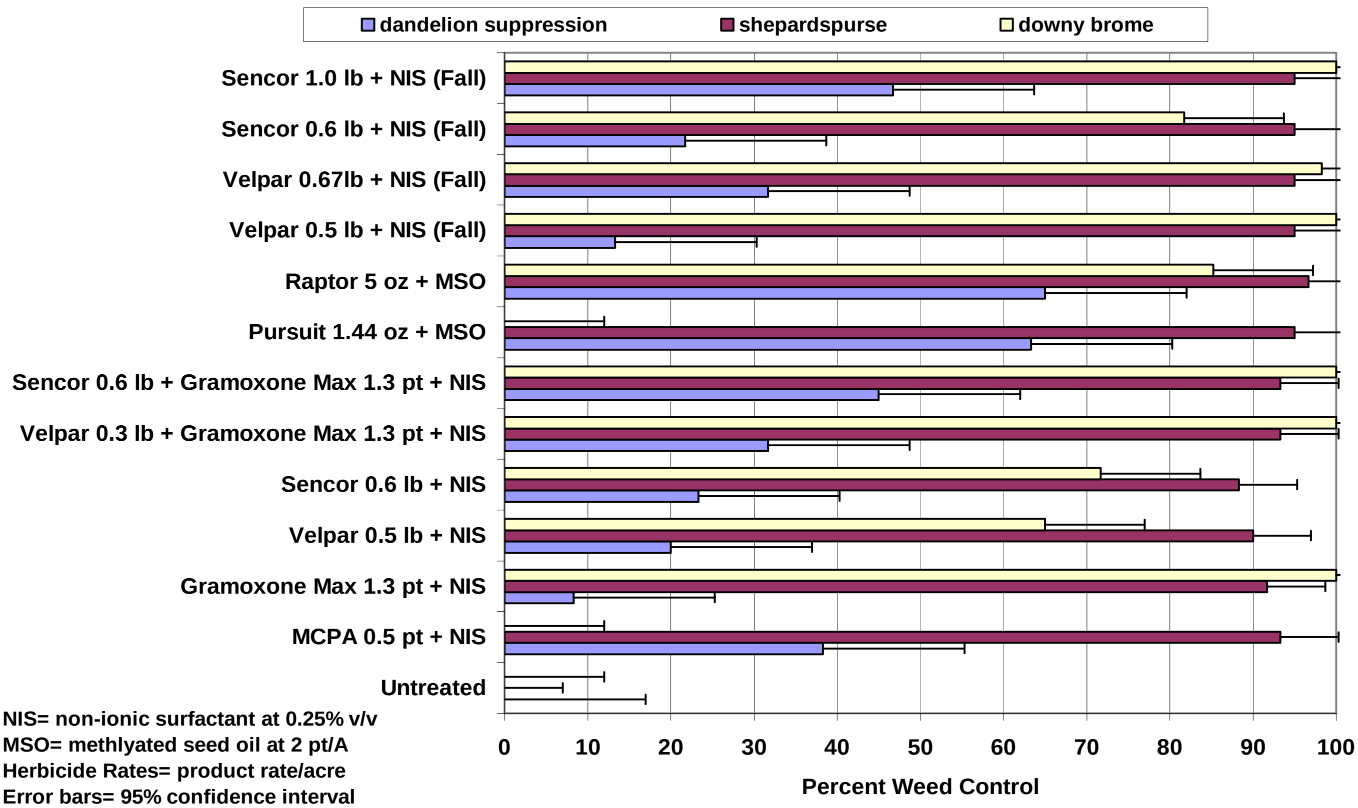
Weed Species Present at time of application: **Bird Flat**- shepardspurse- rosette 1 in diameter, downy brome- tillered 1 in tall, dandelion- rosette 1-2 in diameter. **Quail Valley-** shepardspurse- 1-2 in diameter, hare barley- 1-2 in tall, dandelion- rosette 1-3 in diameter.

Crop Stage: **Bird Flat**- alfalfa- green with 0.5-1 in regrowth; orchardgrass- green with 3-4 in regrowth. **Quail Valley**- alfalfa- green with 2-3 in regrowth; orchardgrass- green with 4-5 in regrowth.

Data Collected: Percent weed control and crop injury was measured on April 7, 2004 at Bird Flat and May 5, 2004 at Quail Valley. 100 % orchardgrass injury equaled complete stand loss. Alfalfa and orchardgrass height were measured a couple days before harvest on May 21, 2004 at Bird Flat and May 27, 2004 at Quail Valley.

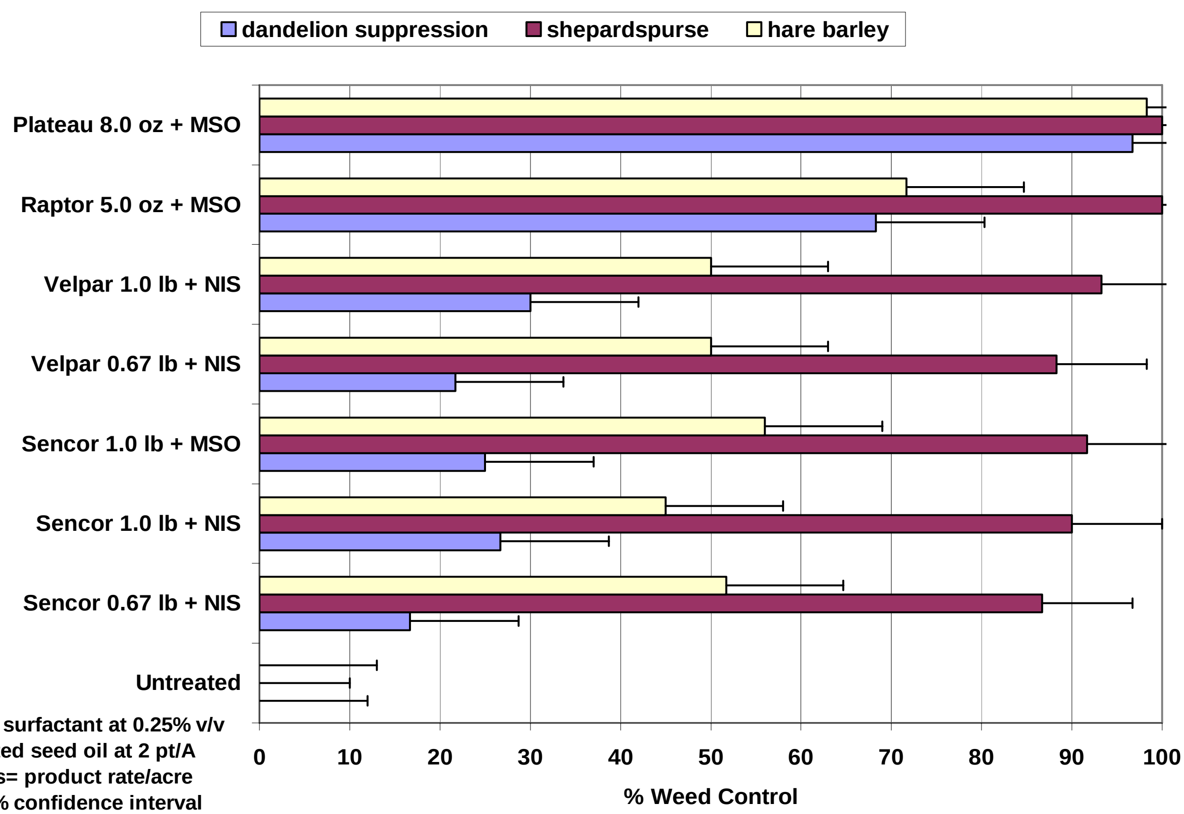
Result Summary: All herbicide treatments provided effective control of shepardspurse (Figures 1 & 2). Sencor at 1 lb/A applied in the fall, Velpar at all rates applied in the fall, and spring Gramoxone Max treatments provided effective control of downy brome. Plateau at 8.0 oz/A was the only spring applied treatment to effectively control dandelion and hare barley at Quail Valley (Figure 2). Spring applied Raptor at 5.0 oz/A, Plateau at 8 oz/A, and Gramoxone Max treatments caused unacceptable orchardgrass injury and significantly reduced first-cutting orchardgrass height compared to untreated plots (Figures 3 & 4). High rates of spring applied Sencor and Velpar also significantly reduced first-cutting orchardgrass height compared to untreated plots at Quail Valley (Figure 4). Plateau at 8.0 oz/A was the only herbicide treatment to reduce first-cutting alfalfa height (Figure 4).

Figure 1. The Effect of Herbicides Applied in Fall or Early Spring on Weed Control in Alfalfa/Orchardgrass at Bird Flat 2004



NIS= non-ionic surfactant at 0.25% v/v
MSO= methlyated seed oil at 2 pt/A
Herbicide Rates= product rate/acre
Error bars= 95% confidence interval

Figure 2. The Effect of Herbicides Applied in Early Spring on Weed Control in Alfalfa/Orchardgrass at Quail Valley 2004



NIS= non-ionic surfactant at 0.25% v/v
MSO= methlyated seed oil at 2 pt/A
Herbicide Rates= product rate/acre
Error bars= 95% confidence interval

Figure 3. The Effect of Herbicides on First-Cutting Alfalfa and Orchardgrass Height at Bird Flat in 2004

