Efficacy and safety of new herbicides on the horizon

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Aminopyralid (Milestone®)

Treatments

- Untreated check
- Aminopyralid (Milestone* herbicide)
  - 2, 2.5, 3, 3.5, 4, 5 and 7 fl oz/A
- Clopyralid (Transline* herbicide)
  - 4, 8, and 10 fl oz/A
- Picloram (Tordon* 22K herbicide)
  - 16 and 32 fl oz/A

All treatments with 0.25% v/v Activator 90 or X-77 surfactant

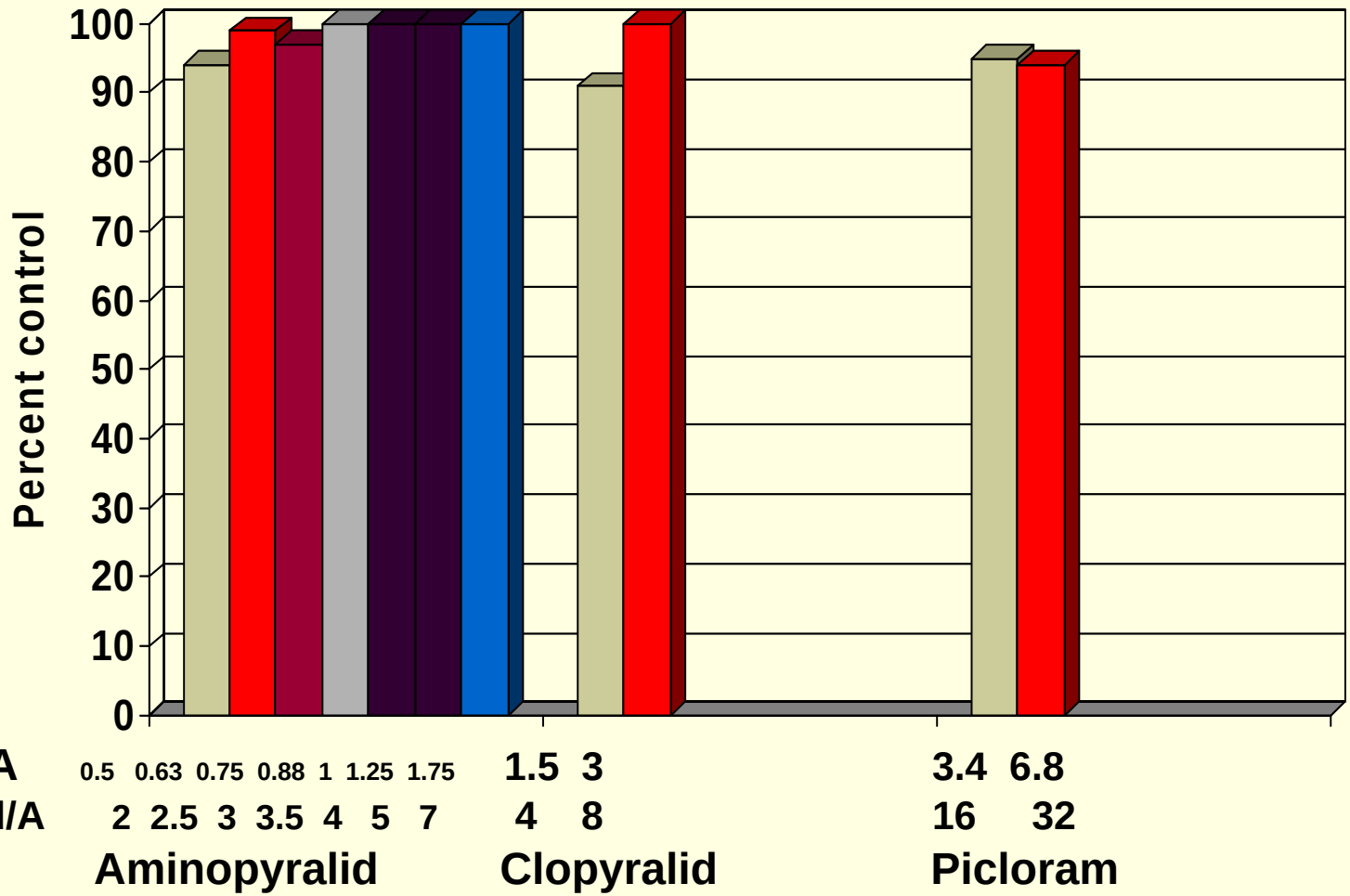
Plots 10 x 20 ft, applied at 20 GPA, replicated 3 or 4 times at each site

10 ft boom with six 8002 nozzles, 30 psi, CO_2 backpack sprayer

* Trademark of Dow AgroSciences LLC

Combined result of aminopyralid on yellow starthistle control in year of treatment

