Barb Goatgrass Seed Production: Grazing, Glyphosate Rate, and Application Timing

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Photo: Guy Kyser

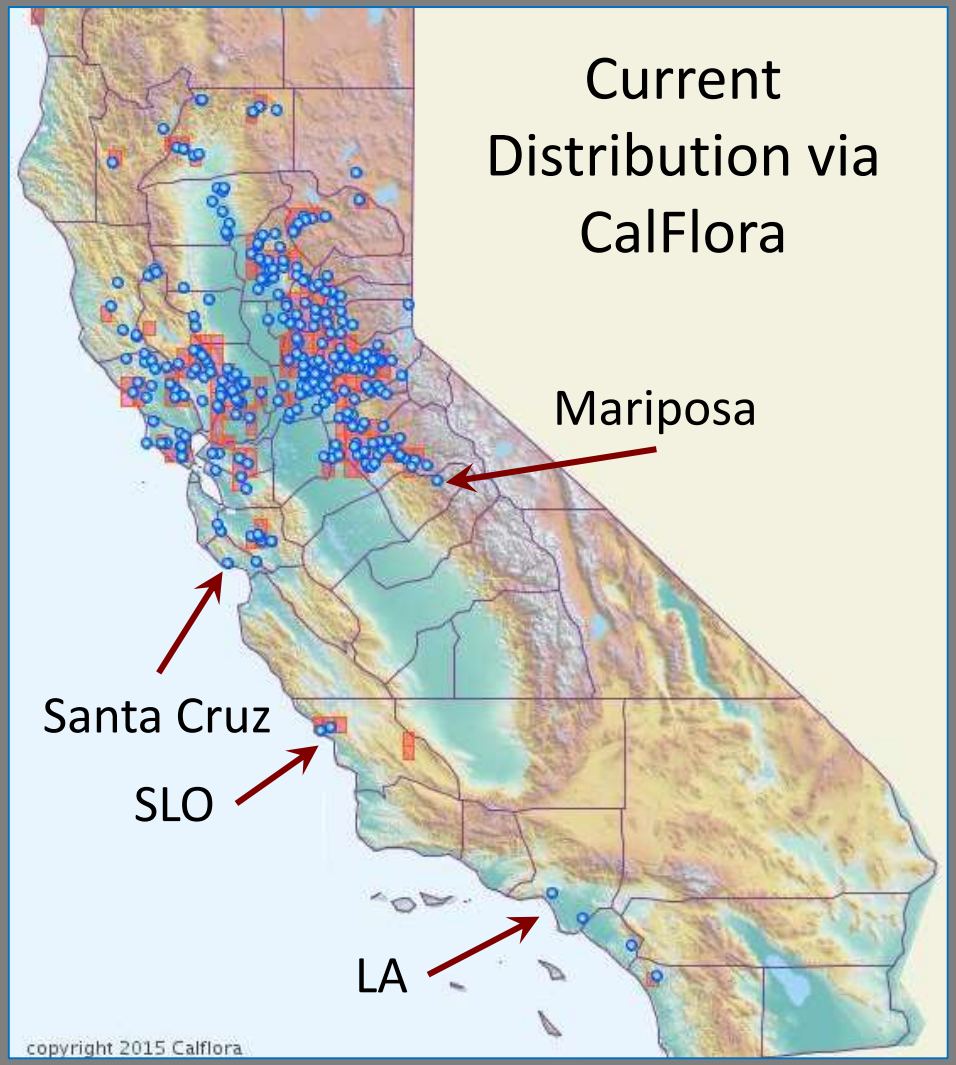
Barb Goatgrass - Background

Photo: J. Davy

- Eurasian winter annual
- Introduced to CA early 1900s (cattle?)
- Cal-IPC Inventory Rating “High”

Barb Goatgrass - Background

Photo: J. Davy



Barb Goatgrass - Impacts

Economic

- Lost production of palatable forage
- Animal injury from awns

Environmental/Transformer

- Drought tolerant
- High silica, persistent thatch
- Displaces desirable species to form monocultures

