YELLOW STARTHISTLE CONTROL

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HEALTHY ENVIRONMENTS

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El Dorado County

Making a Difference for California


WANTED
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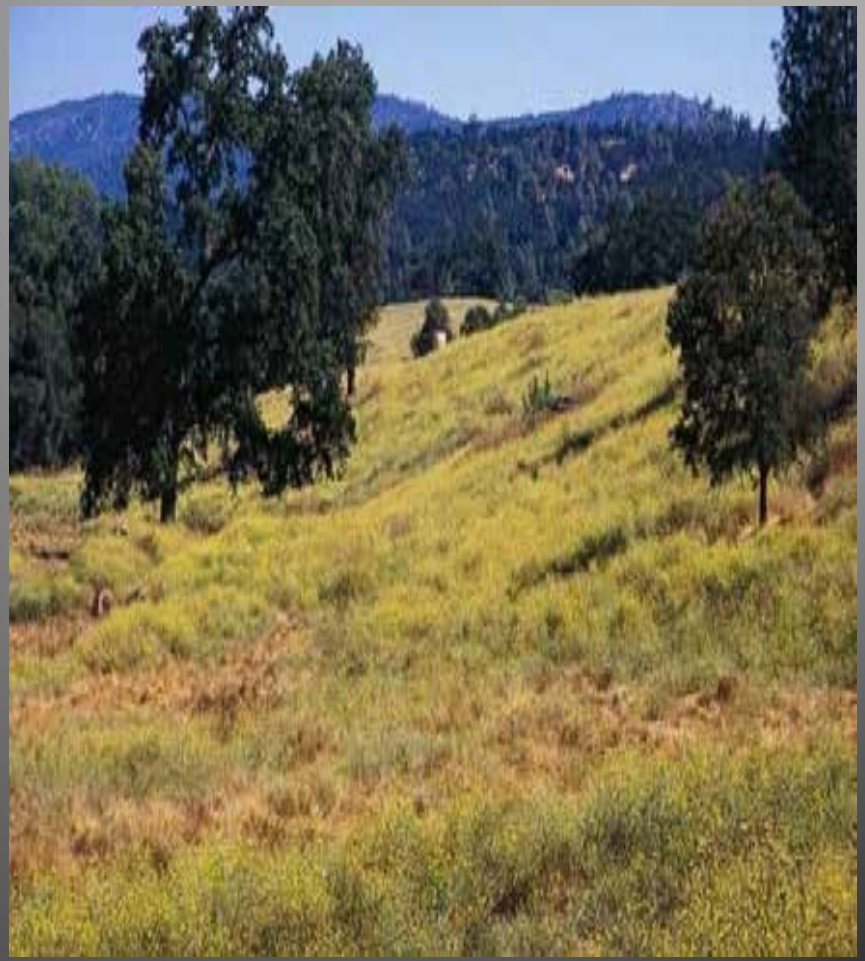
UGA1459656
DEAD OR ALIVE
$1000 REWARD

Topics For Today

I. Origin
II. Distribution
III. Impact
IV. Identification
V. Culture
VI. Control Program Design Factors
VII. Control Mechanisms
VIII. Strategic Planning for Control

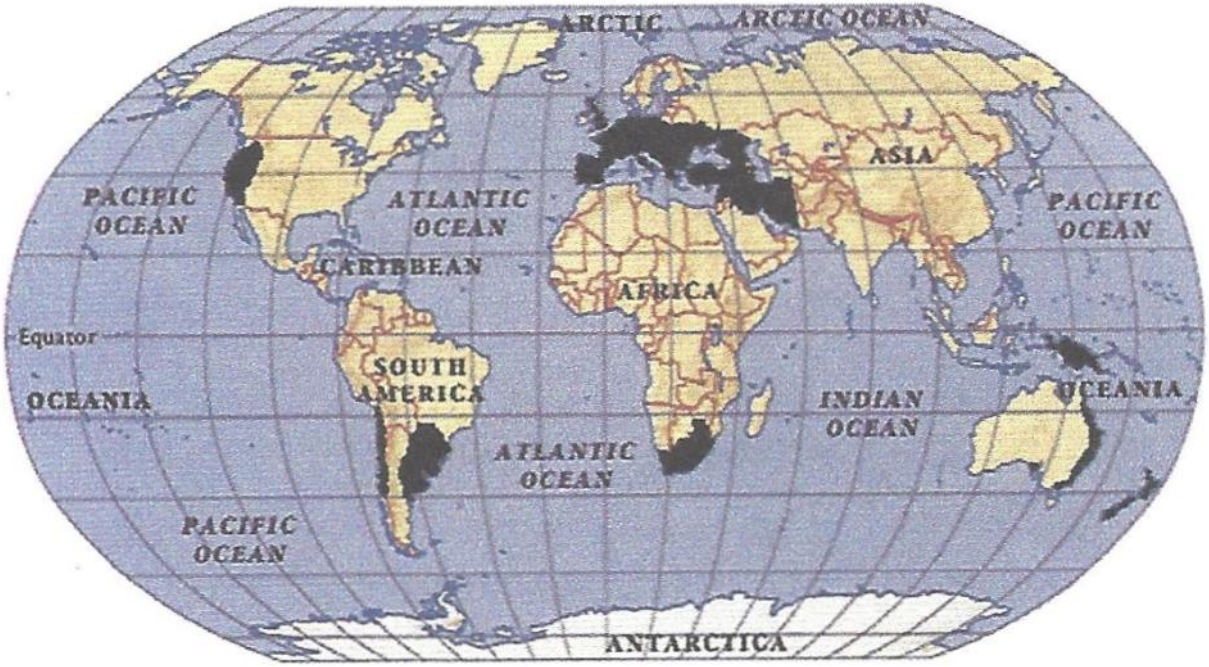
I. Origin

- Member of sunflower family and thistles
- Native to Eurasia
- Introduced to Chile in 1600's
- Introduced to California after 1849-50
- Alfalfa seed was transfer mechanism