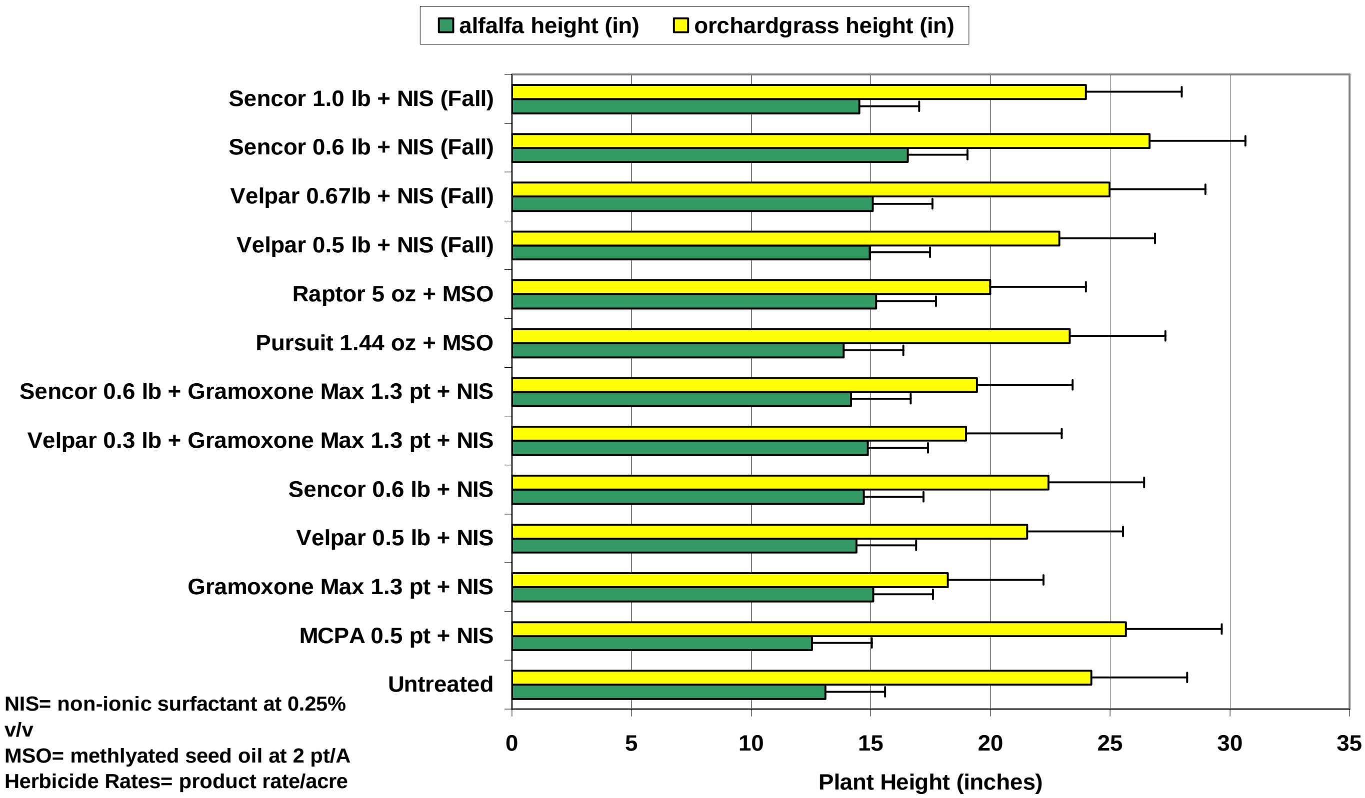
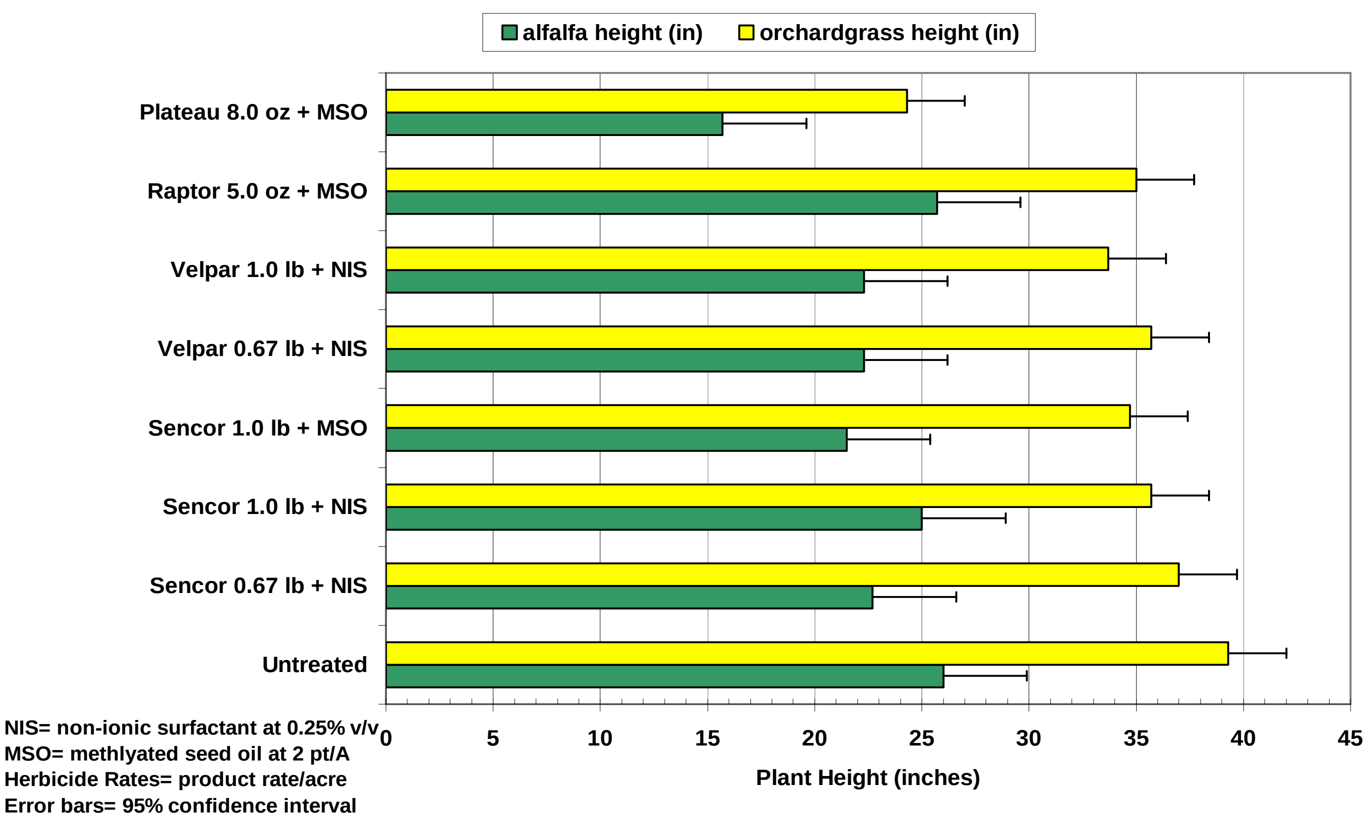


Figure 4. The Effect of Herbicides on First-Cutting Alfalfa and Orchardgrass Height at Quail Valley in 2004



Influence of Medusahead Residue Removal Techniques and Plateau on Medusahead Control and Perennial Grass Establishment

Don Lancaster UCCE Farm Advisor Modoc County; David Lile and Rob Wilson UCCE Farm Advisors Lassen County; & Pete Schreder OSU Extension Agent Lake County, OR

Introduction

Medusahead is troublesome weed that is well adapted to Northeast California and Southeast Oregon. The winter annual grass typically invades disturbed, big sagebrush communities with clay soils. After establishment, medusahead spreads rapidly and forms monoculture stands excluding perennial grass and shrub establishment. This experiment evaluated the effectiveness of imazapic (Plateau) herbicide at several rates and timing for medusahead control. The experiment also assessed imazapic's effects on other vegetation and the feasibility of reseeding perennial grasses following medusahead treatment with imazapic.

Site Information

The trial was initiated at two locations in the fall of 2001. One site is located near Likely, CA on rangeland heavily infested with medusahead. The soil at the Likely site is a Bieber cobbly loam consisting of grayish brown cobbly loam from the 0-6 in depth and dark grayish brown clay loam and brown clay from the 6-18 in depth. The likely site is extremely rocky and had approximately a ½ to 2 in medushead litter layer covering 60 % of the ground at the time of treatment initiation. Few perennial grasses or shrubs were present at the time of treatment initiation. The second site is located near Paisley, OR. The site is rangeland heavily infested with medusahead. The Paisley site is very similar to Likely with regard to soil type and rocks (cobbly loam soil), but it had more established perennial grass, sagebrush, and alfalfa at the time of treatment initiation.

Materials and Methods

At Likely, plots were tilled and burned on November 3, 2001. The plots were very difficult to till due to a plethora of large rocks. Due to soil type and terrain, tillage is unpractical at most medusahead sites in northeastern California. Plots were also difficult to burn due to a lack of consistent litter accumulation (a small amount of medusahead plants established the spring of 2001 due to drought conditions). The fire was carried with a propane torch to conduct a complete burn. Herbicide treatments were applied November 5th, 2001. Maintenance herbicide treatments (Plateau at 4.0 oz/A or 8.0 oz/A) were applied across 1/3rd of each plot on December 3rd, 2003. All fall herbicide treatments were applied before medusahead emergence. All plots were seeded with a crested wheatgrass and squirreltail mix (10 lb/ac) the same day herbicides were applied. Seed was broadcast applied without incorporation due to the large number of rocks. Smaller plots located outside the experimental area were sprayed with the 4 oz rate of plateau and seeded with various native perennial grasses. In these plots, seed was broadcast and raked into the soil. In both areas, same seed mixes were re-applied the spring of 2003 due to the lack of grass establishment in 2002.

In Paisley, fall and spring litter removal/herbicide treatments were conducted. Fall plots were burned and tilled on November 10, 2001, and spring plots were burned and tilled on April 6, 2002. All plots were difficult to till and burn similar to the plots at Likely. Spring treated plots were especially difficult to burn due to increased moisture content in the air, soil, and litter. Tillage was conducted with a spike tooth harrow. Fall herbicide treatments were applied November 15th, 2001 at 11:00 am. No medusahead seedlings had emerged prior to the fall herbicide application. Spring herbicide treatments were applied April 12th, 2002 at 9:30 am. Medusahead had emerged and was 1 - 2 inches tall in the plots prior to the spring herbicide application. Fall treated plots were seeded with a basin wildrye, bluebunch wheatgrass, and Idaho fescue mix (10 lb/ac), and spring treated plots were seeded with a squirreltail, sheep fescue, bluebunch wheatgrass, and crested wheatgrass mix (10 lb/ac). Fall and spring planted seeds were sown the same day herbicides were applied. The seed was broadcast applied without incorporation. The same seed mixes were re-applied the fall of 2002 and spring 2003 because of the lack of grass establishment in 2002.

In late June 2002, 2003, and 2004, plots were evaluated to determine treatment success at controlling medusahead and facilitating perennial grass establishment. In Likely, medusahead density & cover, bare ground cover, and other vegetation cover was measured in two 1 m^2 quadrats per plot. Bare ground cover consisted of areas with only bare soil or thatch present. In Paisley, medusahead, bare ground, and other vegetation percent cover was measured in two 1 m^2 quadrats per plot. Bare ground cover consisted of areas with only bare soil or thatch present. In 2003, medusahead density was also measured at Paisley.