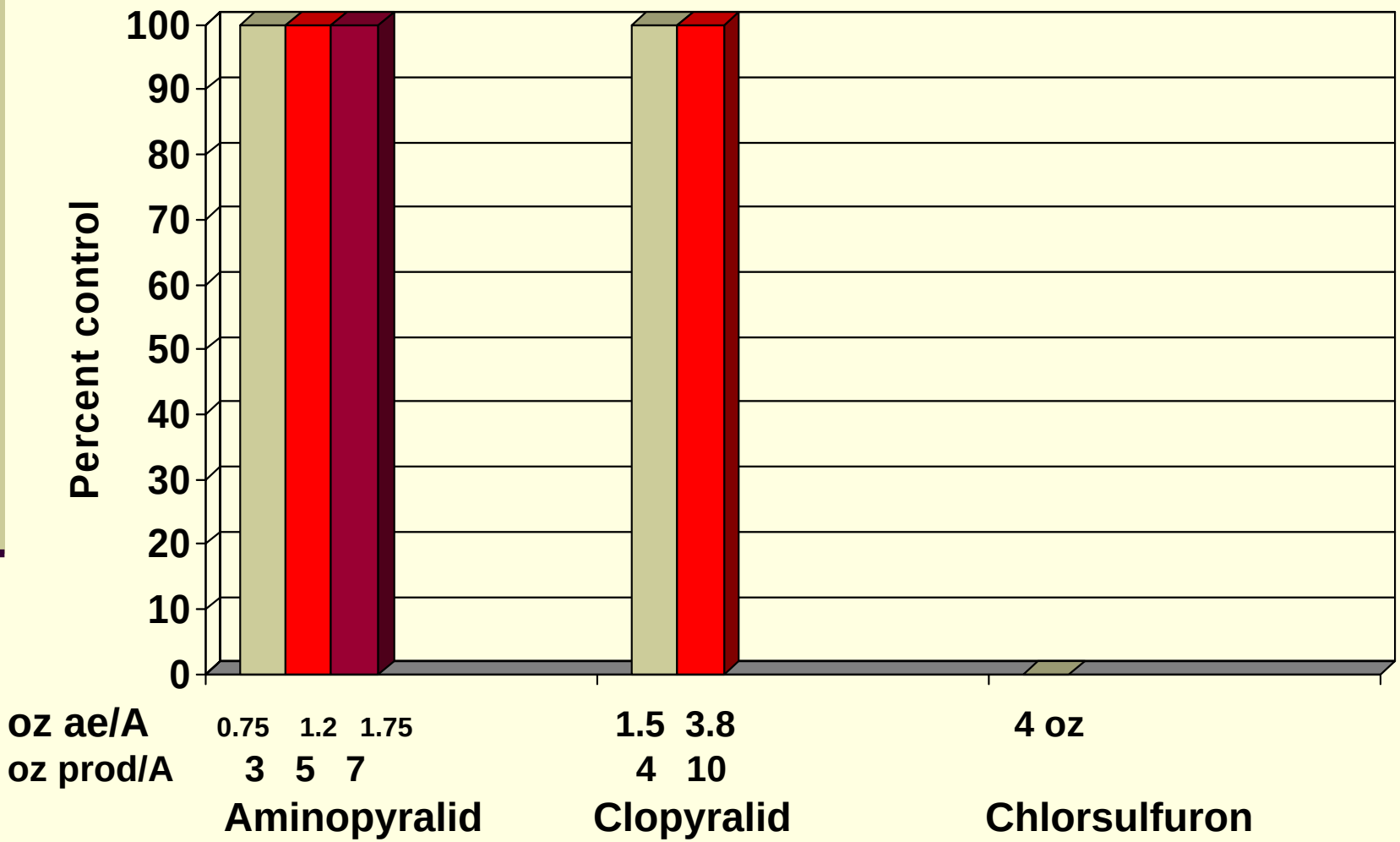
(from studies in Oregon, Washington, Idaho and California)



LSD (0.05) = NS

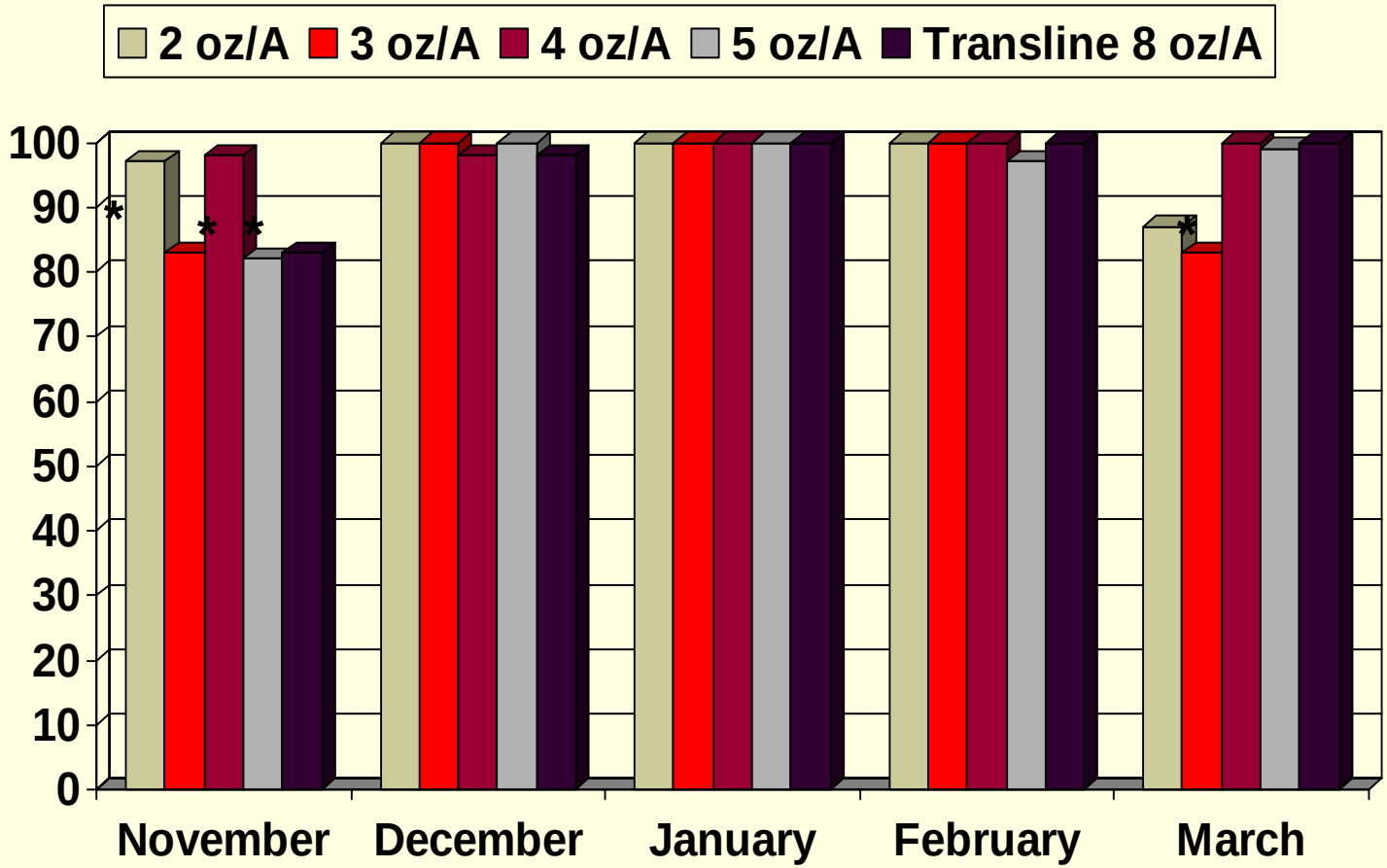
Control of yellow starthistle with aminopyralid in Yreka, CA