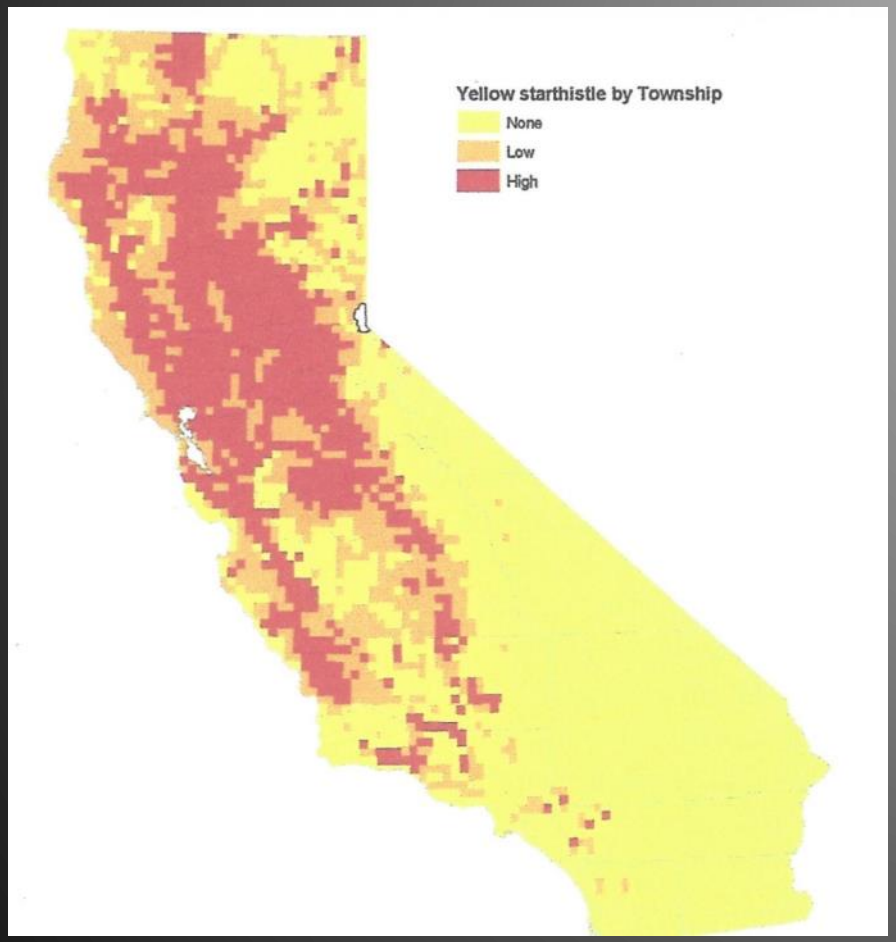
II. Distribution

Occupies all Mediterranean climate regions at about the same latitude



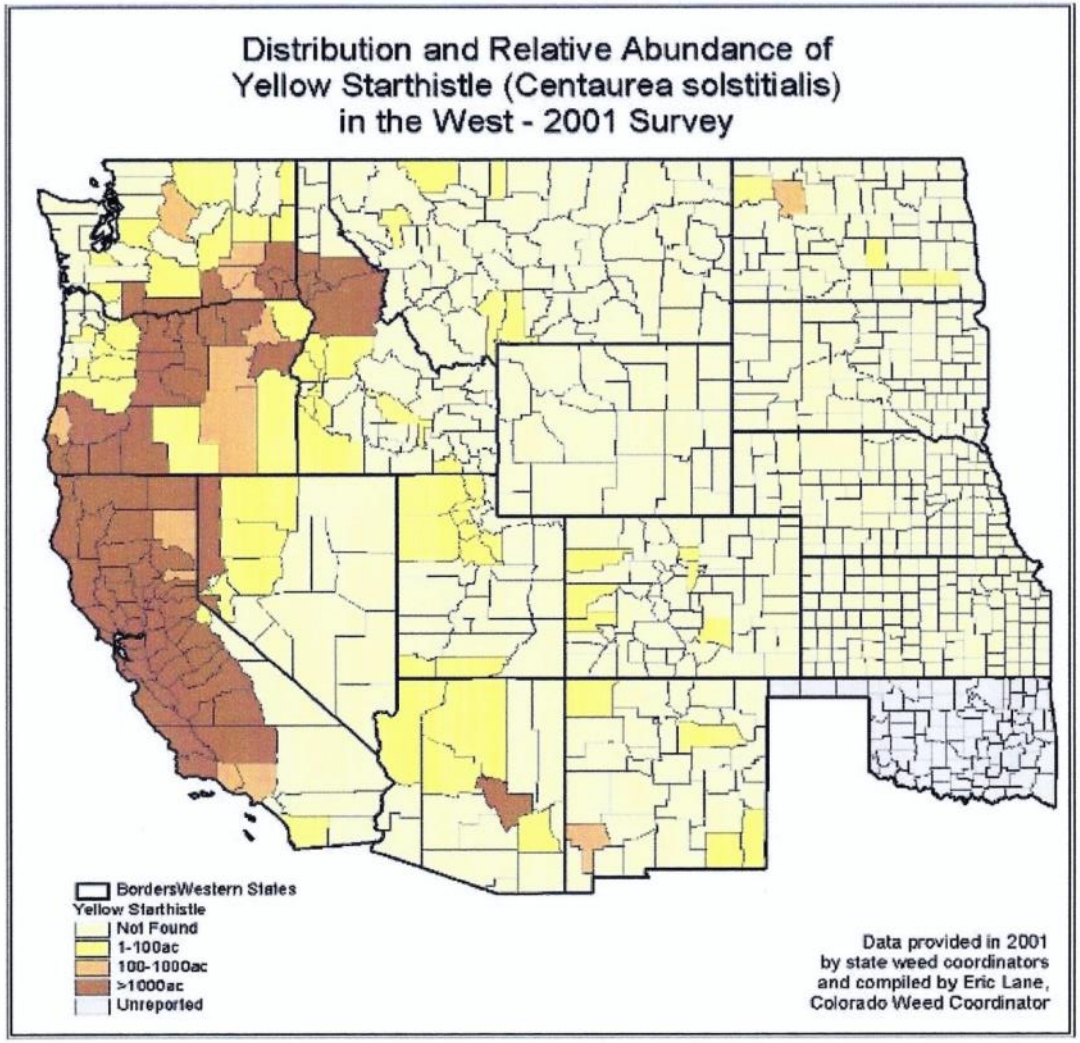
Worldwide distribution of yellow starthistle. *Maddox et al. 1985.*

Distribution – California



- Infests about 15 million acres in CA
- Found in 57 of our 58 counties
- Only Imperial County has none