Results

Complete results from the experiment at both sites are presented in Figures 1- 11. Fall tillage and burning did not affect medusahead cover compared to untreated plots. Fall tillage and burning also did not influence plateau effects on medusahead compared to plots were litter was left undisturbed (It should be noted that in other experiments burning prior to Plateau applications improved Plateau control of medusahead). Tillage and burning did significantly reduce big sagebrush cover at Paisley at all evaluations.

Plateau at rates ≥ 4.0 oz/A significantly reduced medusahead density and cover the spring after treatment at both sites (Figure 1 & 2). Both spring and fall application times provided acceptable medusahead control the spring after treatment (Figure 2). Unfortunately, little vegetation filled the void of medusahead the spring after treatment, and bare ground made up over 75% cover in Plateau treated plots (Figure 3 & 4). Perennial grass seeding at both sites during 2002 was a failure due to lack of spring rainfall.

One year after the initial plateau application, medusahead began to re-invade several treatments (Figure 5). Although plateau rates above 4 oz/A at Likely maintained significantly lowered medusahead cover compared to untreated plots, medusahead cover in all fall plateau treatments at Paisley was not significantly different from untreated plots (Figures 7 & 8). Spring applied plateau treatments maintained much better medusahead control compared to fall treatments at Paisley in June 2003 (Figures 8 & 9). Plateau rates ≥ 6 oz/A applied in the spring reduced medusahead cover by more than 75% compared to untreated plots in June 2003 (Figure 9). Frequent spring precipitation in 2003 allowed for perennial grass establishment. In general, perennial grass establishment increased as medusahead cover decreased regardless of plateau rate (Figure 6).

By June 2004 (two years after treatment), none of the 2001 fall applied Plateau treatments at Likely or Paisley were significantly different from untreated plots with regard to medusahead and other vegetation cover. Thus, 2003 maintenance treatments were needed in fall treated plots to continue medusahead suppression. Fall 2003 Plateau maintenance treatments at Likely successfully reduced medusahead cover in June 2004, but the 4 oz/A and 8 oz/A rates applied in 2003 were not as affective as those same rates applied 2001. The disparity in medusahead control with Plateau in 2001 and 2003 is likely related to winter precipitation and ground litter differences between the two years. Spring applied 2002 Plateau treatments ≥ 6 oz/A maintained medusahead suppression and increased other vegetation cover compared to untreated plots in June 2004 (Figure 11).

In conclusion, Plateau at rates ≥ 4 oz/A was effective at reducing medusahead density and cover 1 to 2 years after treatment. Plateau at rates ≥ 6 oz/A improved perennial grass establishment and increased the vigor of established alfalfa, perennial grass, and sagebrush plants 1 to 2 years after treatment. Unfortunately, Plateau's control of medusahead was temporary, and medusahead populations quickly rebounded to pre-treatment levels within 2 to 3 years regardless Plateau rate and application time. In general, spring Plateau treatments worked better than fall Plateau treatments at Paisley.

Figure 1. The Effect of Plateau Applied November 2001 on Medusahead Density June 2002- Likely, CA

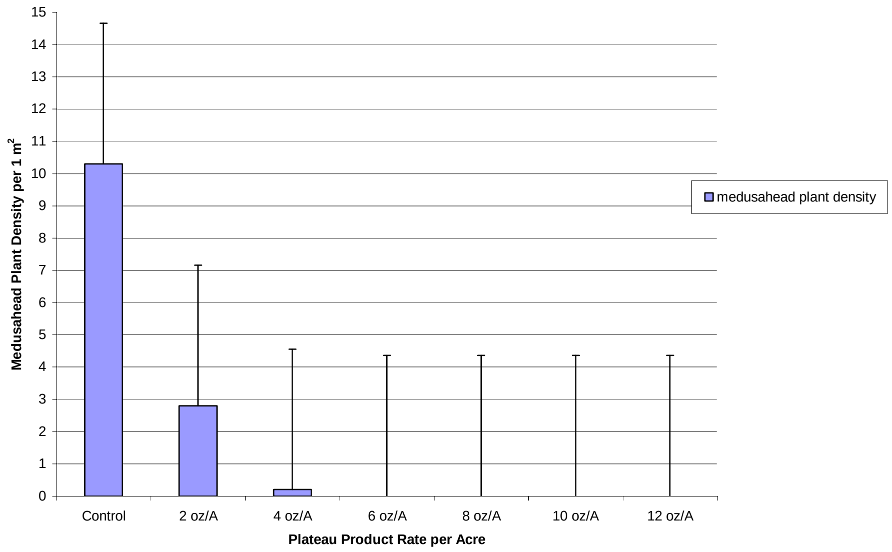


Figure 2. The Effect of Plateau Application Time on Medusahead Cover June 2002- Paisley, OR

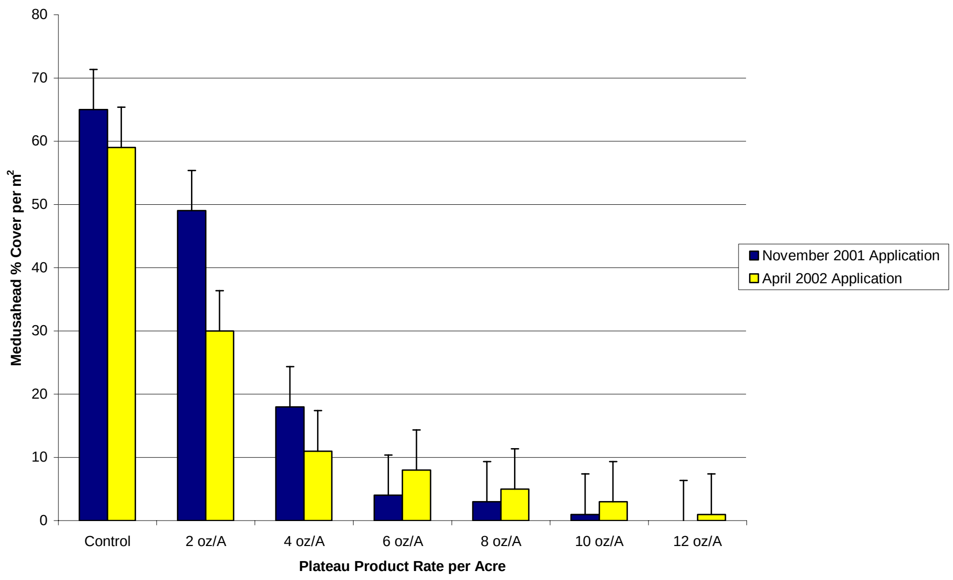


Figure 3. The Effect of Plateau Applied November 2001 on Bareground and Vegetation Cover June 2002- Likely, CA

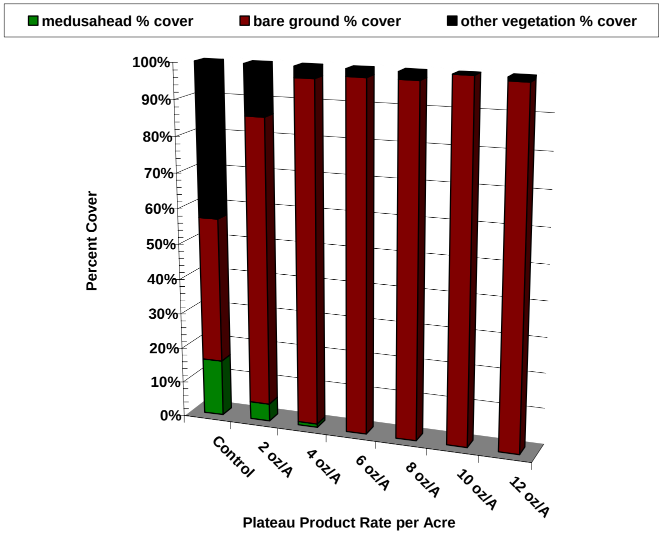


Figure 4. The Effect of Plateau at Varying Rates (spring and fall application times combined) on Bareground and Vegetation Cover June 2002- Paisley, OR

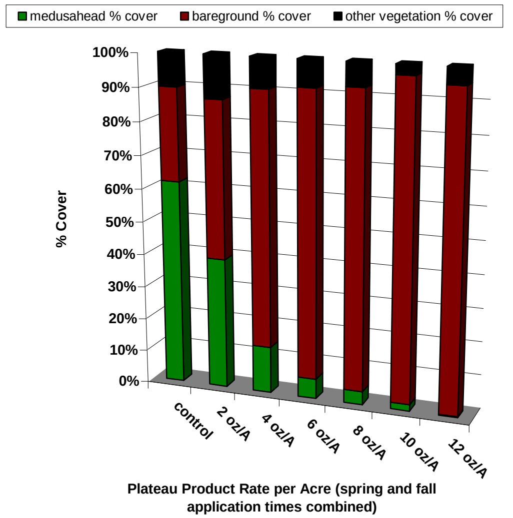


Figure 5. The Effect of Plateau Applied November 2001 on Medusahead Density June 2003- Likely, CA and Paisley, OR

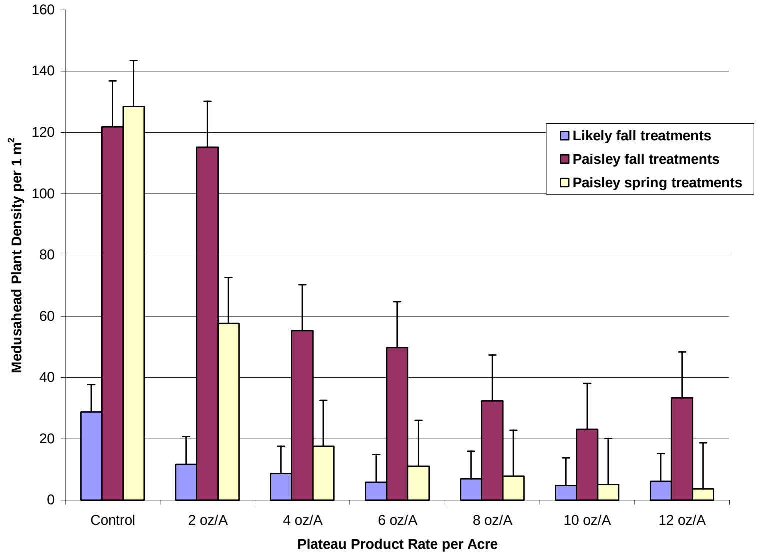


Figure 6. The Effect of Plateau Applied November 2001 on Perennial grass establishment June 2003- Likely, CA and Paisley, OR