Barb Goatgrass - Morphology

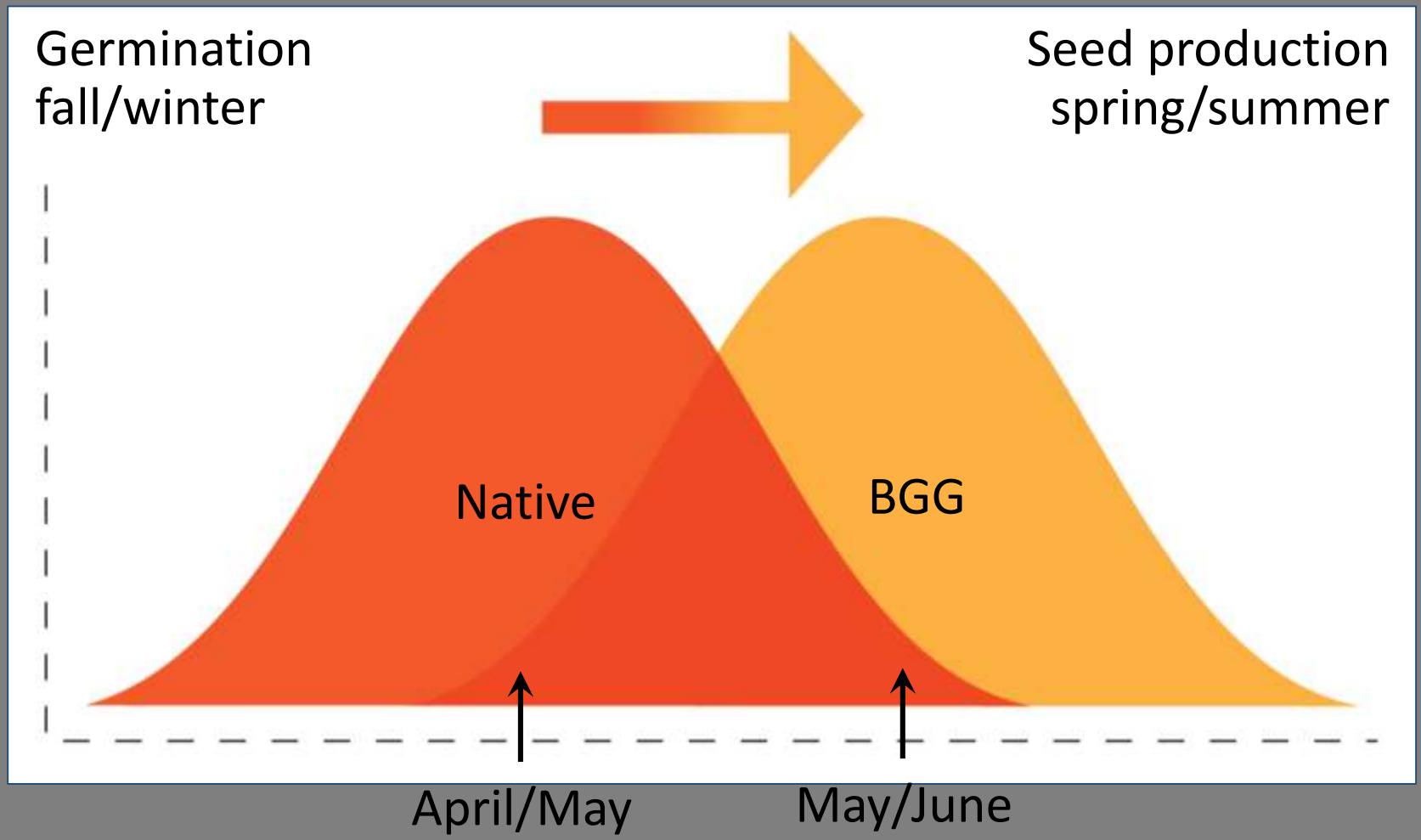
- Large spikelet w/ long, stiff, barbed awns
- Hard seed coat
- Viable ~ 2 yr, fire resistant

Barb Goatgrass - Phenology

Barb goatgrass boot stage

Medusahead heading stage

Barb Goatgrass - Phenology



Barb Goatgrass - Management

Choice of Herbicide and Application Timing

- Grazing restriction on dims/fops
- Cost limit for producers ($20/ac) …glyphosate
- Lower rates and later timings to minimize nontarget damage

After tillering application, prior to grazing

Photo: G. Kyser

Barb Goatgrass - Management

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PHILIP BROWNSEY, Rangeland Restoration Academic Coordinator, Sierra Foothill Research and Extension Center; JOSH DAVY, Livestock, Range, and Natural Resources Advisor, Tehama, Colusa, and Glenn Counties; THERESA BECCHETTI, Livestock and Natural Resources Farm Advisor, San Joaquin and Stanislaus Counties; MADDISON L. EASLEY, Staff Research Associate, Sierra Foothill Research and Extension Center; JEREMEY J. JAMES, Director, Sierra Foothill Research and Extension Center; and EMILIO A. LACA, Professor, Department of Plant Sciences, University of California, Davis

Barb Goatgrass and Medusahead: Timing of Grazing and Mowing Treatments

Barb goatgrass (*Aegilops triuncialis* L.) and medusahead (*Taeniatherum caput-medusae* (L.) Nevski) are invasive annual grasses that have spread or have the potential to spread throughout much of California's annual grasslands. Originally from the Mediterranean, Middle Eastern, and Central Asian regions, these species were first introduced to the western United States in the late 1800s or early 1900s.