Pitcairn, Schoenig, Yacoub & Gendron, 2006)



It's not just a California problem –
actually present in 23 other states,
as far east as New York

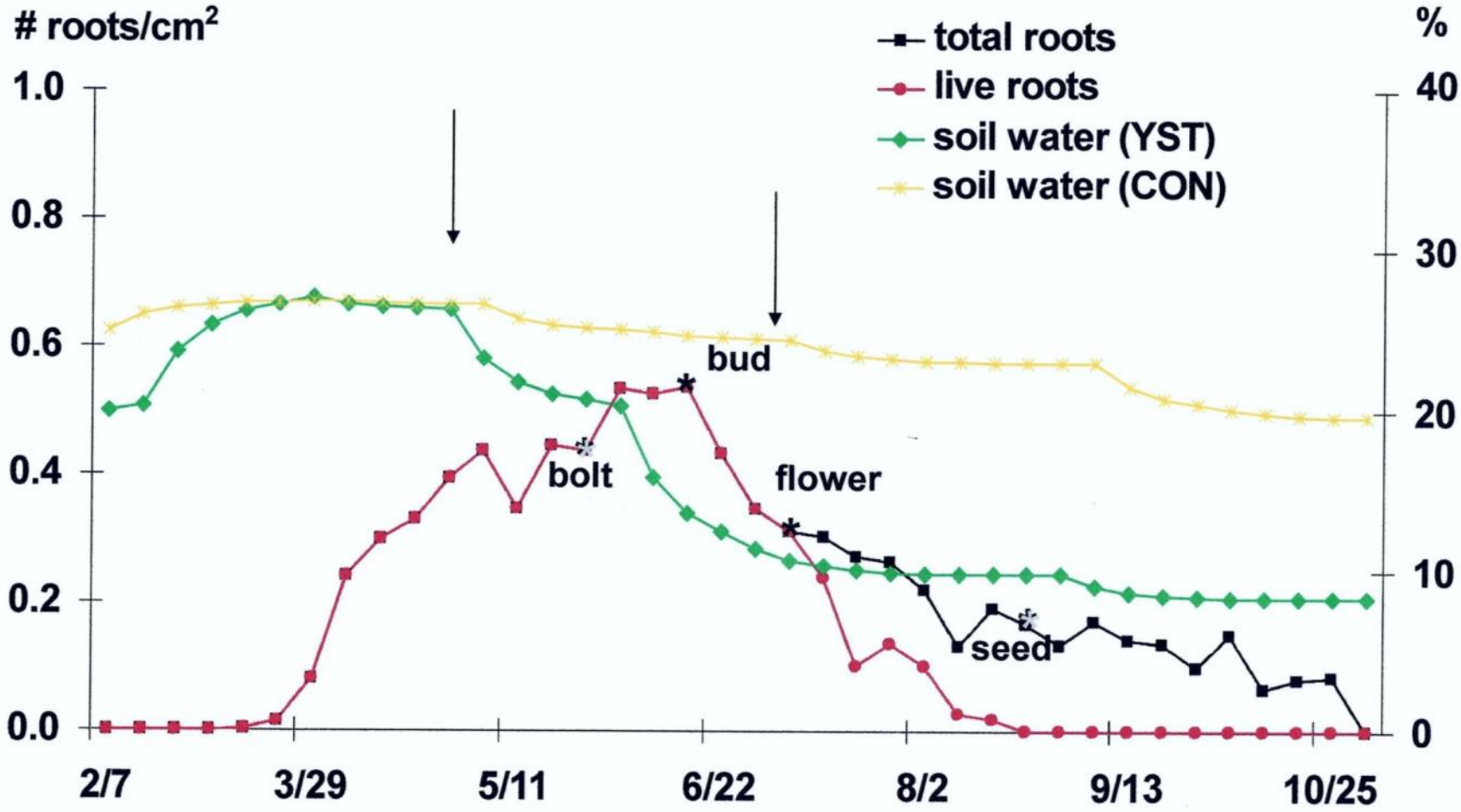
III. Impact

- Deep-rooted
- Summer growing
- Occupies a niche not previously filled by an exotic species

The Result

- Creates loss of access to range lands
- Reduces recreational values and access
- Is toxic to horses
- Reduces biological diversity
- Degrades animal and plant habitat