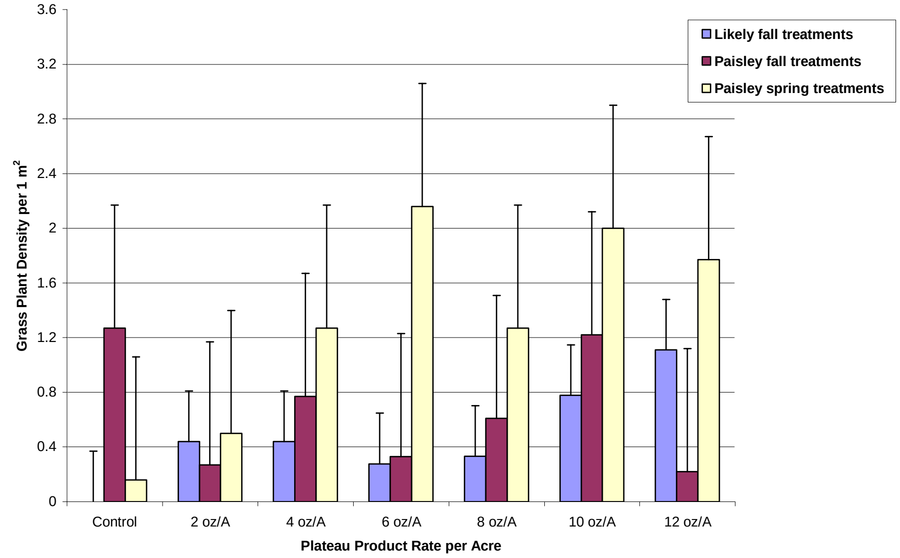


Figure 7. The Effect of Plateau Applied November 2001 on Bareground and Vegetation Cover June 2003- Likely, CA

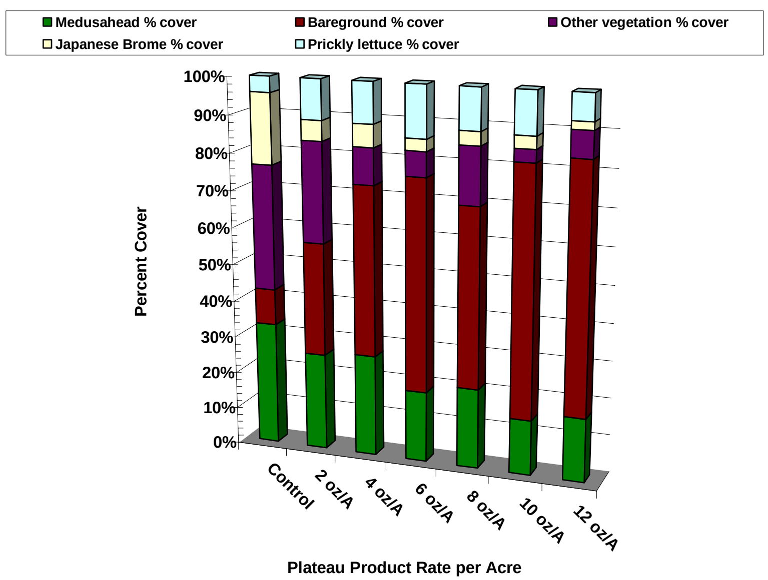


Figure 8. The Effect of Plateau Applied November 2001 on Bareground and Vegetation Cover June 2003- Paisley, OR

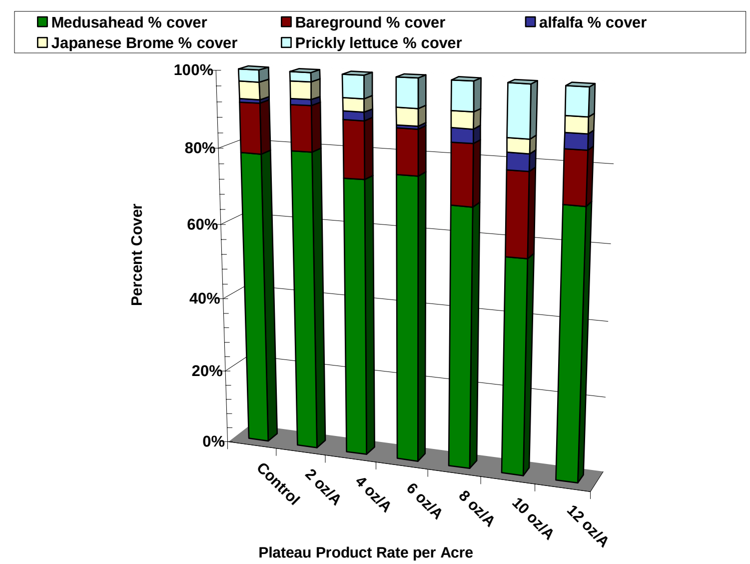


Figure 9. The Effect of Plateau Applied April 2002 on Bareground and Vegetation Cover June 2003- Paisley, OR

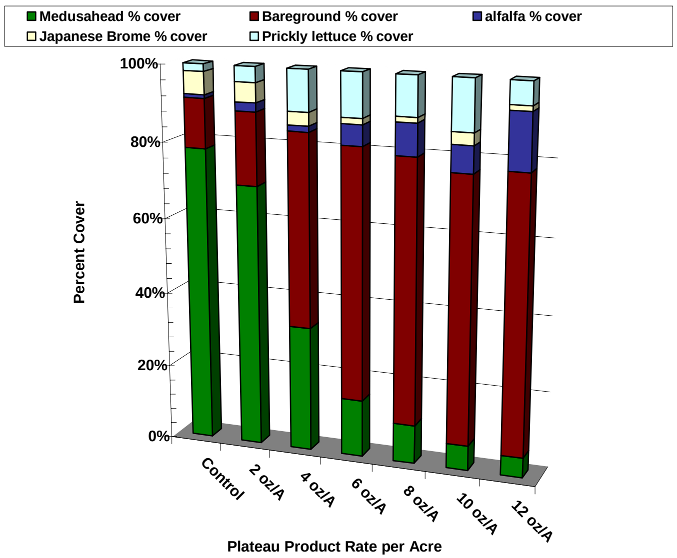


Figure 10. The Effect of 2003 Fall Plateau Maintenance Treatments on Bareground and Vegetation Cover June 2004- Likely, CA

(Intial plateau treatments applied in 2001 at all rates were not significantly different from untreated plots)

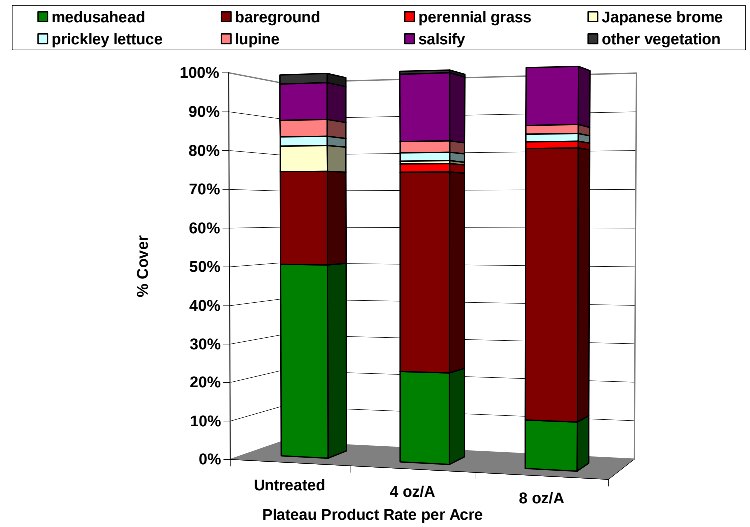
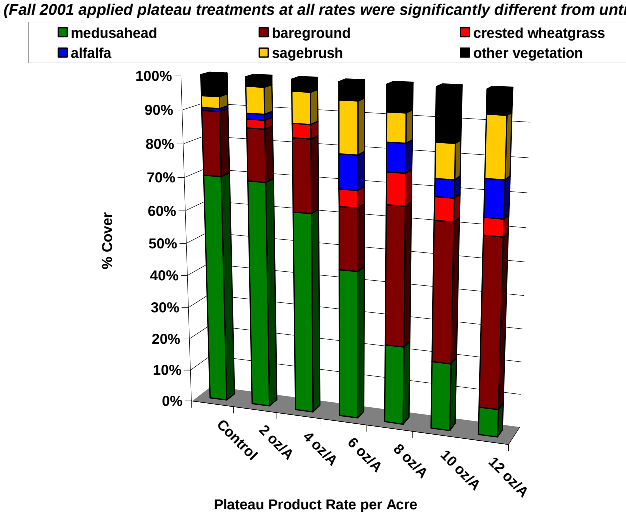


Figure 11. The Effect of Plateau Treatments Applied in April 2002 on Bareground and Vegetation Cover June 2004- Paisley, OR

(Fall 2001 applied plateau treatments at all rates were significantly different from untreated plots)



Establishment of Native and Introduced Dryland Species in the Intermountain Region of Northern California: Investigation of weed control and dryland species' establishment success under different herbicide regimes

Rob Wilson and David Lile, UCCE Farm Advisors Lassen County; Don Lancaster UCCE Farm Advisor Modoc County; Harry Carlson, Tulelake IREC Field Station Superintendent and Farm Advisor, Ceci Dale Cesmat & Dave Dyer, USDA-NRCS

Introduction

Thousands of acres in Northern California are heavily invaded with weeds. Most of the land has been disturbed by road maintenance, human soil disturbance, overgrazing, or fire and lacks perennial vegetation to stabilize the site. Currently, land agencies and private landowners are spending millions of dollars on herbicides and ground covers to control weeds and prevent soil erosion, but little work is being done to restore perennial vegetation on the sites. Although perennial grass establishment doesn't yield immediate weed and erosion control, it's likely the best hope to reclaiming these sites. Unlike annual ground covers, dryland perennials persist without irrigation and do not require extensive management after establishment. Perennial grasses provide wildlife habitat, livestock forage, vegetation diversity, and significantly reduce weed invasion and erosion.

This experiment compares the suitability of several native and introduced perennial grasses for the purpose of livestock forage, wildlife habitat, and weed/erosion control in Northeast California. Specific objectives include:

- Evaluate different native and introduced perennial species on the basis of establishment success, vigor, and ability to prevent weed invasion.
- Determine perennial species' tolerance to pre and post-emergent herbicides commonly used for perennial grass establishment.
- Assess different herbicide + perennial species combinations on their ability to suppress weed competition during and after grass establishment.