Barb goatgrass primarily occurs in California, although there are records from Washington, Oregon, and Nevada, as well as from some mid-Atlantic states (Meimberg et al. 2006). Medusahead is widespread in California and the Intermountain West, occupying roughly 2.4 million acres across the western United States (Duncan et al. 2004). Estimates for the extent of barb goatgrass infestation are not currently available, though it is much less widespread than medusahead. Barb goatgrass is a B-rated noxious weed and medusahead is a C-rated noxious weed in the State of California, meaning that they both cause economic or environmental detriment. Barb goatgrass has a higher rating due to its more limited distribution and, therefore, greater opportunity for containment than

Figure 1. Barb goatgrass and medusahead compared with other common annual grasses, showing a later phenology. Left to right: Barb goatgrass, jointed goatgrass, hare barley, medusahead, ripgut brome, soft brome. *Photo: J. Davy.*

Barb Goatgrass - Management

Timed Grazing (Brownsey et al. 2016)

- During vegetative growth increases density
- Boot stage to prevent/limit seed production (soil moist/carb.)
- Later- plants not palatable

Barb Goatgrass - Management

Timed Burning
(DiTomaso ea 2001)

- Spring burn before seed dispersal
- Single burn ineffective (seedbank)

Barb goatgrass, above, was introduced in California around 1915. This noxious rangeland weed crowds out more valuable grass species, reduces forage quality and can cause mechanical injuries to livestock. Right, researchers at the UC Hopland Research and Extension Center tested the effectiveness of prescribed burns to control barb goatgrass.

Carefully timed burning can control barb goatgrass

Joseph M. DiTomaso ❑ Kerry L. Heise ❑ Guy B. Kyser
Adina M. Merenlender ❑ Robert J. Keiffer

Barb goatgrass is a noxious annual grass that is rapidly invading California's grassland ecosystems. No effective control strategies for managing barb goatgrass have been available that do not simultaneously injure other more desirable grass and broadleaf species. In our study at the UC Hopland Research and Extension Center, we conducted prescribed burning in late spring or early summer before barb goatgrass seeds had reached maturation. One year of prescribed burning was not sufficient to control re-establishment the following year. However, 2 years of complete burning gave effective control of barb goatgrass while increasing native perennial grass cover and native species richness, particularly legumes. The success of the goatgrass control was directly proportional to the completeness of the second-year burn.

Three species of goatgrass occur in California: jointed, ovate and barb goatgrass. All three species are winter annual grasses introduced early in the 20th century from Mediterranean Europe and western Asia. They are closely related to winter wheat (*Triticum aestivum*) and have been shown to hybridize with the cereal crop. In the Western states, jointed goatgrass is the most widespread species within the genus and is a serious problem for cereal crops, particularly winter wheat. Unlike jointed goatgrass, ovate (*Aegilops ovata*) and barb goatgrass are invasive primarily in disturbed and undisturbed grasslands and pastures.

Barb goatgrass (*A. triuncialis*) was probably first introduced to California around 1915. From early records, it was reported to crowd out other valuable range species, reduce forage quality and quantity, and injure livestock when its barb awns (slender, bristle-like appendages with sharp "hooks") became lodged in their noses, mouths or eyes (Kennedy 1928). Once a grassland became infested with barb goatgrass, estimates indicated that livestock range capacity (the number of cattle the acreage can support) was reduced by 50% to 75% (Jacobsen 1929). By the late 1920s it had spread to thousands of acres, but the infestations were local and restricted to two counties, Calaveras and El Dorado (Talbot and Smith 1930). Despite its limited distribution, state and county officials made an effort to eradicate barb goatgrass. At that time, however, few options were available. Burning was used as a control measure, but prescribed burns were generally conducted either too early, when controlled fires were not sufficiently hot, or too late, when seedheads were more resistant to destruction. Consequently, burning as a control strategy was considered unreliable unless it was combined with a previous mowing or oil treatment (Talbot and Smith 1930).