YST soil water use at 180 cm

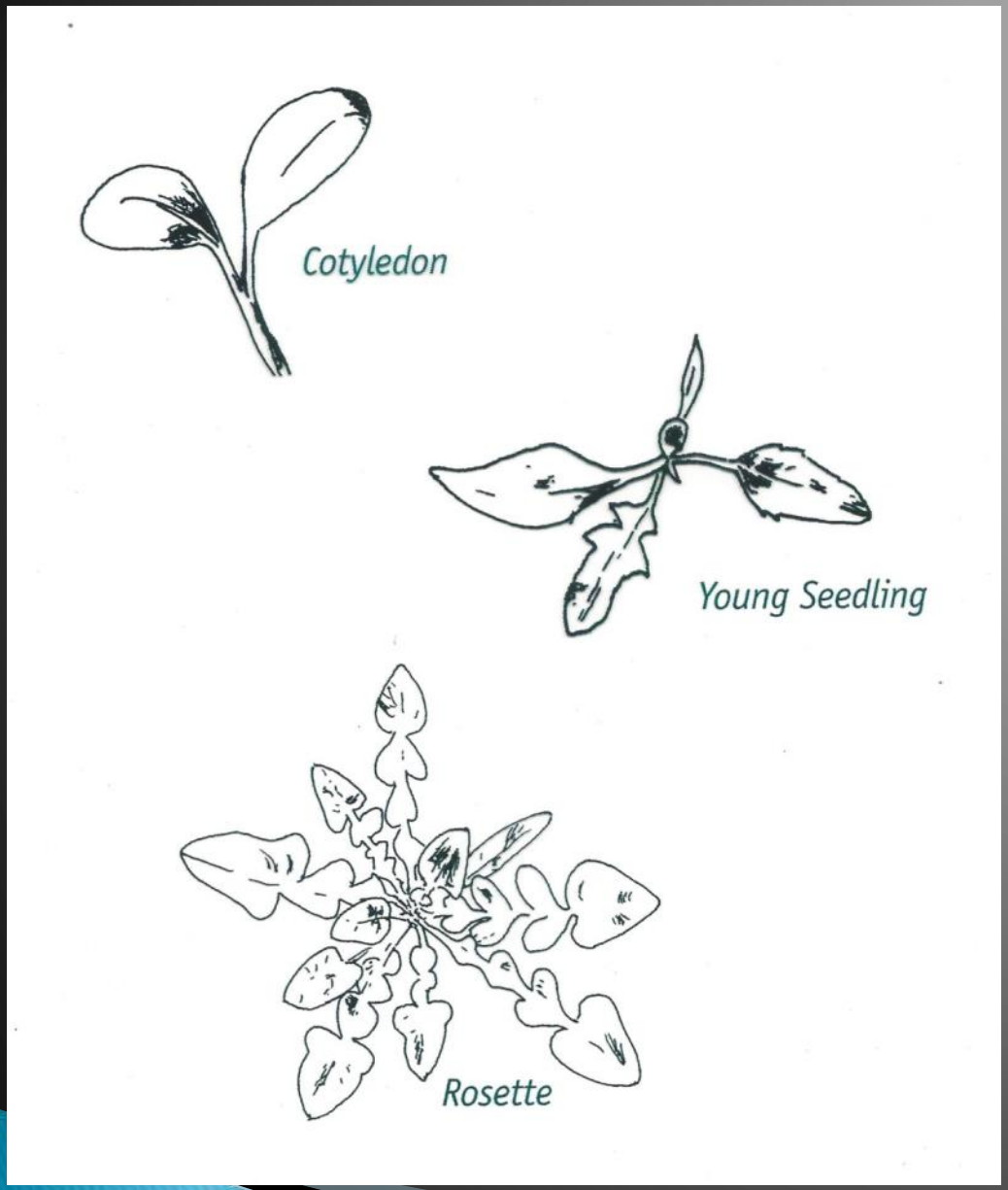


Voracious consumer of ground water

Impact

- High costs of control
- Contaminates grain harvest
- Overtakes parks, trails, and hillsides

IV. Identification



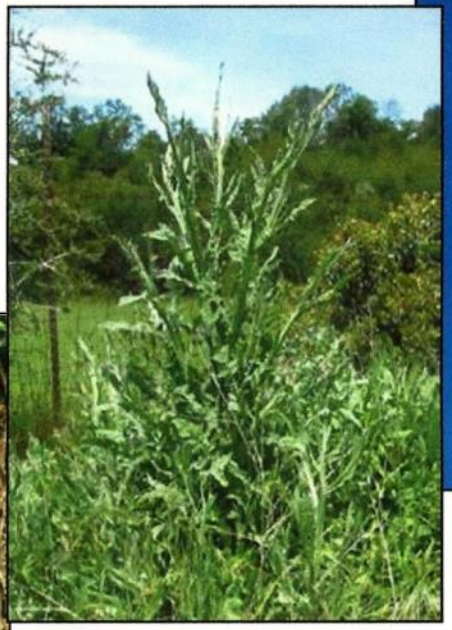
Early Growth Stages

Young Seedling Stage

Yellow Starthistle Life Cycle

Seedling

Rosette



Bolting Stage

Flowering

Find the Yellow Starthistle!

V. Culture

- Climate
- Germination
- Development
- Seed Viability
- Transfer

Climate

- Mediterranean
- Rain
- Temperature
- Sun loving – hates shade

Germination

- Weed seed vs. starthistle
- Long germination period
- New flushes after each rain
- Hard to identify early when control is most effective

Development of Roots

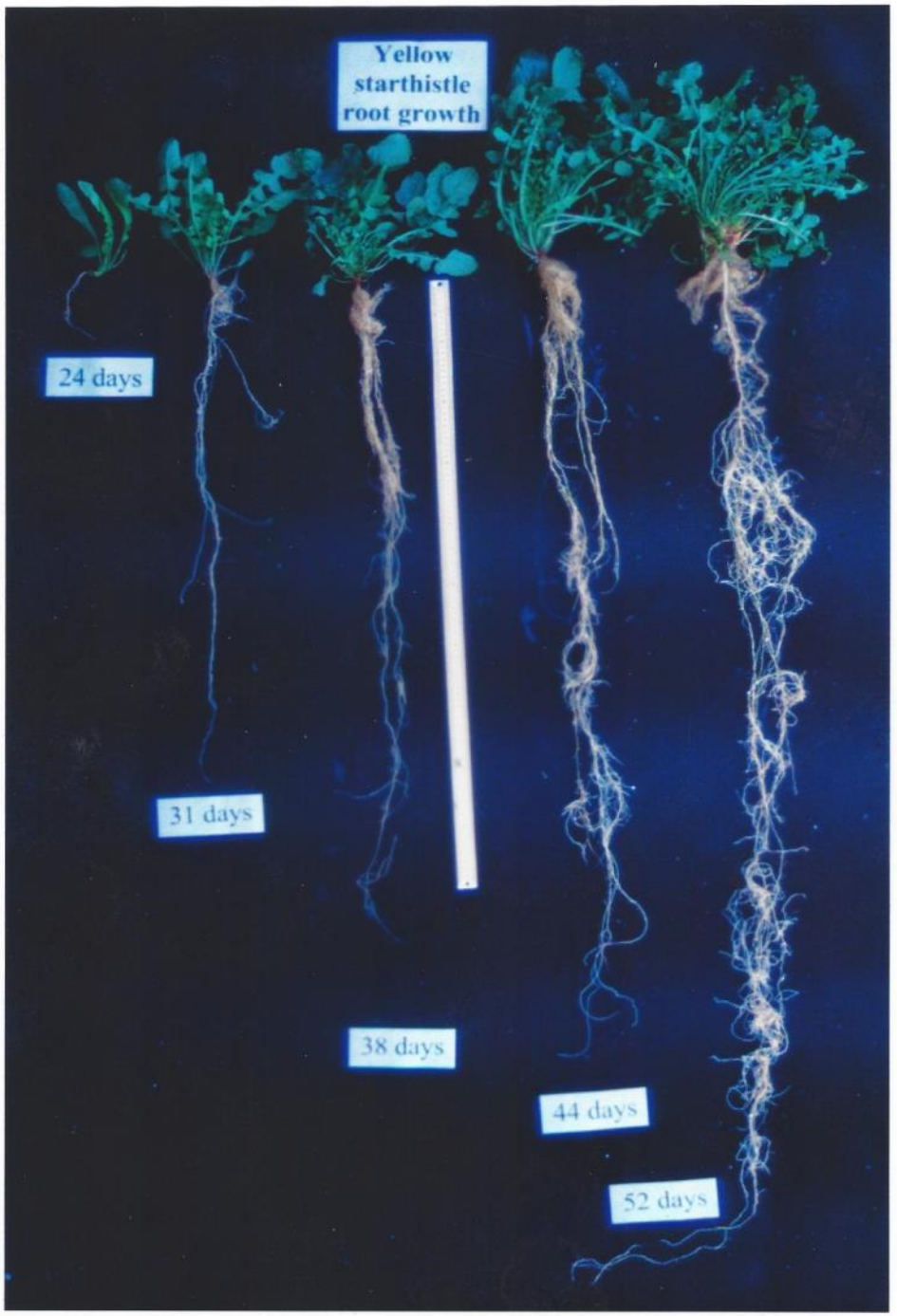
- Plant growth slow initially
- Initial energy to root development