Materials and Methods

The experiment was started at 3 sites in the spring of 2003. Sites are located in Doyle (Bird Flat Ranch), Wendel (HLWA), and Tulelake (IREC). Two additional sites will be established the spring of 2004 in weed infested areas near Alturas and Tulelake. The experiment at all sites was arranged in a split block design with 3 replications.

Whole plot treatments (Herbicide treatments): Plot size: Width of 16 drill lengths X 21 ft length

A. No herbicide application (untreated control)
B. Round-up Ultra (1 qt/A) application at planting and post 2,4-D (1.0 pt/A 1st/year) (1 qt/A 2nd/year) application in May for two years after planting.
C. Plateau (4 oz/A) application at planting and Plateau (4 oz/A) applied in late fall the same year of seeding.
D. Round-up (1qt/A) at planting and Plateau (4 oz/A 1st/year) (8 oz/A 2nd/year) applied post-emergent in May for two years after planting.
E. Round-up (1qt/A) at planting and Pursuit (1.44 oz/A) or Buctril (1.5 pt/A) post-emergent in May for two years after planting.
F. Round-up (1 qt/A) at planting and post Telar (1 oz/A) application in May for two years after planting.

Sub- plot treatments (Perennial grass species): Plot size= width of the drill X 30 ft length

1. 'Rosana' Western wheatgrass- aggressive native sod-grass with low forage production. (7.0 lb/ac)
2. 'Lincoln' Smooth Brome- sod-grass with good vigor and notable ability to suppress weeds (8.0 lb/ac)
3. 'Secar' bluebunch wheatgrass- drought tolerant native bunchgrass with good seedling vigor (7.0 lb/ac)
4. 'Bannock' thickspike wheatgrass- drought tolerant native sod-grass (8.0 lb/ac)
5. 'Revenue' slender wheatgrass- native bunchgrass with rapid development and salt tolerance (6 lb/ac)
6. 'Hycrest' crested wheatgrass- drought tolerant introduced grass that consistently establishes on arid range sites (6.0 lb/ac)
7. 'Oahe' intermediate wheatgrass- mild sod-forming grass suited for use as pasture or hay (12 lb/ac)
8. 'Luna' pubescent wheatgrass- long lived aggressive sod-former that was the top performing grass selection in a 2001 Siskiyou grass trial (12 lb/ac)
9. 'Newhy' wheatgrass- cross between quackgrass and bluebunch wheatgrass that tolerates alkaline soils. (8 lb/ac)
10. 'Alkar' Tall Wheatgrass- tall-growing bunchgrass that is very tolerant to salt, alkali, and drought (12 lb/ac)
11. 'Shoshone' Beardless Wildrye- sod-forming native grass adapted to saline-alkali conditions (16 lb/ac)
12. 'Paiute' orchardgrass- dryland orchardgrass variety with good seedling vigor (6.0 lb/ac)
13. 'Sand Hollow' bottlebrush squirreltail- native bunchgrass with excellent seedling vigor that is often an increaser on rangeland (8.0 lb/ac)
14. 'Blazer XL' alfalfa- alfalfa variety that persists in dryland situations (5 lb/ac)
15. forage kochia- semi-evergreen perennial shrub with good establishment success in desert and semi-desert climates (3 lb/ac)
16. yellow sweetclover- tall stemmy, biennial legume suited to a wide range of environments including sagebrush-grass to moist salty lowlands (4 lb/ac)

Field sites were disked and packed in late fall or winter to control existing weeds and prepare a seedbed. Grass species were seeded around March 1st at a 3/8 inch depth using a cone planter. The Tulelake site was supplemented with irrigation starting in April to match normal rainfall until June 1st. Herbicides were applied with a CO_2 backpack sprayer or ATV/tractor sprayer at 20 GPA. Plant species establishment and vigor was evaluated June 2004 and August 2004. Ratings of (0-10) were visually estimated for plant density. The density rating reflected whether seed species occupied 0-100% of the drill row. Seeded plant cover and weed species cover was measured in each plot within 2 one m^2 quadrats. Herbicide injury on seeded species was visually estimated at each evaluation. Evaluations will be made in 2005 and 2006 to measure results after the year of establishment.

Results

Establishment was a success at Bird Flat and Tulelake, but all plant species failed to establish at the Wendel (HLWA) site. Abnormally high March and April temperatures in combination with no spring rainfall prevented plant species germination and seedling growth at Wendel. The Wendel site will be reseeded in 2005. In general, the Bird Flat site was much drier and had significantly more weed competition compared to Tulelake the year of establishment. Roundup (pre) + Telar (post) provided the best weed control at both sites the year of establishment, although all herbicide treatments significantly reduced weed cover compared to untreated plots (Figures 1 & Figure 6).

Herbicide effects on perennial species differed between sites. At Bird Flat, the general trend was as weed cover decreased species establishment increased (Figures 1 & 2). Since weed competition was the biggest stress factor at Bird Flat, herbicide treatments that provided the best weed control also yielded the best grass establishment (averaged across species). At Tulelake, the general trend was as herbicide injury increased species establishment decreased (Figure 2). Tulelake had little weed competition and excellent soil moisture, so plant species established well with or without weed control making herbicide injury a significant stress factor (Figures 2 and 3). At both sites, Roundup (pre) + 2,4-D (post), Roundup (pre) + Telar (post), and Roundup (pre) + Pursuit (post) caused the least amount of injury to perennial grasses, and Roudup (pre) + Pursuit (post), Plateau (pre), and Roundup(pre) + Plateau (post) caused least amount of injury to alfalfa and sweetclover (Figures 7 & 8). At Tulelake, Plateau (pre) caused unacceptable injury to all grass species and significantly reduced grass density and cover compared to untreated plots (Figures 3 & 7). Plateau (post) was safer on grass species compared to Plateau (pre), but Plateau (post) also caused unacceptable injury to most grass species except bluebunch wheatgrass, intermediate wheatgrass, and newhy wheatgrass (Figure 7).

When comparing individual species' vigor averaged across herbicide treatments, species grown at Tulelake had higher density and dramatically higher cover values compared to Bird Flat (Figures 4 & 5). The difference in density and cover between sites was due to lower precipitation and increased weed competition at Bird Flat. Western wheatgrass, smooth brome, bluebunch wheatgrass, slender wheatgrass, intermediate wheatgrass, newhy wheatgrass, tall wheatgrass, and 'Paiute' orchardgrass successfully established at both sites (Figures 4 &5). Alfalfa and yellow sweetclover successfully established at Tulelake in untreated, Roundup + Pursuit, and Plateau plots (Figure 7 & 8). Forage kochia had the worst establishment success at both sites.

First year results suggest several species are capable of establishing under the normal rainfall regime in Northeast California, although species' long-term survival is still in question. Where weeds are problem, it appears suppressing weed competition with herbicides is the most critical factor to establishment success. In general, Roundup (pre) + Telar (post) was the best herbicide treatment for maximizing weed control and minimizing herbicide injury to perennial grasses. Although weed control was lower than Telar, Roundup (pre) + Pursuit (post) was the best herbicide treatment for maximizing weed control and minimizing herbicide injury to perennial grass/legume combinations. Plateau (pre or post) caused unacceptable injury to most perennial grasses at Tulelake.

Figure 1. The Effect of Herbicides Applied During Establishment on Weed Cover June 2004

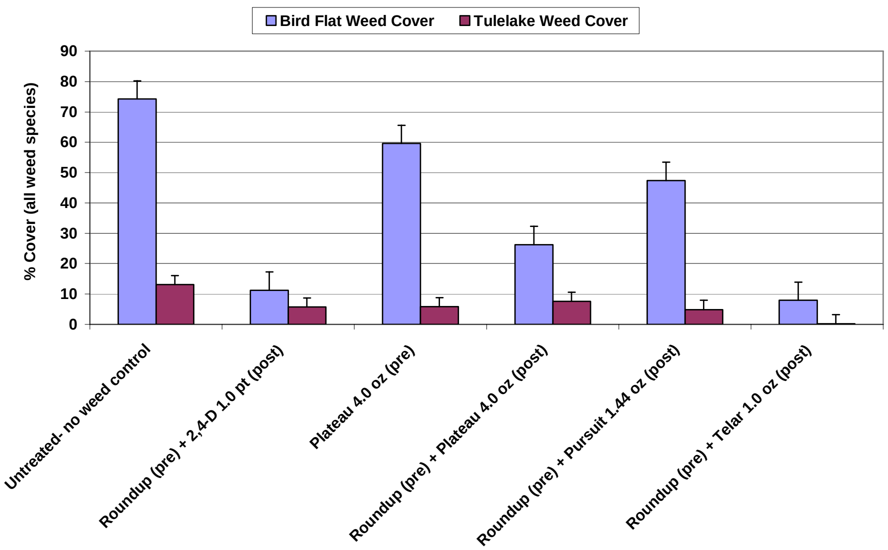


Figure 2. The Effect of Herbicides on Seeded Plant Density (averaged across species) June 2004