Treated on March 11, 2005, evaluated June 20, 2005



LSD (0.05) = NS

Effect of treatment timing on yellow starthistle control in Davis, California

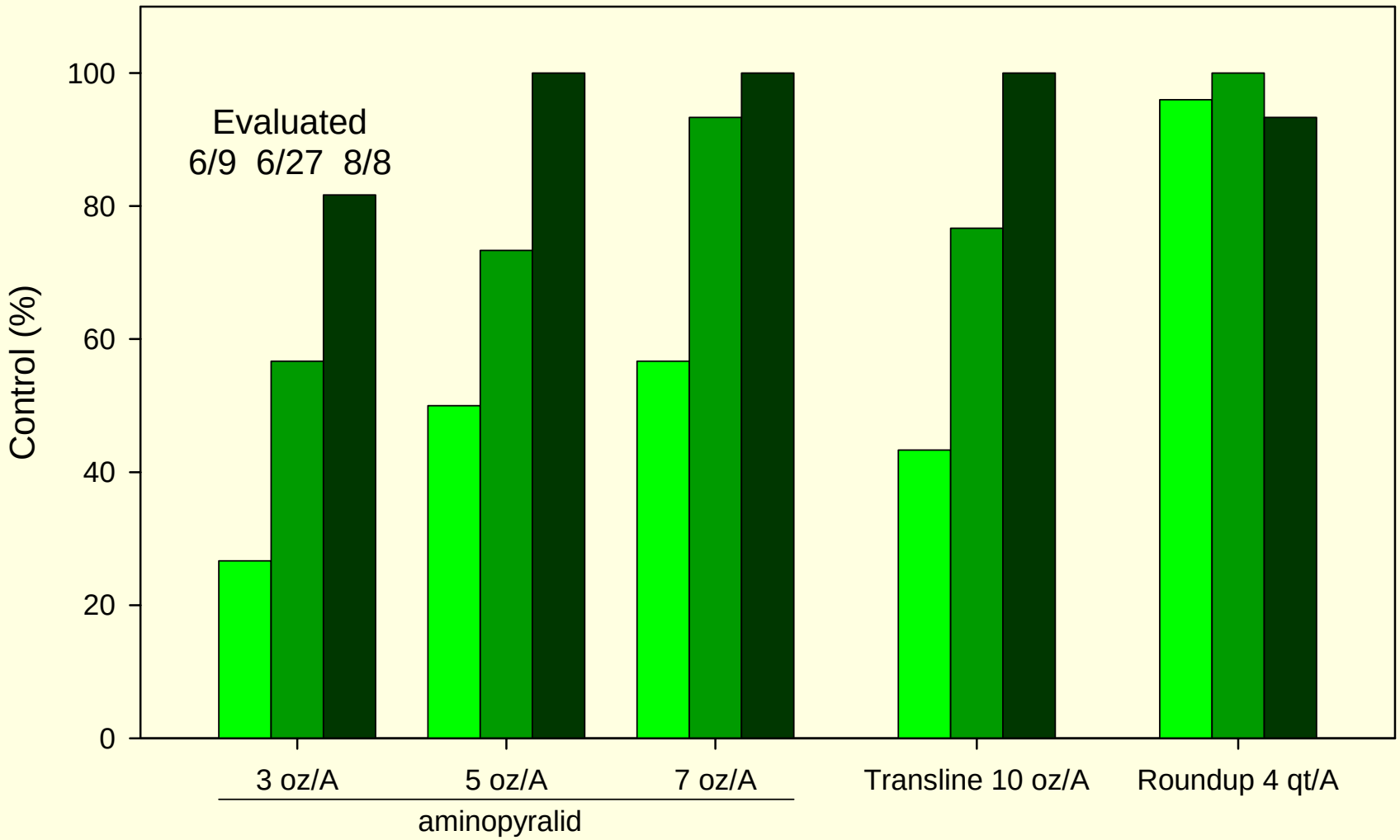


Treatments from Nov 2002 to March 2003, final evaluation in July 2003

*** LSD (P=0.05)**

Artichoke thistle (*Cynara cardunculus*)