The control efforts in the early part of the 20th century probably slowed the spread of barb goatgrass, which can rapidly move through livestock transfers and contaminate vehicles or

Barb Goatgrass - Management

Timed Burning
(DiTomaso ea 2001)

- Spring burn before seed dispersal
- Single burn ineffective (seedbank)

Photo: T. Bean

Hopland Research & Extension Center Project: 2015-present

Questions

- Can high intensity grazing (HIG) reduce bgg cover/seed production?
- Does glyphosate application timing affect seed production/viability?

Photo: T. Bean

Hopland Research & Extension Center Project: 2015-present

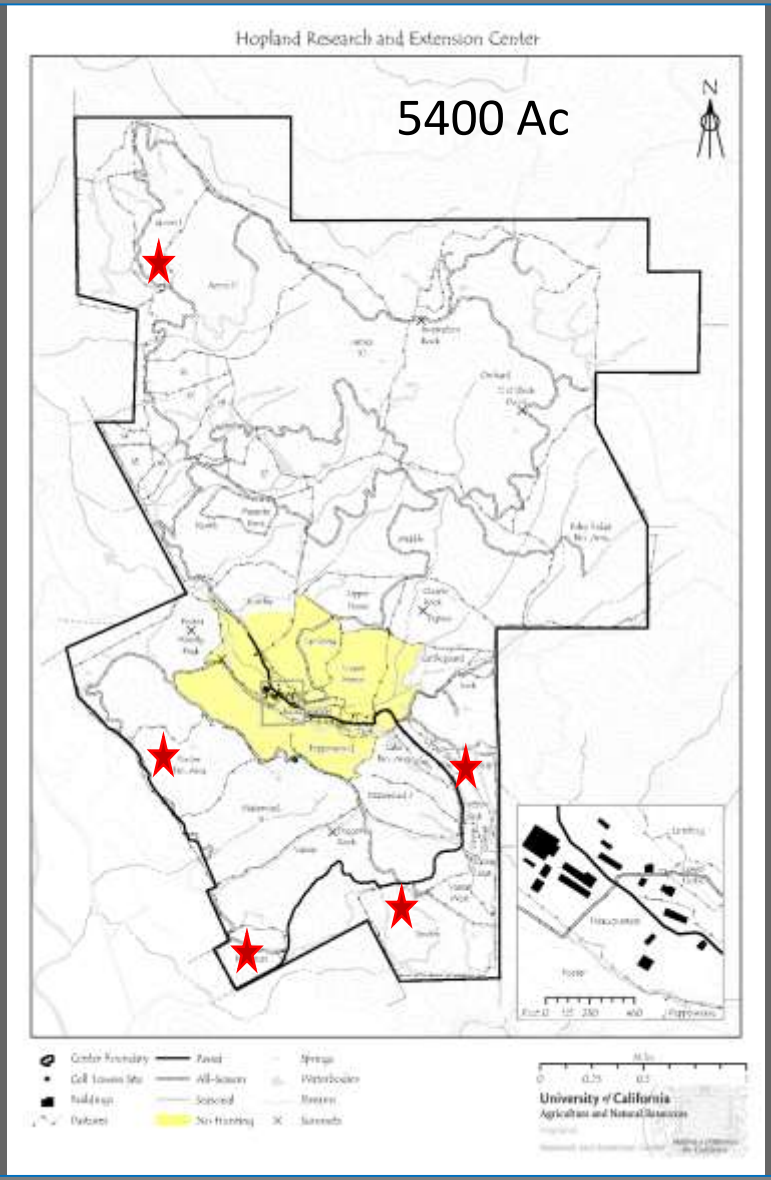
Questions

- Can control be achieved (*& damage limited*) with a lower (*more selective*) rate?
- Does a combination treatment work better than individual treatments?

Photo: T. Bean

HREC: Location

- Heavily invaded (also medusahead) grassland and oak woodland
- Interior Coast Range, Mediterranean climate
- 40 in ppt yr^{-1}, ~75% Nov to Feb
- Moderate slopes, loam to clay soils (some serpentine)
- Sheep grazing dominant land use



Study Design

5 pastures

- 3 blocks (18 x 36 m) each

Glyphosate (RoundUp WeatherMax ®)

- low (10 oz ac^{-1}) prod.
- high (32 oz ac^{-1}) prod.