More on Roots

- Root growth rapid winter to spring
- Early root growth to 6” in days

Long Roots!

- Roots to 6 feet in 3-4 months
- Roots 6 feet down use water even lower



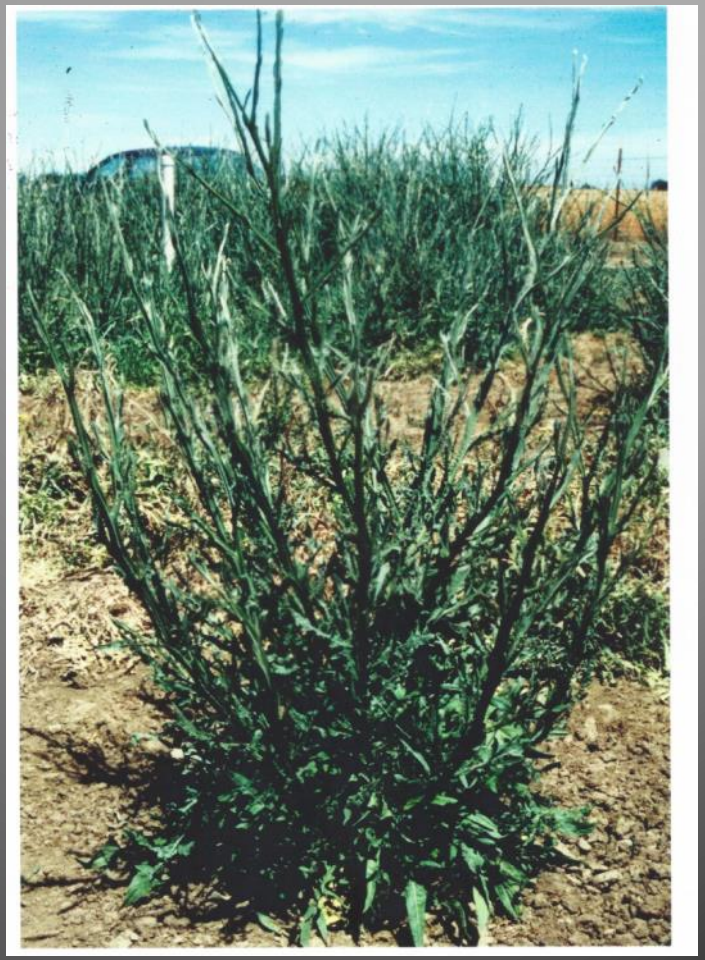
Development Stages

Rosette

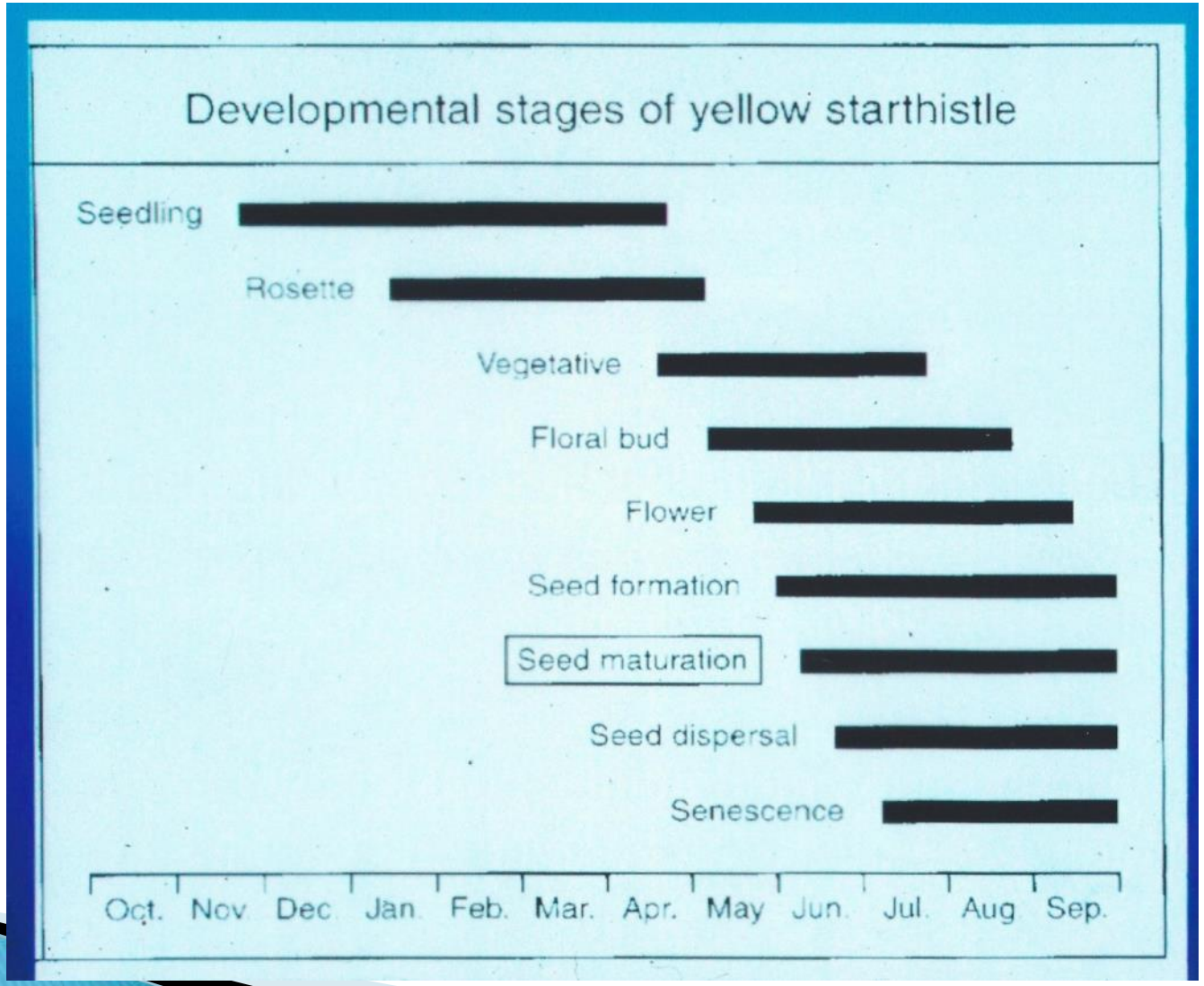
- Slow initial growth in winter
- Usually prostate in open areas
- Can grow upright when:
  - Plant densities high
  - Heavy competition