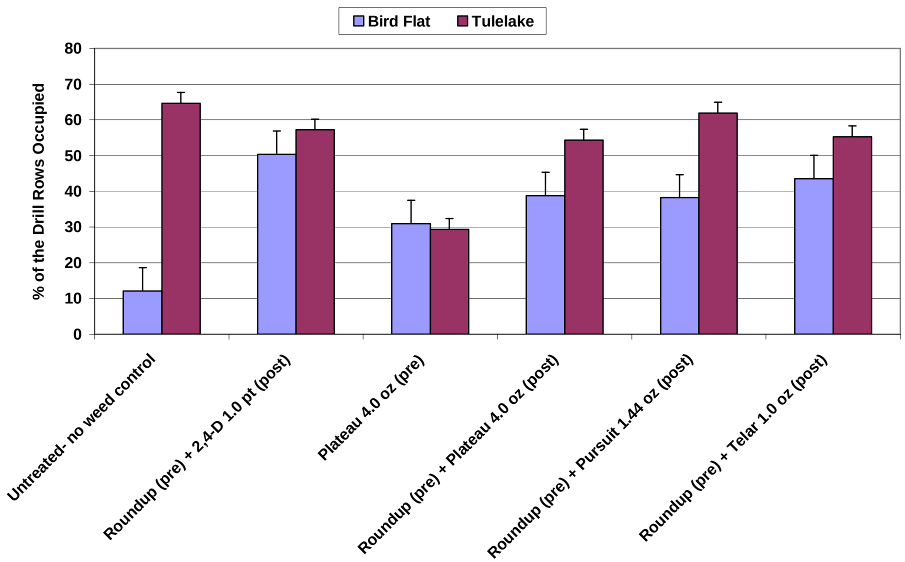


Figure 3. Herbicide injury on Seeded Plants (averaged across species) June 2004

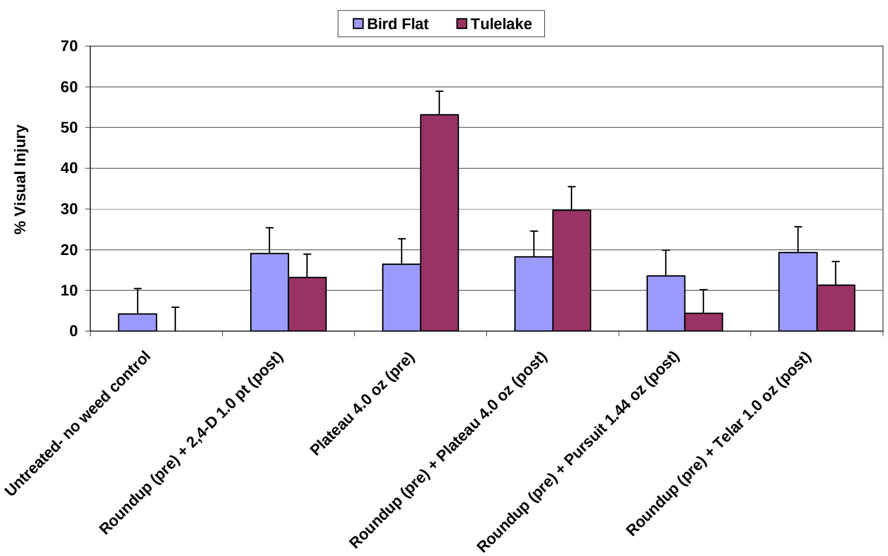


Figure 4. Seeded Plant Density at Bird Flat and Tulelake June 2004 (averaged across weed control treatments)

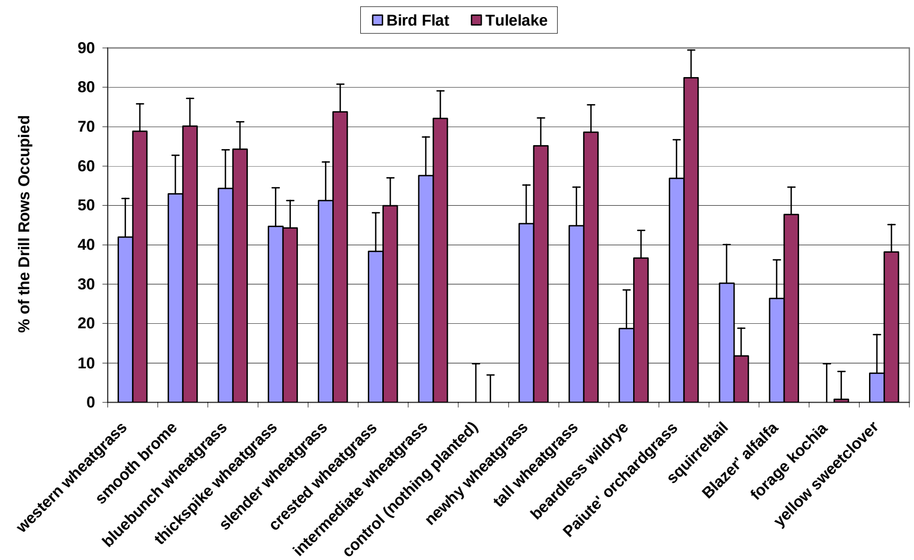


Figure 5. Seeded Plant Cover at Bird Flat and Tulelake June 2004 (averaged across weed control treatments)

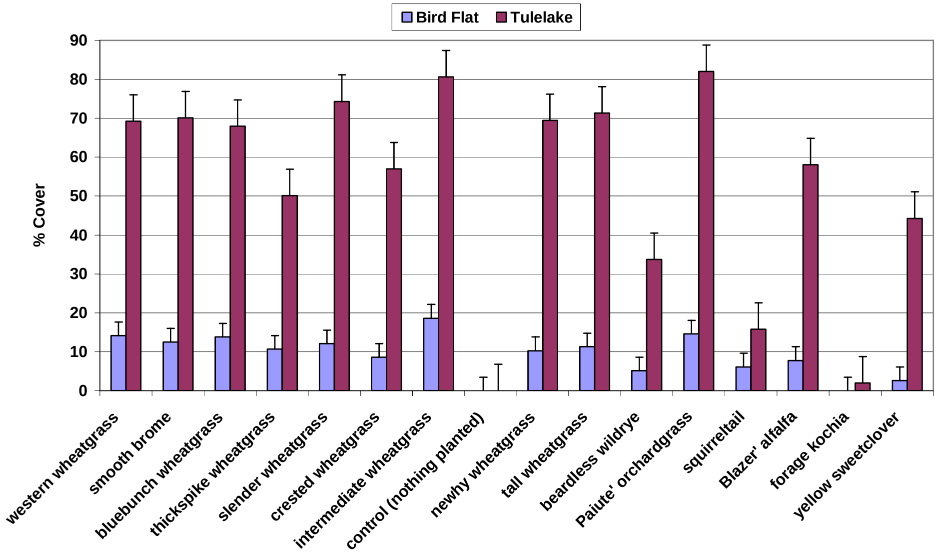


Figure 6. The Effect of Herbicides On Weed Cover Through the Growing Season at Tulelake

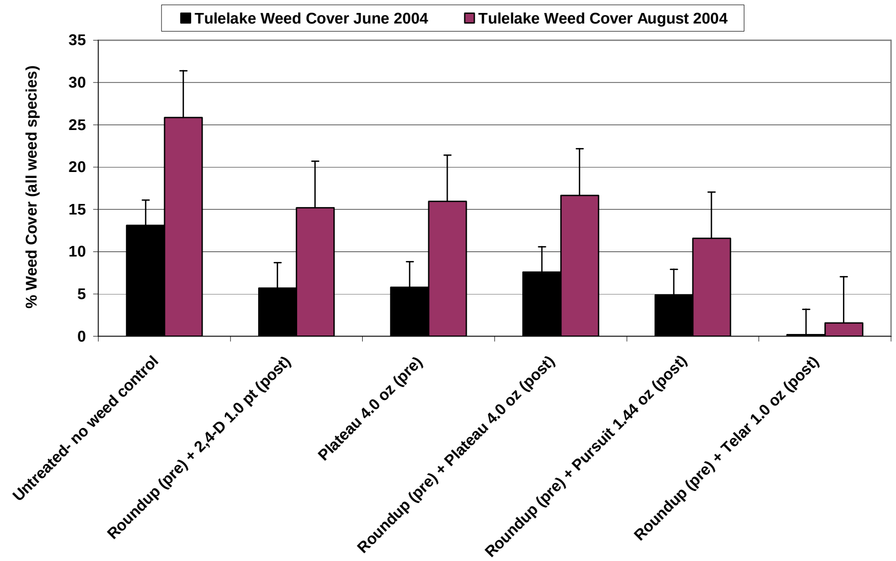


Figure 7. The Effect of Plateau Application Time on Dryland Species Cover at Tulelake August 2004

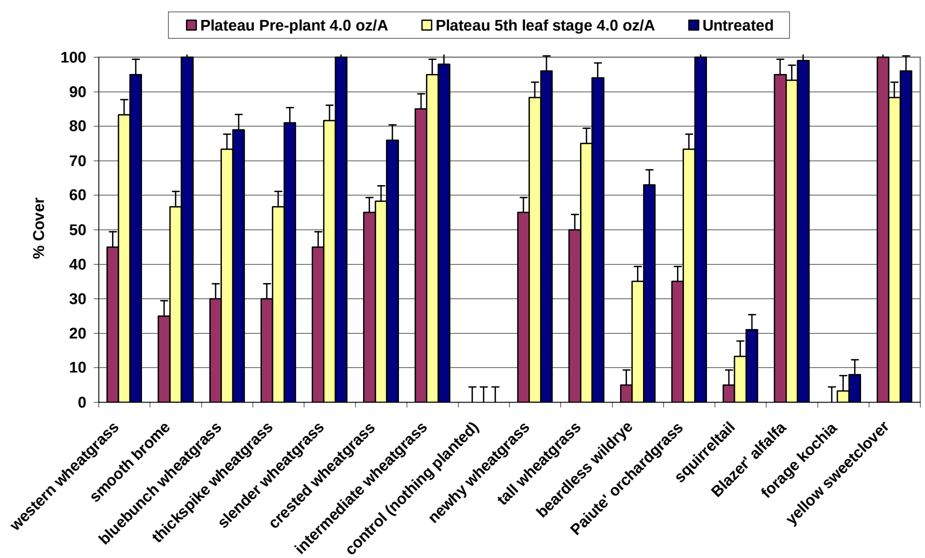
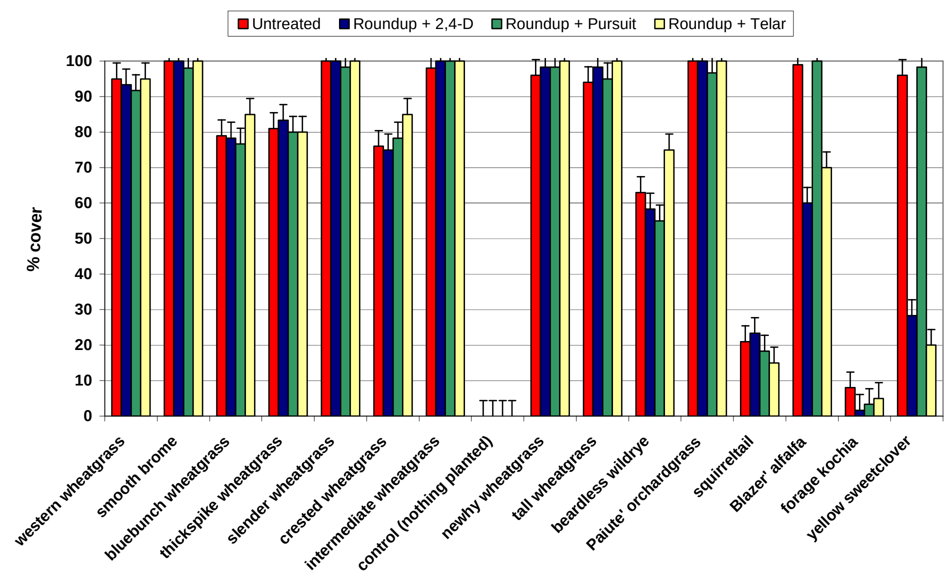