Photo: A. Smith

Study Design

Applied @

- tillering (*late March*)
- boot (*early May*)
- heading (*late May*)

Grazing

- 405 sheep days per ac
- *Late April*

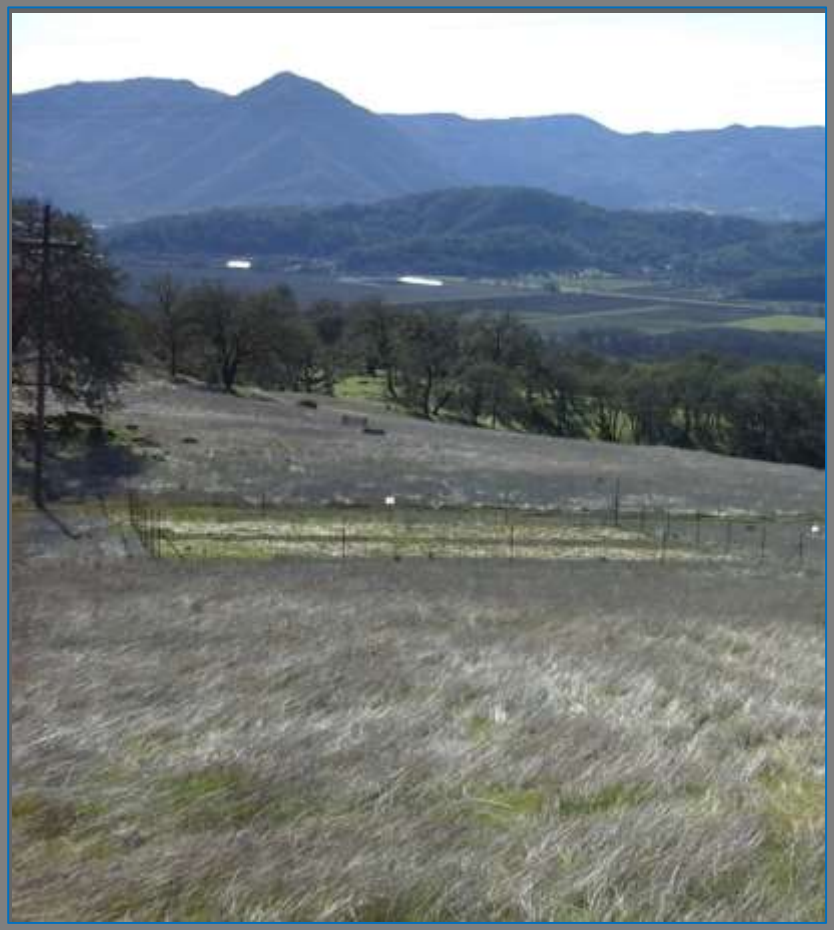


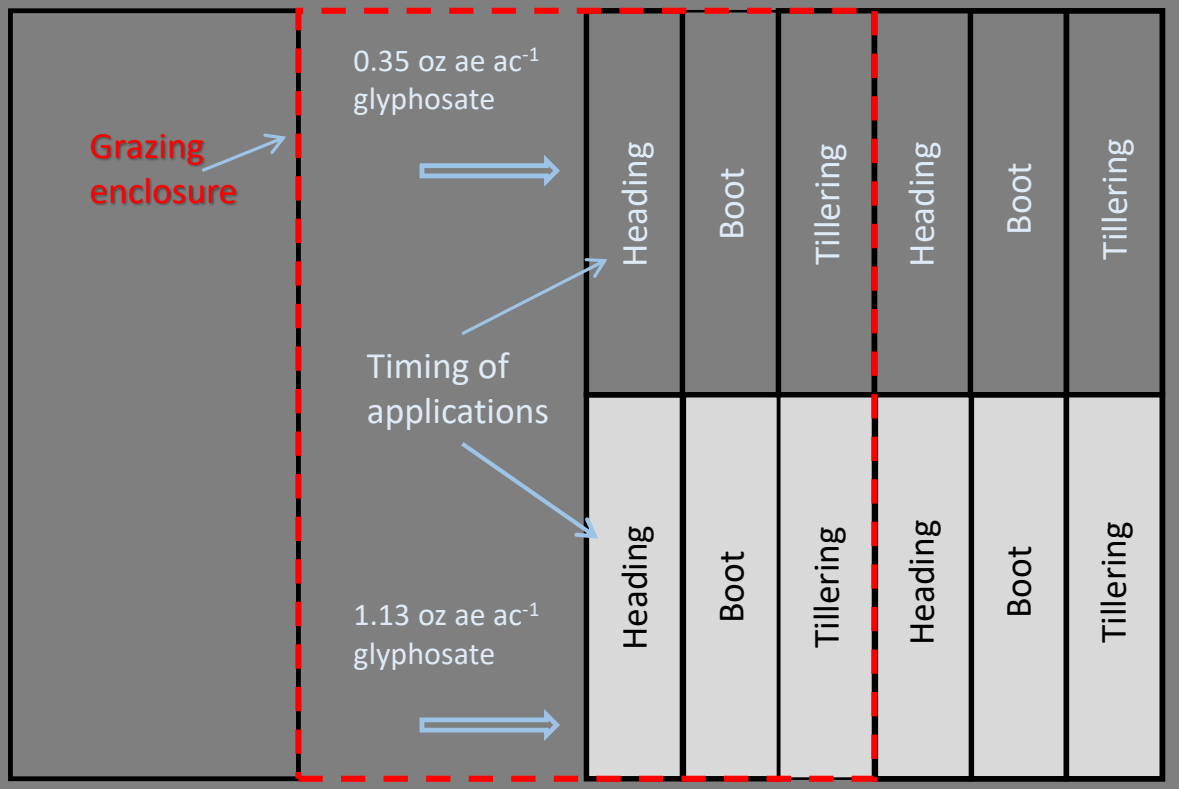
Photo: A. Smith

Plot Layout

Grazing
- 2 factors

Rate
- 3 factors

Timing
- 3 factors



Measurements

Species cover in Apr/May

- Six random 1-m^2 quadrats per plot
- Excluded grazed plots & and plots treated at tillering

Seedhead density in June

- Three random (0.04 or 1-m^2) quadrats per plot (6 for untreated plots)

Seed viability in June

- 10 random seedheads per plot (20 for untreated plots)