And growing…

- Bolting occurs as competing plants die off
- Plant matures in mid to late summer



Development Stages of YST



Seed Viability

- Two types of seed make control harder, because…

…Seed Viability

- Lighter colored seed
  - Bristly hair on top (pappus)
  - Disperses quickly after maturity
  - Germinates with onset of fall rains

- Darker colored seed
  - No pappus
  - Stays on flower heads until head disintegrates in mid-winter
  - Germinates toward spring

And more Seed Viability

- Production per plant varies
- Ranges from 700 to 10,000 seeds
- About 95% viable

Lots of Seed

- Concentration in soil
  - 1000-2000 seeds per square meter low end
  - 10,000-12,000/m^2 high end
  - Can be as high as 29,000/m^2
- Survives in soil about 3 years
- Seed death averages 60-80%/year
  - 80% die after 1 year
  - 94% after 2 years
  - 97% after 3 years

Example of Seed Depletion

SEEDS REMAINING	YEARS
5000	1
1250	2
313	3
78	4
20	5
5	6
1	7

Seed Transfer

- Wind not a good transmitter
- Most seed (92%) falls within 2 feet of plant
- Seed spreads via:
  - Gravel
  - Fill dirt
  - Equipment
  - Animals
  - Hay & straw used for erosion control

Transfer – in Mulch

Transfer – In Gravel or Fill

VI. Control Program Design Factors

If your goal is:

- ERADICATION

You must:

- Eliminate all seed production
- Deplete seed reservoir
- Prevent outside seed from being introduced

Control (cont.)

If your goal is:	You must:
MANAGEMENT	Reduce ◦ Plant density ◦ Seed production ◦ Plant height ◦ Canopy size Prevent YST patches from developing into solid stands

Control (cont.)

If your goal is:	You must:
} CONTAINMENT	} Define boundaries around infested areas } Eliminate outlying patches and solitary plants outside boundaries

Control (cont.)

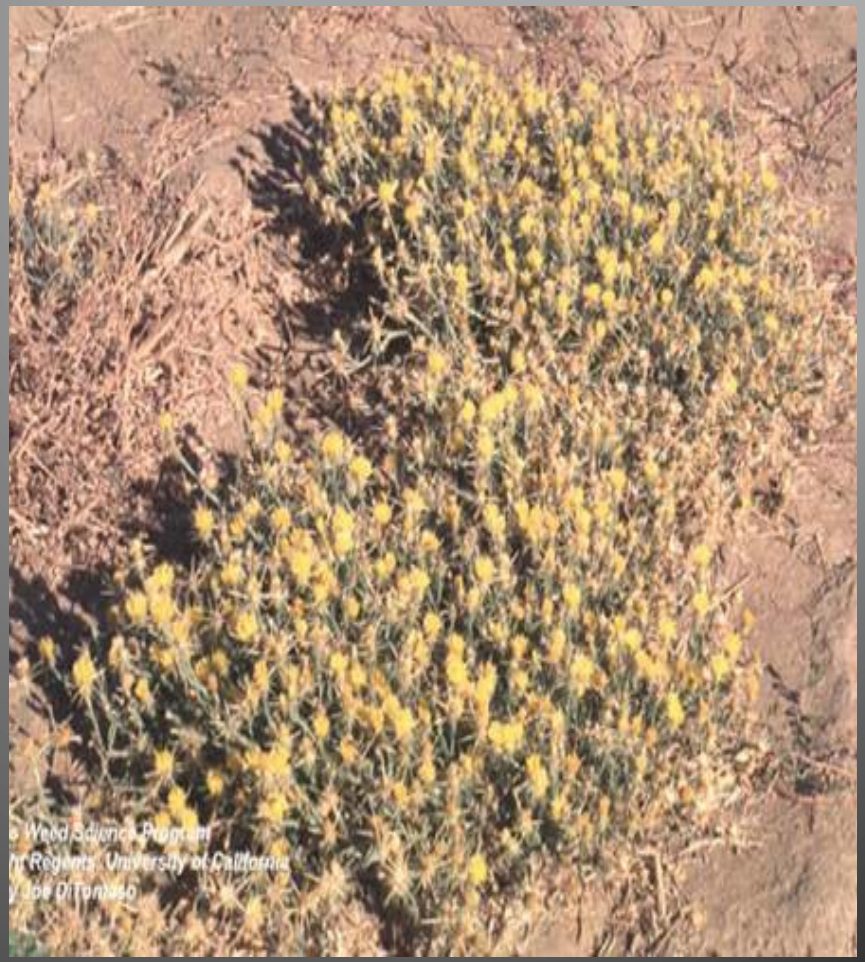
If your goal is:	You must:
} PREVENTION	} Eliminate isolated plants } Use clean seed, hay, fill soil, & road building materials } Clean equipment & vehicles } Examine nursery stock & plantings

Control Options:

- Mechanical – hand pulling, hoeing, weed whip, tillage, mowing
- Biological – insects, fungus
- Cultural – grazing, burning
- Chemical
- Integrated – burning & chemical followed by revegetation

VII. Control Mechanisms

- Mowing
- Tillage
- Grazing
- Fire
- Herbicides
- Bio-control
- Manual
- Competition
- Timing



Mowing

- Plant structure
- Timing

Mowing – Plant Structure

Plant Structure - Spindly

Plant Structure - Robust

Mowing – Timing

- Best mowing time at first flower
- 1-8 day window between floral initiation & viable seed
- Not more than 2% flower coverage

Mowing – Disadvantages

- Done at wrong time can increase YST
- Rough terrain can't be mowed
- Mower skips can leave stands of YST to reseed area
- Fire danger – best time to mow is also time of high fire danger

Mowing Strategy

Will mowing be effective?