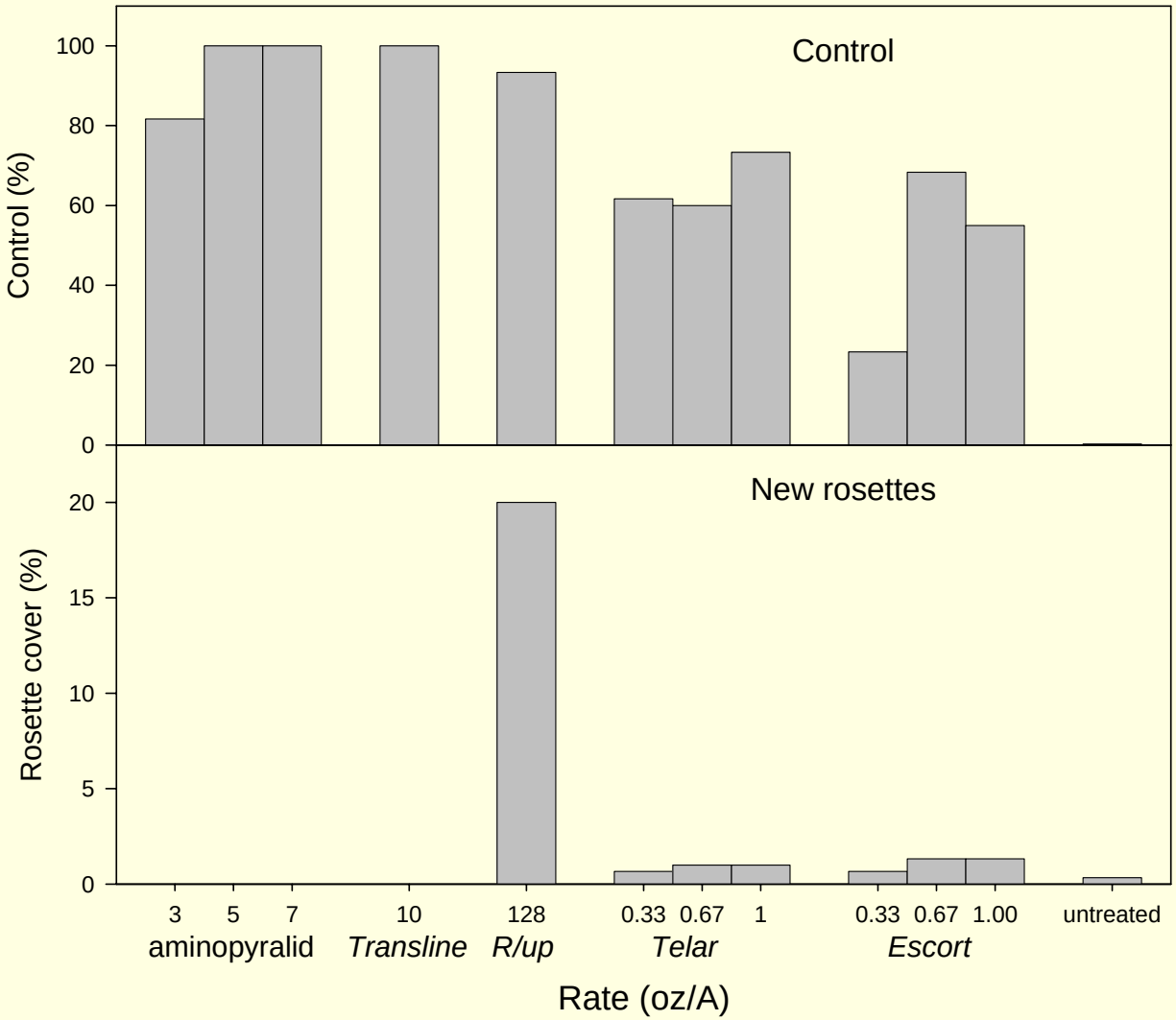
Artichoke thistle control, Solano County