Mixed Model ANOVA

Source	F Ratio	Prob > F
Grazing	**109.8**	**<0.0001**
Herbicide Rate	**45.6**	**<0.0001**
Application Timing	**46.6**	**<0.0001**
Grazing x Herbicide Rate	2.4	0.0954
Grazing x Application Timing	**28.9**	**<0.0001**
Herbicide Rate x Application Timing	0.8	0.4670

Seedhead Density Results

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- Grazing reduced barb goatgrass SH density by 68%
- Herbicide reduced barb goatgrass SH density by 60%
  - No difference btw high and low

Seedhead Density Results

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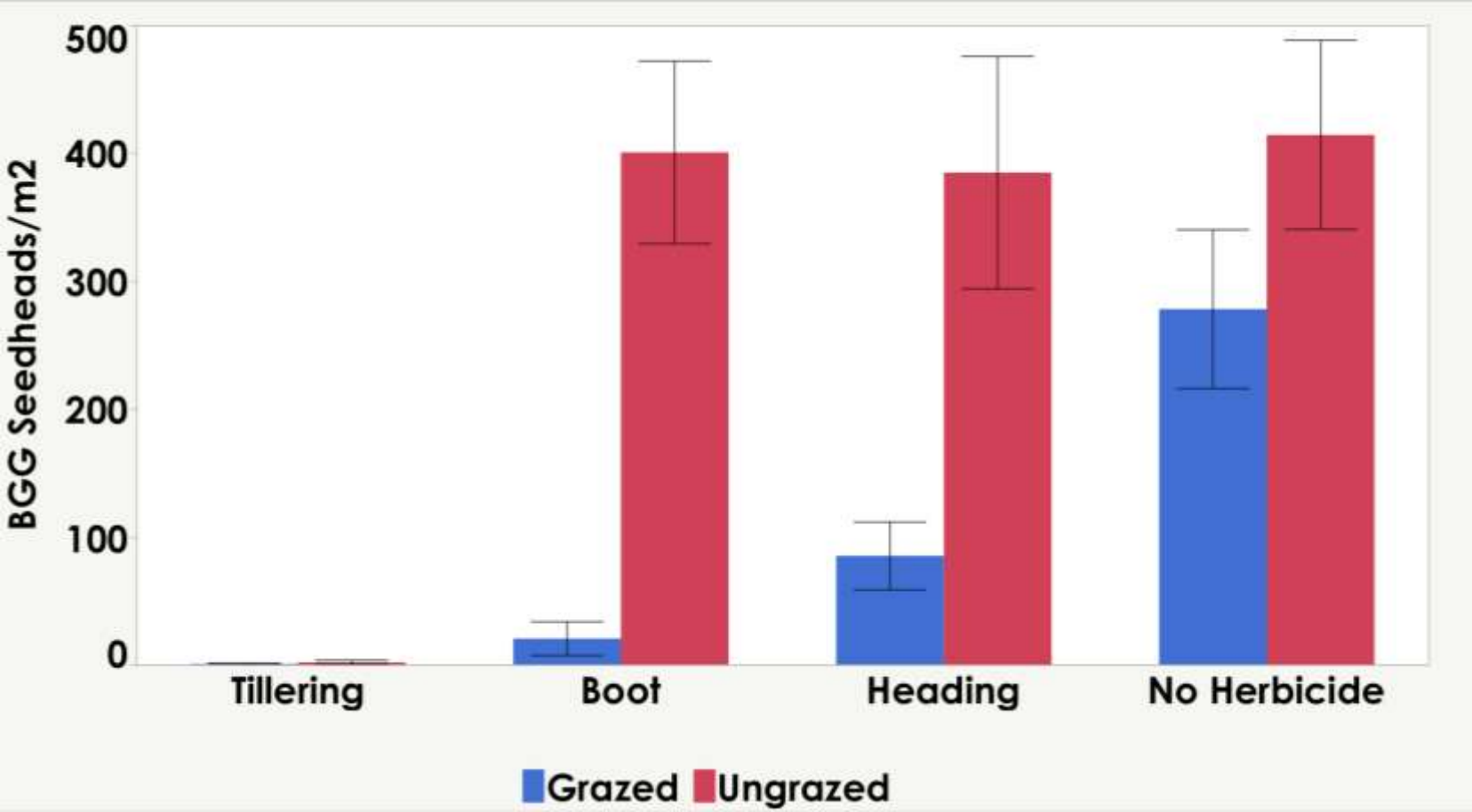
Application timing at