Figure 8. The Effect of Herbicide Treatments on Dryland Species Cover at Tulelake August 2004



Integrated Management of Perennial Pepperweed (tall whitetop): Combining mowing, disking, grazing, or burning with herbicides and perennial grass re-vegetation

Rob Wilson, UCCE Farm Advisor Lassen County; Dr. Joe DiTomaso, UCCE Weed Specialist UC Davis; Debra Boelk, Graduate Student UC Davis

Introduction

Perennial pepperweed (tall whitetop) is aggressive perennial weed that is rapidly spreading throughout California. It infests a vast array of habitats including alkali deserts, pasture, waterways, and wet, riparian areas. Currently, herbicides are the primary method for managing perennial pepperweed. Herbicides are effective at controlling perennial pepperweed, but they require repeat applications for several years to maintain long-term control. This experiment is designed to develop long-term sustainable management techniques for perennial pepperweed without a continued reliance on herbicides. The study examines management strategies that control perennial pepperweed and restore desirable vegetation on the site. The study also sets out to find effective management techniques for use in wetlands, rough terrain, and environmentally sensitive areas.

Specific Objectives include:

1. Determine if integrating burning, mowing, fall/winter grazing, or disking with herbicides and revegetation creates a synergistic effect with regard to perennial pepperweed control.
2. Evaluate burning, mowing, fall/winter grazing, and cultivation's effectiveness at removing perennial pepperweed's litter layer of senesced shoots.
3. Assess the effect different control treatments have on natural vegetation recovery.
4. Determine if re-establishing a competitive, native plant population prevents perennial pepperweed re-invasion.

Materials and Methods

The experiment is set up in a split-split plot design with four replications. The treatments are listed below.

Whole Plot Treatments

1. Control (No Alteration to the Site)
2. Winter Burn
3. Spring Mowing
4. Fall/Winter Grazing
5. Cultivation

Sub-plot Treatments

A. Control
B. Spring Telar at 1.5 oz ai/A
C. Spring 2,4-D ester at 1.9 lb ai/A
D. Spring Roundup at 3 lb ai/A

Sub-sub-Plot Treatments

a. Control
b. Seed native species

The experiment was established at two locations in Lassen County in Fall 2002. Study sites were located in areas heavily infested with perennial pepperweed that lacked competing vegetation. Whole plot size is 120 ft X 60 ft and sub-plot size is 30 ft X 30 ft (5 whole plot treatments * 8 sub-plot treatments * 4 replications) making the entire experiment 3.3 acres per site.

Initial burning, mowing, cattle grazing, and cultivation took place before herbicides were applied. The burn was conducted in the winter between February and April when optimal burn conditions arose. A winter burn was chosen because of the lack of burning restrictions during the winter and the fact that most favorable plants are dormant. The fire's purpose was to burn perennial pepperweed litter and release nutrients back to the soil. Fall/winter grazing consisted of fencing cattle at high stocking rates (100+ cows per whole plot) with supplemental feed (alfalfa and grass hay) for one day. The purpose of grazing was to trample/ break apart perennial pepperweed's litter layer and graze coarse grasses such as tall wheatgrass and basin wildrye. Spring or summer grazing was not used since cattle preferentially graze grass over perennial pepperweed. Spring mowing occurred after perennial pepperweed flowered using a flail mower. The purpose of mowing was to cut and break apart the litter layer and change perennial pepperweed's growth pattern to increase herbicide efficacy. Fall disking was used for the cultivation treatment. The purpose of fall disking was similar to mowing, except cultivation incorporates litter into the soil and severs perennial pepperweed's interconnected roots.

In spring 2003, Telar, Roundup, or 2,4-D treatments were applied when perennial pepperweed was in the flowerbud stage. In mowed plots, all herbicide applications were delayed until September to allow mow plants to re-grow to the flowerbud stage. Roundup and 2,4-D treatments were repeated in September in disked plots to treat perennial pepperweed shoots that arose after the spring treatment. All herbicides were applied with recommended surfactants using a CO_2 backpack sprayer.

In March 2004, re-vegetation plots were seeded with a cool season, perennial grass mix using a no-till drill. Re-vegetation in winter grazing plots consisted of broadcasting seed a week before grazing allowing livestock to trample the seed into the soil. Grass species (western wheatgrass, beardless wildrye, tall wheatgrass, & basin wildrye) were chosen based on previous success in Northeastern California, potential to compete with perennial pepperweed, and precipitation/ soil preferences.

In spring 2004, Telar at 1.0 oz/A or 2,4-D at 1 lb ai/A was applied to all herbicide plots to suppress perennial pepperweed re-growth and control annual broadleaf weeds. 2,4-D was applied to plots treated with 2,4-D and Roundup in 2003, and Telar was applied to plots treated with Telar in 2003.

Percent cover for all plant species, bare ground cover, perennial pepperweed standing thatch cover, and perennial pepperweed ground litter cover was measured in spring and fall 2003/2004 to determine treatment effects. Perennial grass density was recorded in spring and fall 2004 to access seeded grass establishment and vigor. Data was collected in three, randomly placed 1 m^2 quadrats in each sub-plot.

Data was analyzed using analysis of variance (ANOVA) on each measured factor. A mixed model was used to pull random variability between replications, sites, and years out of the analysis. In addition to vegetation data, an initial soil sampling at each site was conducted (5 samples from each rep) before any treatments are applied. The soils was analyzed to determine the level of macro and micro-nutrients, C:N ratio, pH, OM %, soil texture, EC, Na concentration, and SAR value.

Results

Preliminary results suggest burning, tillage, and mowing are effective at removing accumulated standing thatch before herbicide treatment (figure 1). Mowing and tillage also significantly reduced perennial pepperweed cover compared to untreated, burned, and grazed plots the year of herbicide application (figure 1). All herbicide treatments significantly reduced perennial pepperweed cover one year after treatment, although certain herbicide + cultural treatment combinations worked better than others (figure 2). Telar, 2,4-D, Roundup, 2,4-D + Burning, Roundup + Burning, Telar + mowing , Roundup + mowing, Telar + Grazing, and Roundup + Grazing provided the best control of perennial pepperweed.

Winter burning and fall tillage provided the best seedbed and did an excellent job at removing old, standing thatch and ground litter. Although fall tillage provided an excellent seedbed, it also promoted perennial pepperweed regrowth (figures 3 & 4). Due to low rainfall during spring 2004, perennial grass establishment was poor at both sites. None of the plots had perennial grass cover exceed 7 %, but fall tillage, winter grazing, and winter burning in combination with 2,4-D or Roundup seemed to provide the best conditions for perennial grass establishment (figure 5).

Figure 1. The Influence of Burning, Cattle Grazing, Mowing, and Tillage on Perennial Pepperweed and Ground Litter Cover Immediately Before the 2003 Herbicide Application (averaged between sites)