Artichoke thistle control with aminopyralid

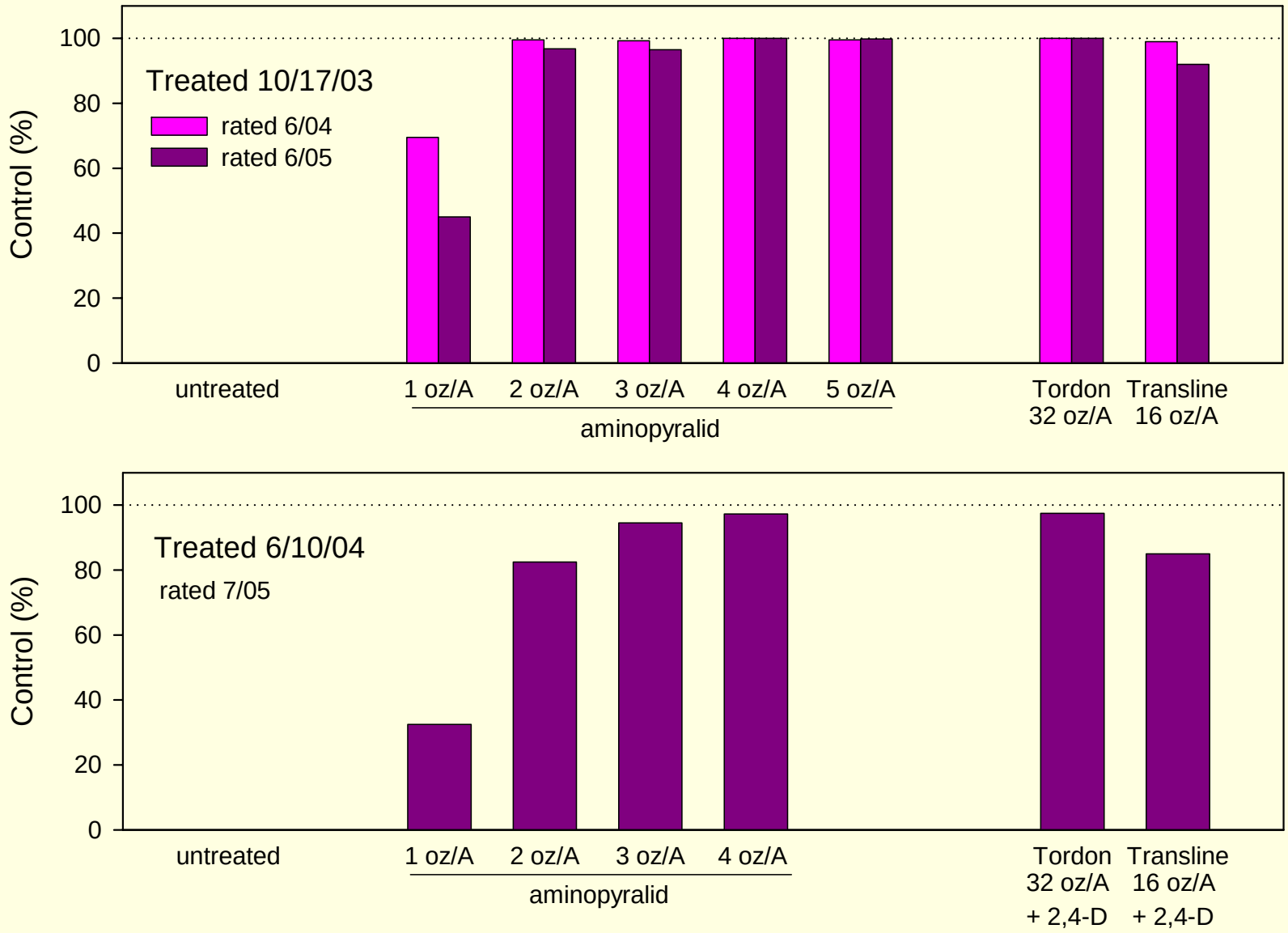
Control of artichoke thistle with aminopyralid and other herbicides

Solano County
Treated 3/31/05
Evaluated 8/8/05



Russian knapweed (*Acroptilon repens*)

Control of Russian knapweed at two sites in Lassen County



October treatment

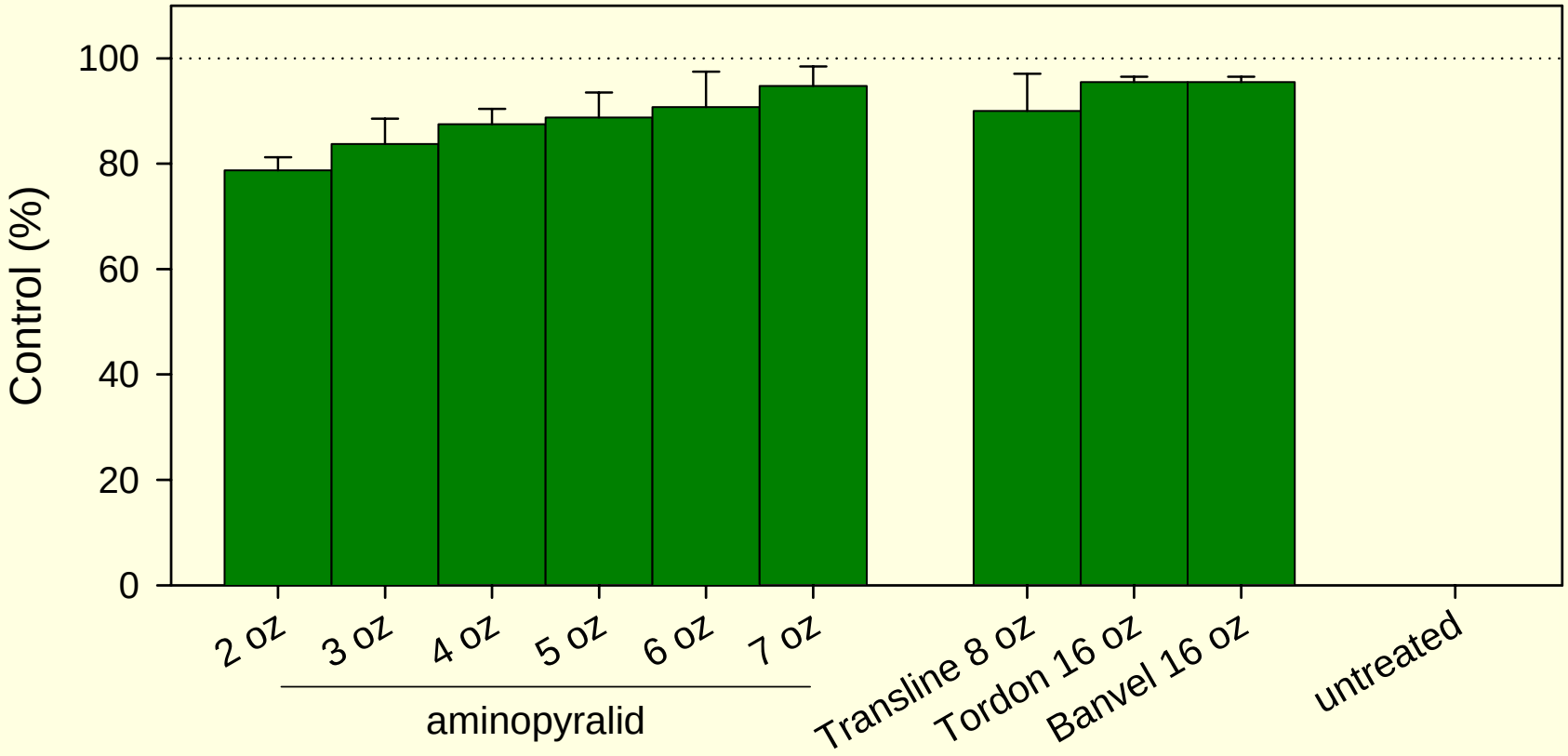
One year after treatment

Scotch thistle (*Onopordum acanthium*)

Treatment timing

Scotch thistle control, Modoc County.