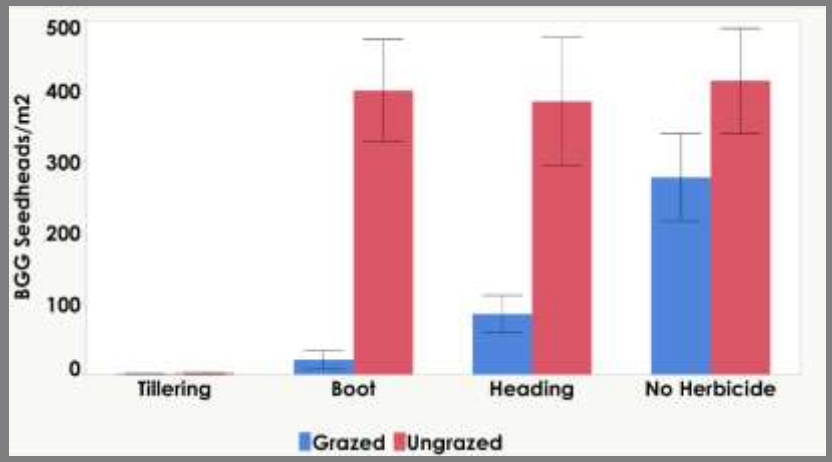
- Tillering reduced SH density by 99% compared to other timings
- Boot reduced SH density by 10% compared to heading
- No interaction among grazing and herbicide rate OR rate and stage of application

Seedhead Density Results



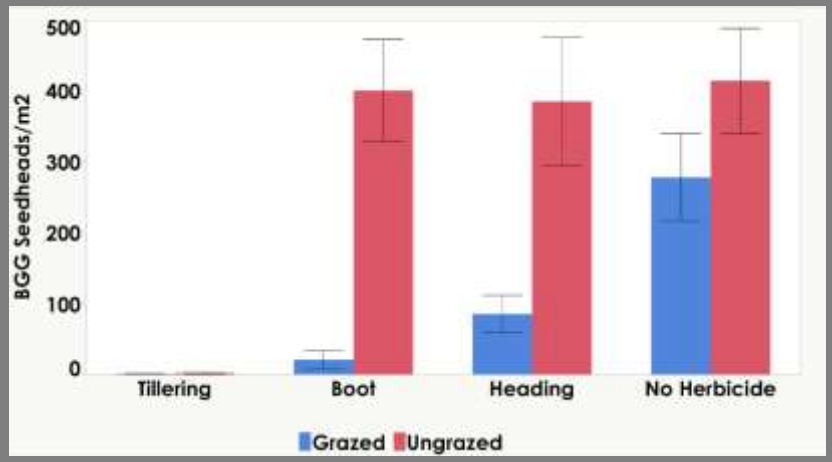
Seedhead Density Results

1. Herbicide application at *tillering* or application at *boot + grazing* had lowest bgg seedhead densities



Seedhead Density Results

2. Herbicide application at *heading + grazing* had lower bgg seedhead densities than *ungrazed* or treatments or *grazing without herbicide*