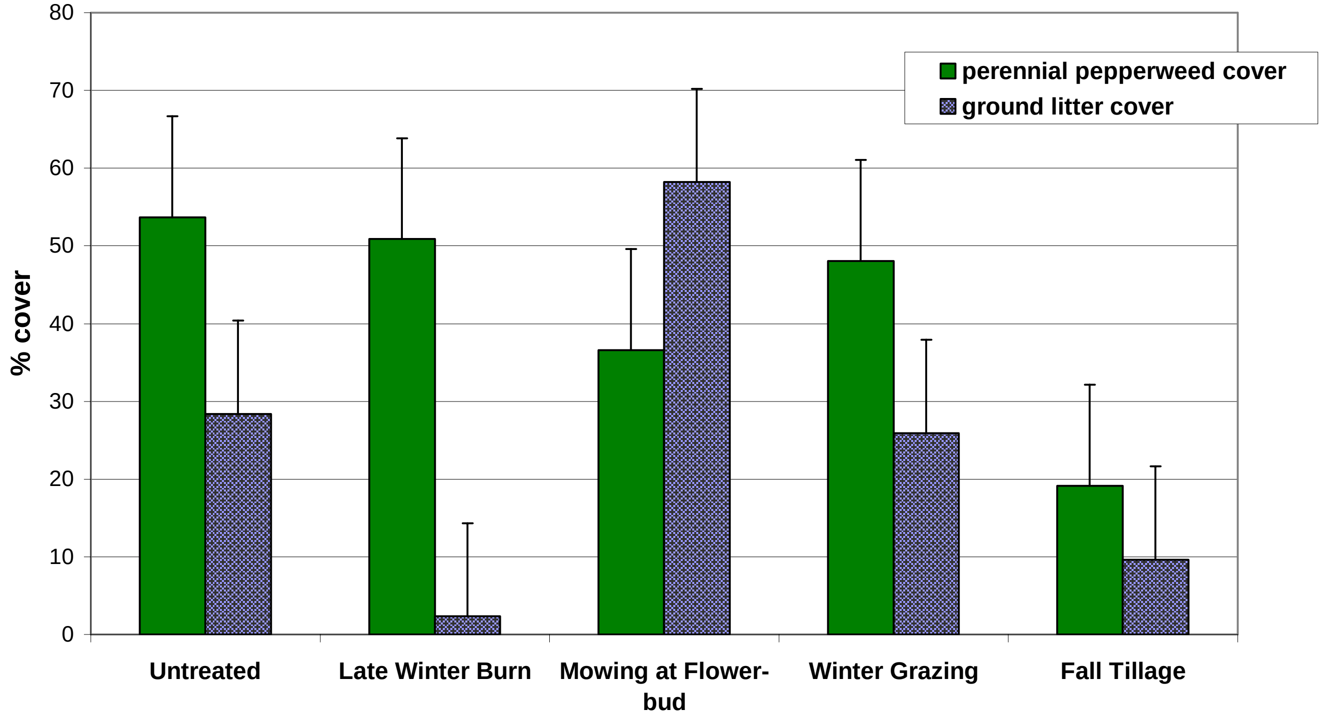
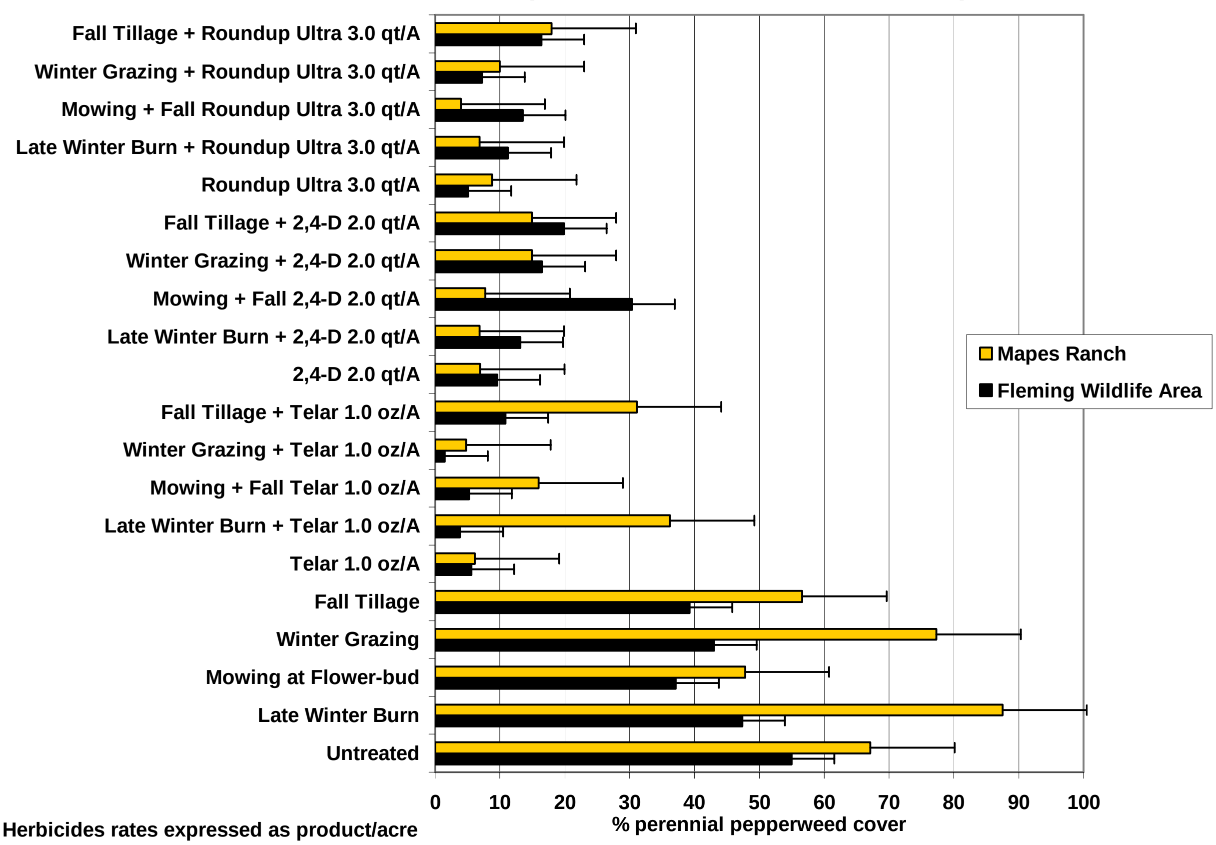


Figure 2. The Effect of Control Methods on Perennial Pepperweed Cover June 2004 (1 Year after Herbicide Treatment)



Herbicides rates expressed as product/acre

Figure 3. The Influence of Cultural Treatments on Perennial Pepperweed, Ground Litter, Standing Thatch, and Bare Ground Cover June 2004 at Fleming Wildlife Area (Data was averaged across herbicide treatments)

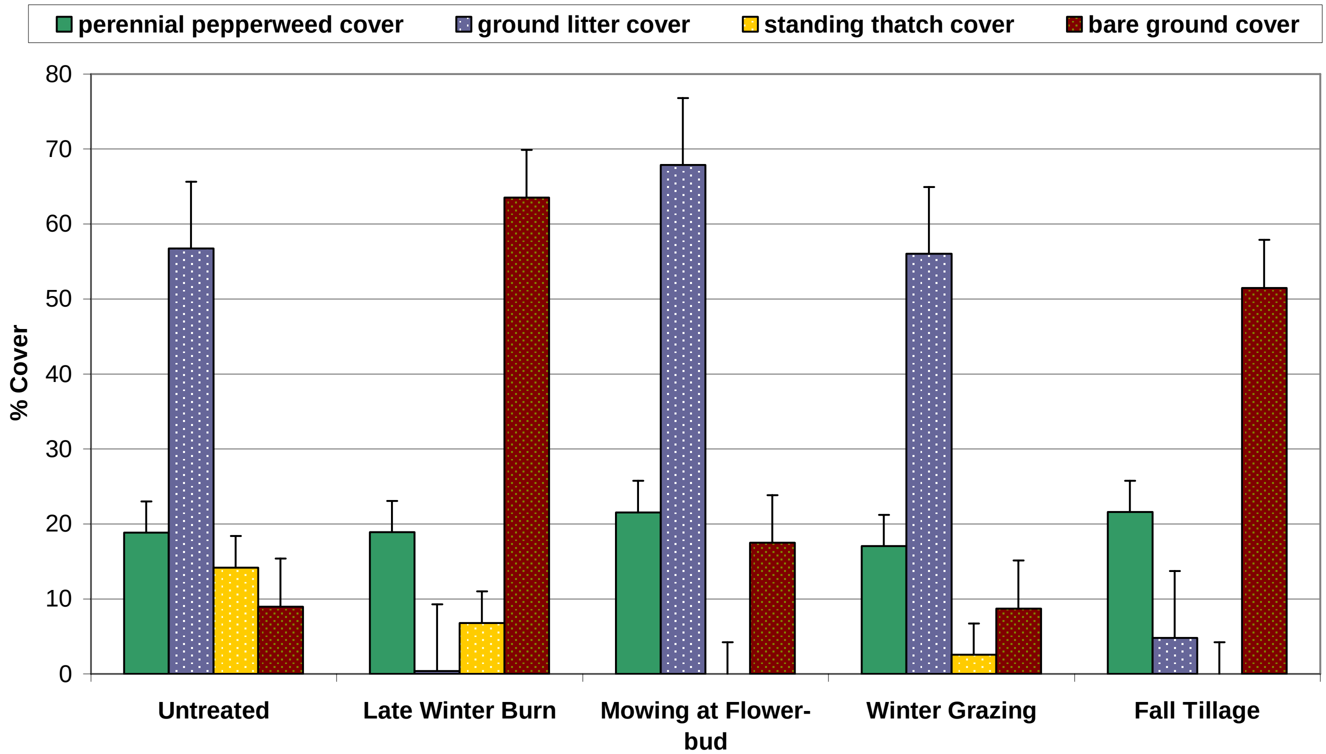


Figure 4. The Influence of Cultural Treatments on Perennial Pepperweed, Ground Litter, Standing Thatch, and Bare Ground Cover June 2004 at Mapes Ranch (Data was averaged across herbicide treatments)

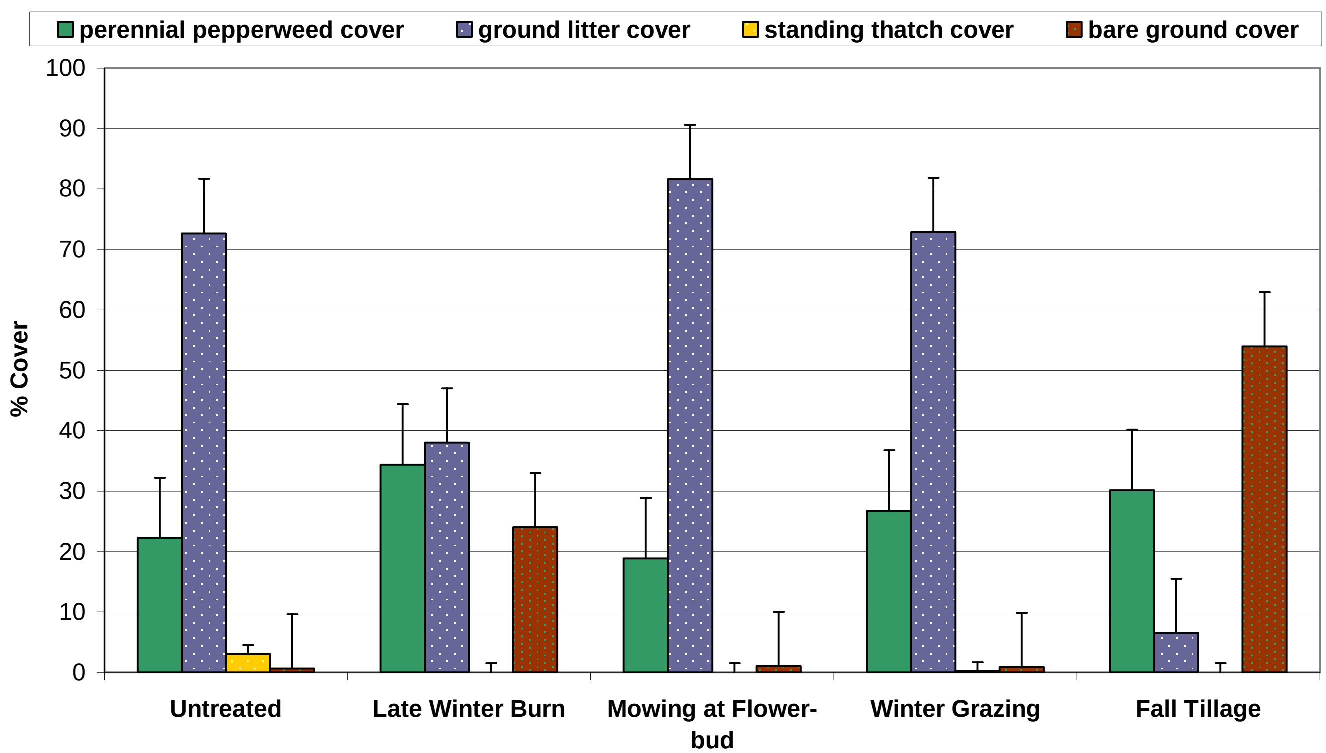


Figure 5. The Influence of Cultural and Herbicide Treatments on Perennial Grass Establishment at Mapes Ranch September 2004