Treatments applied 5/26/05; evaluated 7/27/05.



Aminopyralid toxicology

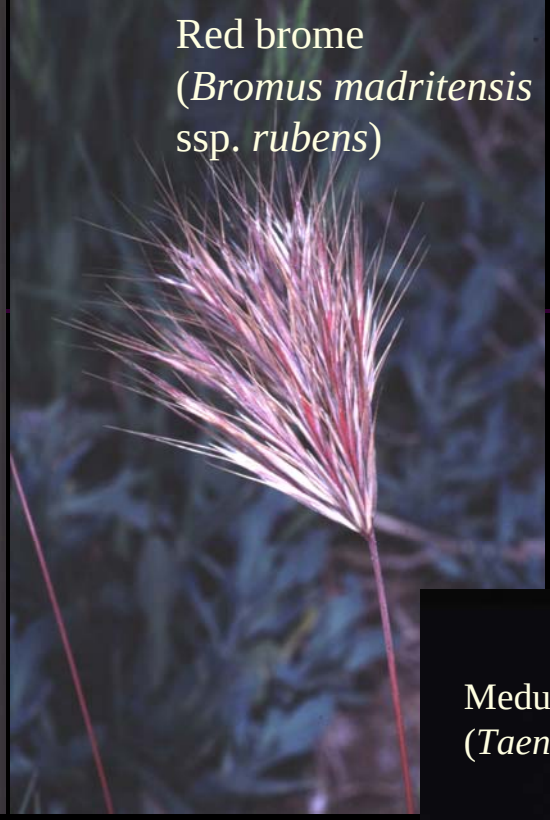
- Toxicology
  - Acute LD_{50} >5,000 mg/kg
  - Dermal LD_{50} >5,000 mg/kg
  - Reduced risk classification
    - Practically non-toxic to birds, mammals, fish, honeybees, earthworms, aquatic invertebrates
    - No carcinogenic, teratogenic or mutagenic effects. No birth defects, neurological or endrocrine problems or adverse reproductive effects

Aminopyralid environmental fate

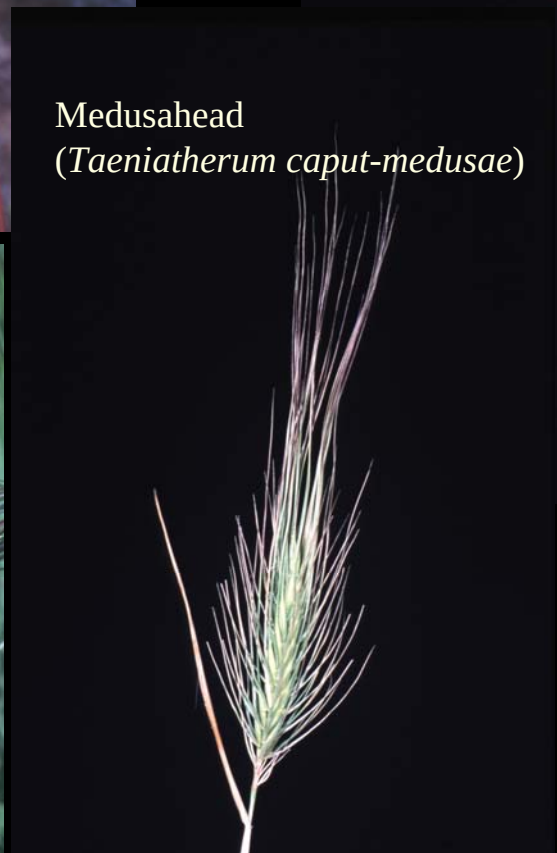
- Soil
  - Microbial degradation
  - $T_{1/2}$ = 35 days
  - Limited movement in soil
  - No degradation products accumulate
- Water
  - $T_{1/2}$ = 0.6 days
  - Low groundwater contamination potential
- Air
  - Low vapor pressure, low risk of volatilization

Imazapic (Plateau®)


Downy brome (cheatgrass)
(*Bromus tectorum*)


Red brome
(*Bromus madritensis*
ssp. *rubens*)


Ripgut brome (*Bromus diandrus*)


Medusahead
(*Taeniatherum caput-medusae*)


Barb goatgrass
(*Aegilops triuncialis*)

Acres of western states infested with major invasive species

Species	Acres infested (x million)
Downy brome	56.0
Yellow starthistle	14.8
Canada thistle	7.1
Sericea lespedeza	5.5
Spotted knapweed	5.2
Musk thistle	4.7
Leafy spurge	3.7
Saltcedar	3.7
Medusahead	2.4
Perennial pepperweed	2.0
Diffuse knapweed	1.8
Russian knapweed	1.2

Perennial grass tolerance and annual grass control with imazapic applied preemergence

Rate (oz/A)	% Control			% Stand vigor		
	Medusahead	Bulbous bluegrass	Downy brome	Intermediate wheatgrass	Pubescent wheatgrass	Squirreltail
0	0	0	0	50	35	63
2	94	80	98	15	5	10
3	94	78	100	10	8	5
4	99	94	100	40	40	27
6	100	88	100	60	50	35
8	100	94	100	65	63	65