- Check skeletons of last year's growth:

  Were they spindly? Good candidate!

  Were they bushy? Bad candidate?

YST Skeletons

Control Mechanisms – Tillage

- Timing:
  - Best – after last rainfall as grasses dry (April, May, June)
  - Too early
    - Requires second or third tilling
    - Selects for starthistle
- Disadvantages of disc: May not be practical because it destroys other plants.

Tilling – What to Use

Use spiked tooth or spring harrow if soil is loose & plants are small

Use disc if plants are larger – go deep to destroy taproots

Control Mechanism – Grazing

Grazing

- Effective control
- Good component of animal's diet
- Best time:
  - Bolting stage, May-June
  - Reduces growth & seed production
- No grazing prior to May
  - Can actually select for starthistle if done improperly

Grazing Cycles

- Graze 6-8 weeks in total
- Initial graze plus 1-3 follow-ups at two week intervals
- Correct way:
  - Start in May
  - Graze 1-2 weeks
  - No graze for 1-3 weeks
  - Repeat for 3 cycles

More on Grazing Cycles

- Incorrect way:
  - Start in March or April
  - Graze 2 weeks
  - No graze for 1 week
  - Repeat for 3 cycles

- In correct way actually selects for YST, increasing plant density & seed heads

And more on Grazing Cycles

- Actual grazing frequency & cycles depends on:
  - Regrowth rate
  - Rainfall occurrences
  - Available soil moisture

Grazing with Animals

- No horses
- Other types of livestock – doesn't matter
- Animals concentrated on YST plot – 1-2 per acre won't do
- Takes 1900 goats/1000 acres
- Spines can stick under hooves & spread elsewhere
- Cattle & sheep avoid YST once buds produce spines
- Goats continue to browse into flowering stage

Need Goats?

www.goatcentral.com
530-621-2920

kiko@goatcentral.com

From Sac Bee 08/20/13

Grazing Caveats

- Will not eliminate or provide long-term management of YST
- Best used in an integrated management program
- Most valuable for its potential to increase effectiveness of other control methods
- Grazing in rosette stage actually selects for YST – destroys competition

Control Mechanisms – Fire

Prescribed Burning

- How it works
  - Timing
  - Methods
  - Disadvantages

Fire – How it Works

- Desirable species:
  - Require fire as aid to germination –OR-
  - Mature early, dropping seed to ground where fire is not hot enough to destroy them

- Undesirable species:
  - Later seed maturity
  - Seed still on plant where fire can destroy them