Management Implications

- Grazing appears to extend window for max efficacy of herbicide from tillering to boot stage
- If this window is missed, application at heading is a good backup for grazed areas
- No difference in herbicide rates means less herbicide so lower cost (2/3 less) and potentially less nontarget damage

Future of current project

- Evaluate seed viability data (do plants sprayed at boot stage develop viable seed?)
- Evaluate treatment effects on seeding success and natural recruitment of desirable species
- Evaluate resilience of treatments to reinvasion longer term

Future research for a comprehensive management prescription

- Incorporate prescribed/opportunistic fire to accelerate seedbank depletion
- Evaluate additional herbicide options for conservation goals
- Expand to Sacramento Valley and Sierra Foothills – evaluate influence of local climate on barb goatgrass phenology
- Evaluate relative efficacy of multiple treatments per season vs. treatments deployed across seasons

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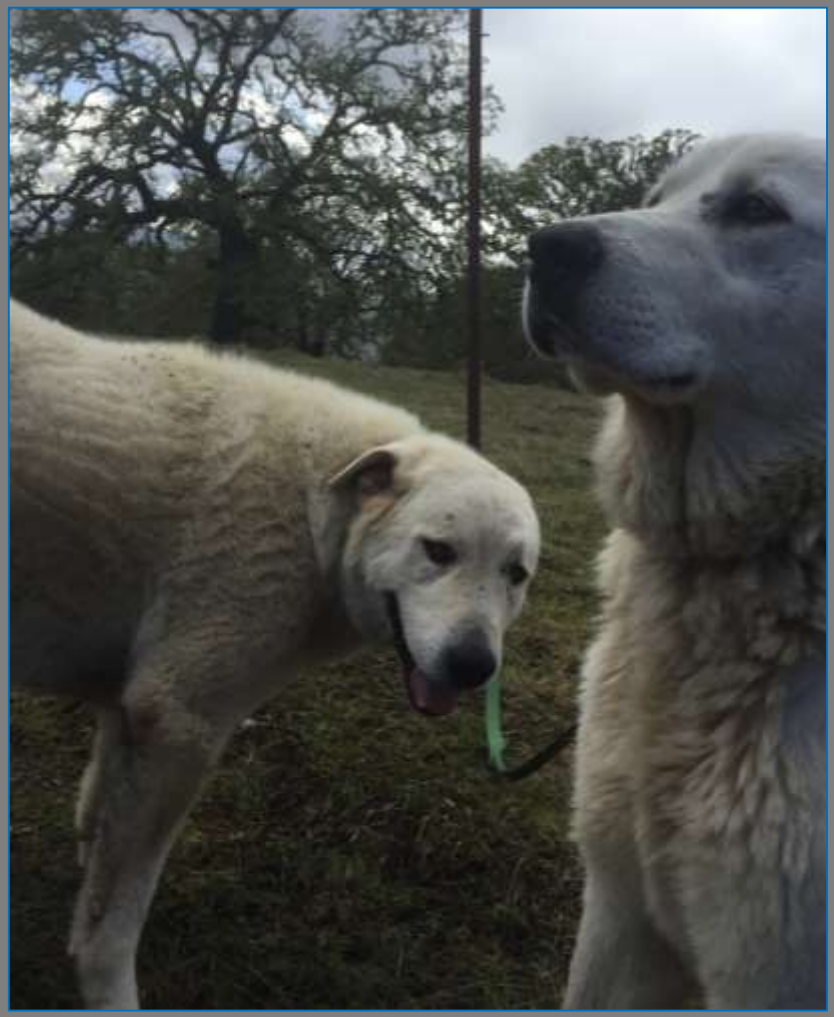
- UC Hopland Research and Extension Center
  - Kim Rodrigues, Alison Smith, Tom Seward, Troy McWilliams, Hannah Bird, Dave Koball, Chuck Vaughan, and the dogs:



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Project Team

Elise S. Gornish[1], Travis M. Bean[2*], Josh S. Davy[3], Guy B. Kyser[1]

[1]*Department of Plant and Environmental Sciences, University of California, Davis*

[2]*Department of Botany and Plant Sciences, University of California, Riverside*

[3]*University of California Cooperative Extension Glenn, Colusa and Tehama Counties*

Where did all this goatgrass in Riverside come from?

*Questions?

bean@ucr.edu
(951) 827-5130