Effect of imazapic on native plants and exotic annual grasses at 4 oz/A (1 oz ae/A) preemergence

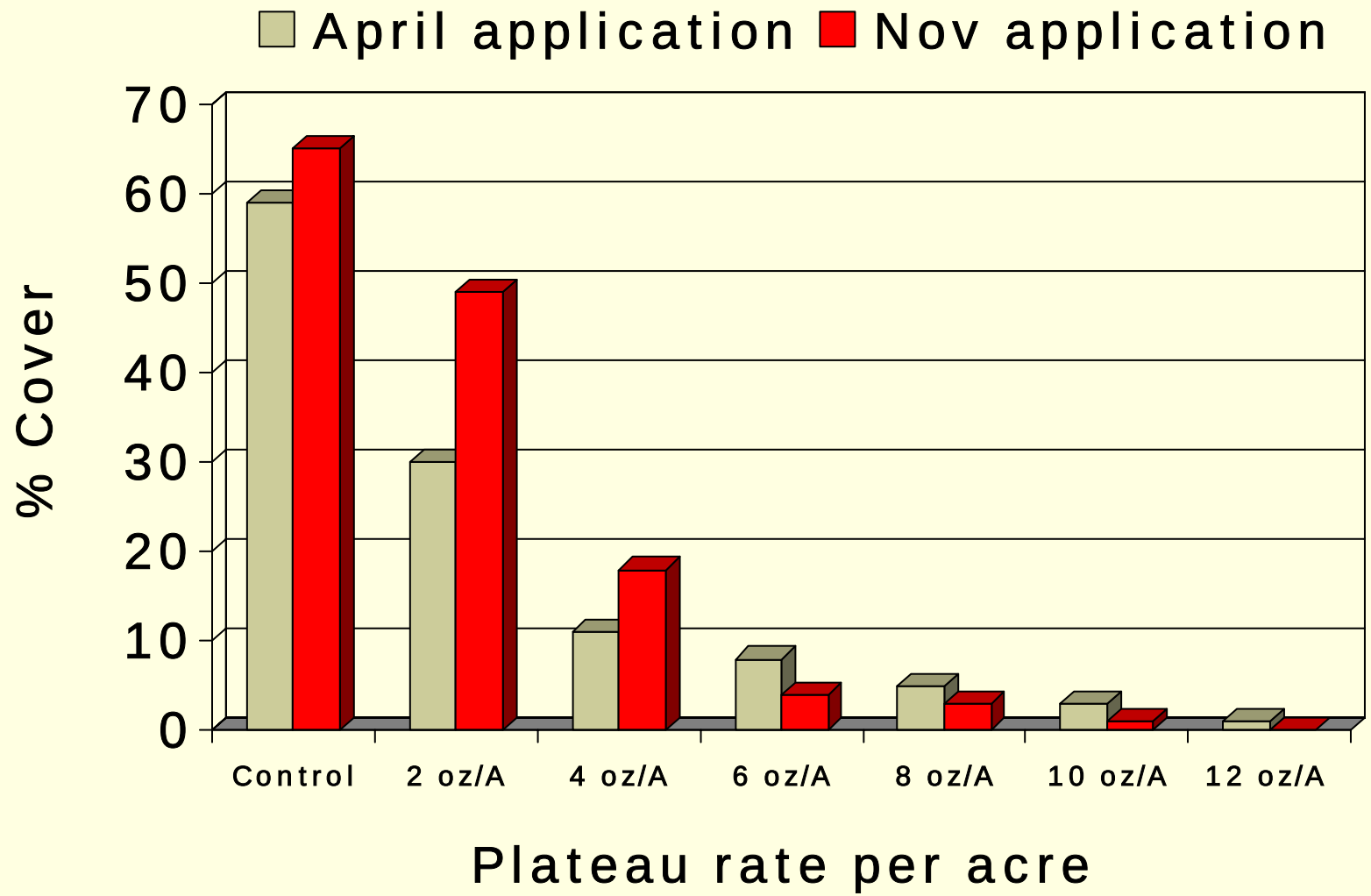
Native tolerance

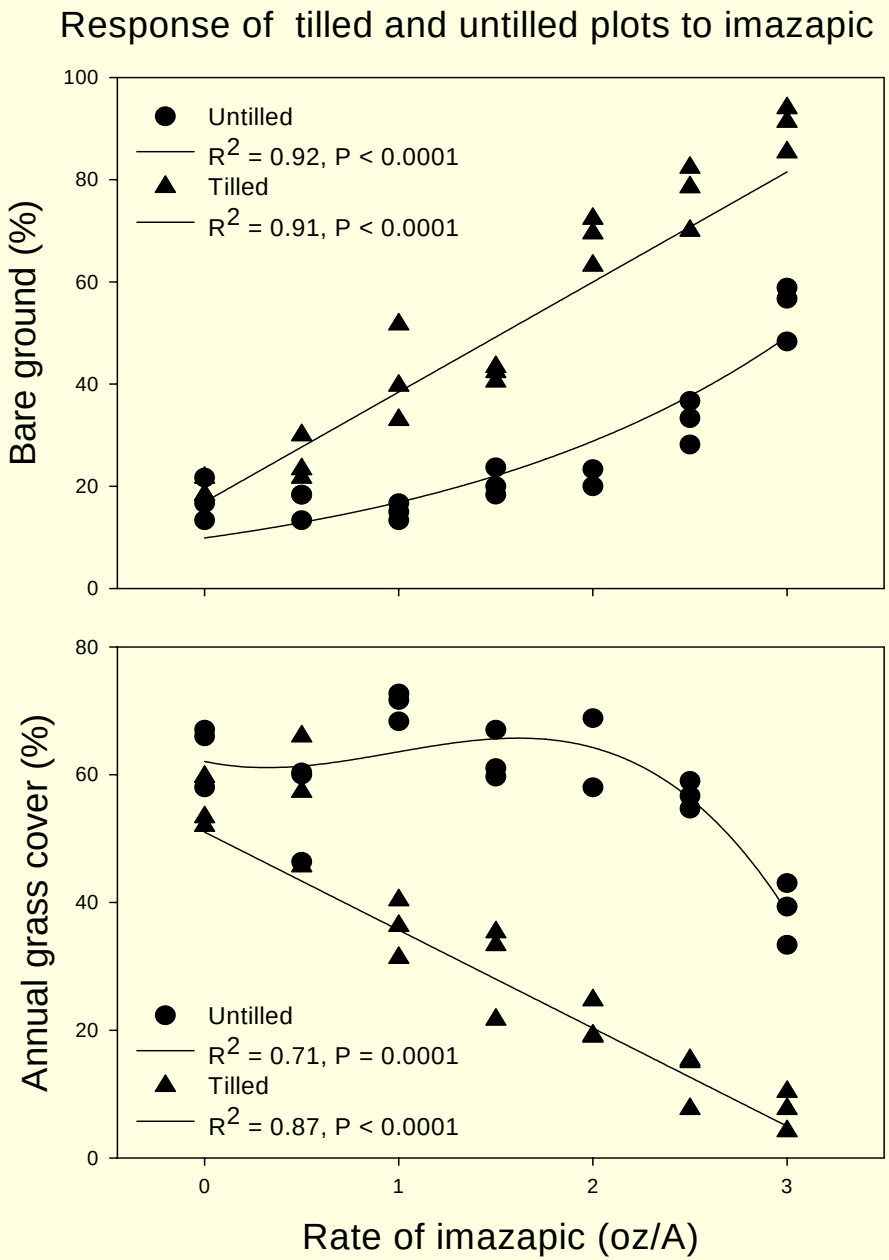
- *Bromus carinatus (G)*
- *Elymus elymoides (G)*
- *Elymus trachycaulus (F)*
- *Festuca idahoensis (G)*
- *Hordeum brachyantherum (G)*
- *Hordeum californicum (G)*
- *Leymus triticoides (G)*
- *Eschscholzia californica (G)*
- *Grindelia hirsuta (G)*
- Annual legumes (G)

Exotic annual grass susceptibility

- Ripgut brome *(Bromus diandrus) (G)*
- Soft brome *(Bromus hordeaceus) (G)*
- Red brome *(Bromus rubens) (G)*
- Italian ryegrass *(Lolium multiflorum) (G)*
- Barb goatgrass *(Aegilops triumcialis) (F)*
- Wild oat *(Avena fatua) (F)*
- Hare barley *(Hordeum murinum) (F)*
- Rattail fescue *(Vulpia myuros) (F)*
- Medusahead *(Taeniatherum caput-medusae) (F)*

Control of medusahead with imazapic




Response of tilled and untilled plots to imazapic
Bare ground (%)
Untilled
R2 = 0.92, P < 0.0001
Tilled
R2 = 0.91, P < 0.0001
Annual grass cover (%)
Untilled
R2 = 0.71, P = 0.0001
Tilled
R2 = 0.87, P < 0.0001
Rate of imazapic (oz/A)

Summer medusahead cover after first year treatments

	% cover	
County	Fresno Co.	Yolo Co.
Untreated check	50 a	79 a
Burn only	1 c	11 c
Treated 1 oz ae/A	3 c	74 a
Treated 3 oz ae/A	4 c	45 b
Burned, treated 1 oz ae/A	0 c	2 c
Burned, treated 3 oz ae/A	0 c	0 c

Imazapyr (Habitat®)

Aquatic registration of imazapyr. Other formulations include Arsenal®, Chopper®, and Stalker®

Herbicide treatment techniques for emerged plants

- Broadcast applications
- Directed treatments
- Rope wick applications
- Cut stump
- Basal bark
- Hack-and-squirt (stem injection)

Control of saltcedar with imazapyr and combinations with glyphosate

Herbicide	Rate	Month	% Control
Foliar			
imazapyr (Arsenal)	1 lb ae/A	Sept	90
imazapyr	1 to 2%	June-Sept	80-99
imazapyr + glyphosate	0.5 + 0.5%	Aug-Sept	92-99
Rope Wick to Saplings			
imazapyr	0.13%	early season	92
imazapyr + glyphosate	0.13 + 0.25%	early season	90
glyphosate	0.5%	early season	5
Cut Stump			
imazapyr	12 oz/gal water	growing season	good

Biology and Control of Tree-of-heaven (*Ailanthus altissima*)

Ailanthus cut stump treatment with imazapyr

Imazapyr and imazapic toxicology

- Toxicology
  - Acute LD_{50} >5,000 mg/kg
  - Dermal LD_{50} >2,000 mg/kg
  - Category IV, Caution label
    - Practically non-toxic to shrimp, birds, fish, earthworms, mammals
    - No carcinogenic, mutagenic or teratogenic effects. No birth defects or adverse reproductive effects

Imazapyr and imazapic environmental fate

- Soil
  - Microbial degradation
  - $T_{1/2}$ = 25-142 days imazapyr
  - $T_{1/2}$ = 120 days imazapic
  - Limited movement in soil (top 12-20 inches)
  - No degradation products accumulate
- Water
  - $T_{1/2}$ = 1-2 days
  - Low groundwater contamination potential
- Air
  - Low vapor pressure, low risk of volatilization