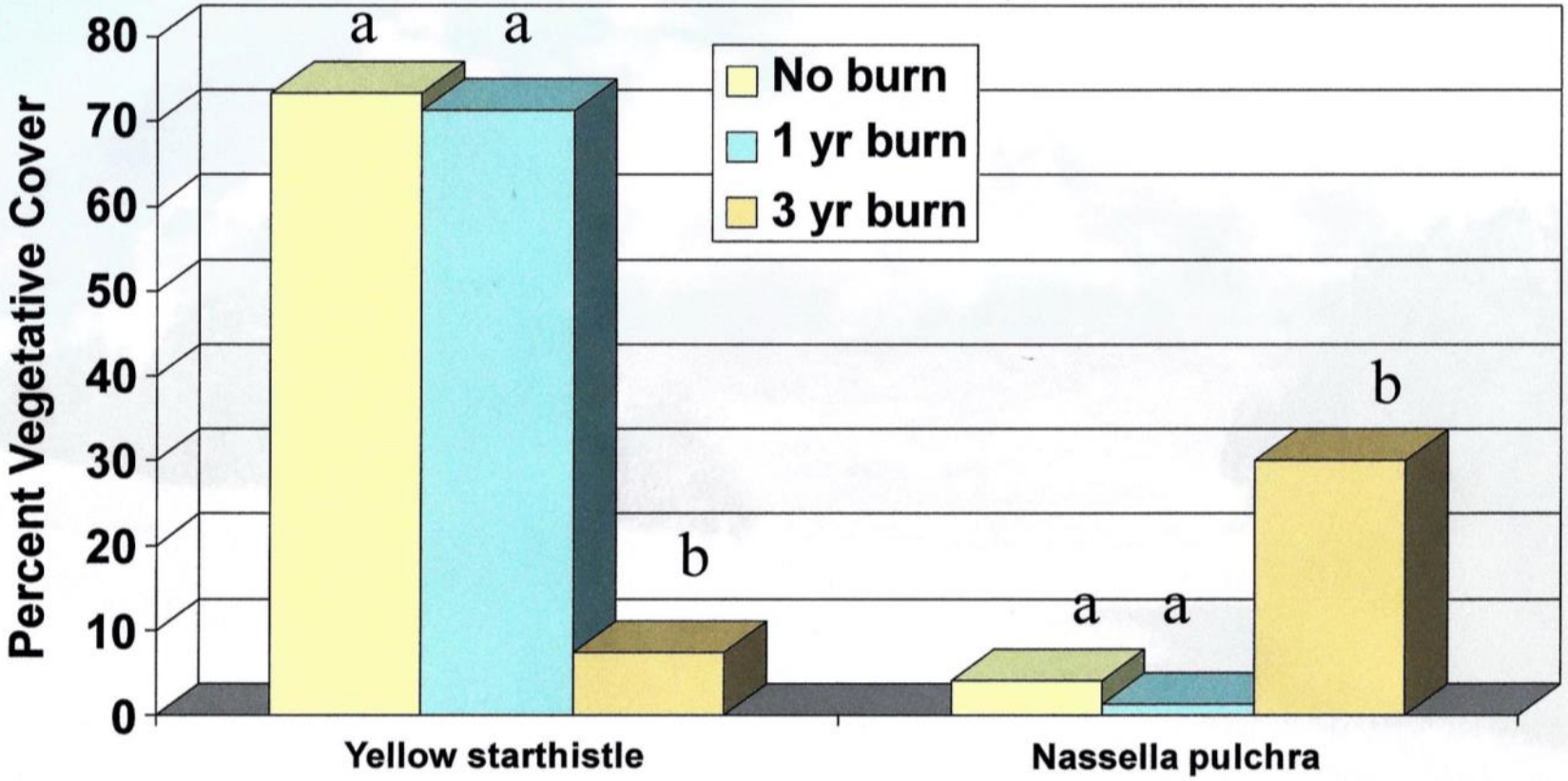
Fire – Timing

- Best time early to mid-summer (late June to early July)
- Coincides with early flower stage – same as mowing
- Too early – too much green, won't burn, destroys competition (late rain selects for YST)
- Can mow in late bolting stage, allow to dry to increase fuel to improve burn

Fire – Methods

- Generally 3 successive burns required
- After first burn, YST can actually increase or remain the same
- After third burn, YST decreases, natives increase
- If no other control methods used after 3 years, YST gradually comes back

Vegetative cover in July



Purple needle grass – native clumping grass once covered much of Central CA

Fire – Disadvantages

- Generally not usable by homeowners with small acreages
- Best time to burn corresponds with highest fire danger
- Burning does not kill YST seeds already in soil – can select for YST
- Air quality problems
- Erosion problems
- Impact on small animals & insects

Control Mechanisms – Herbicides

- Post emergents
- Pre/post emergents
- Warnings!

Post Emergent Herbicides

- 2, 4-D (Weed-B-Gone)
- Dicamba (Weed-B-Gone, Bayer Weed Killer)
- Triclopyr (Ortho Poison Ivy & Brush Killer, Bayer Brush Killer)
- Glyphosate (Roundup)
- Strategies for use

Controls – Post Emergents

- All – selective broad leaf herbicides except Roundup (which is non-selective)
  - Little or no residual activity in soil
  - Must be reapplied after late season rains to control new flushes
  - Drift is common problem – apply when wind is 5 mph or less – early morning

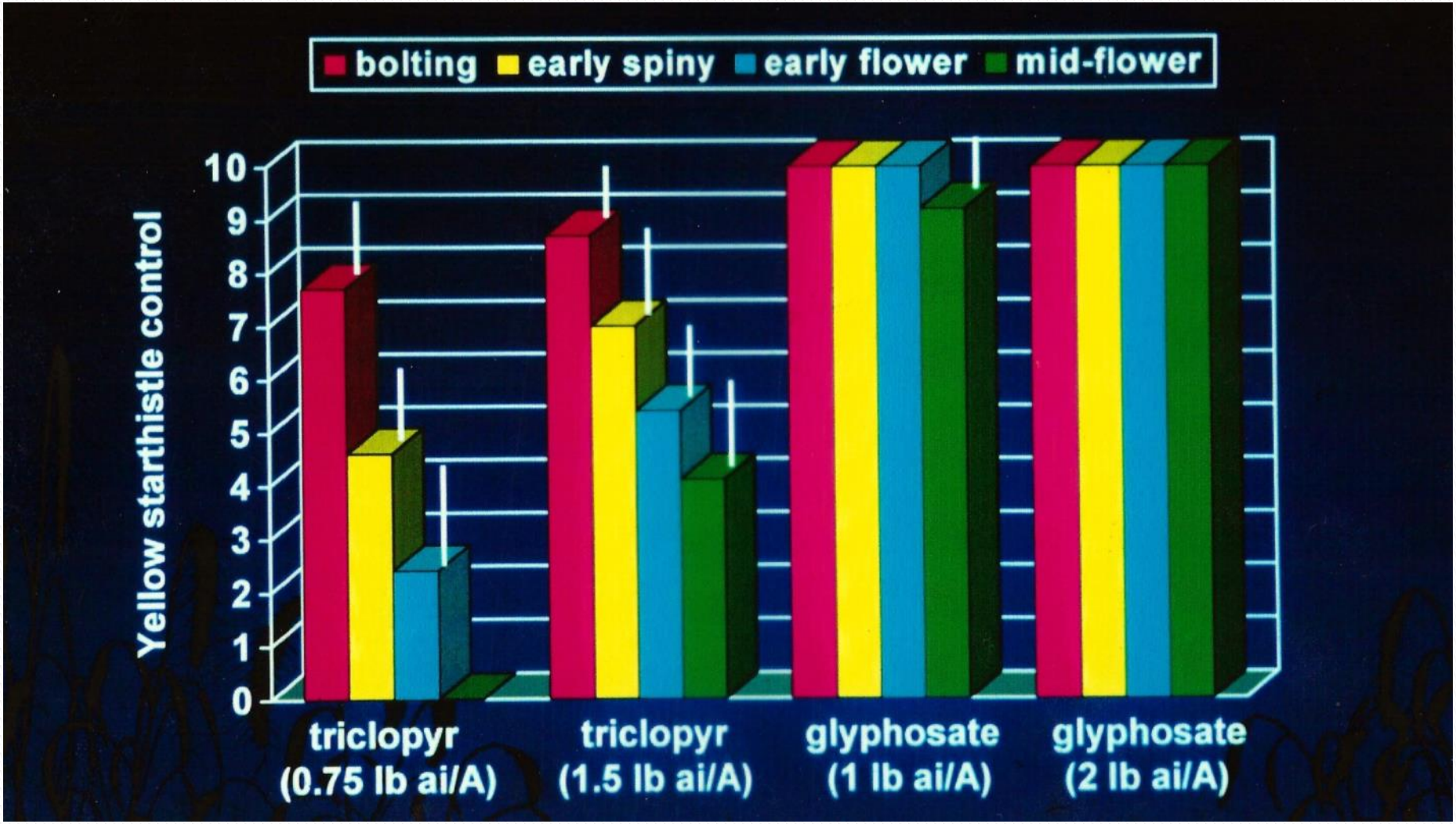
More on Controls

- 2, 4-D
  - Best control at seedling & small rosettes at .5 to .75 lb AI*/acre
  - After bolting requires 1 lb AI/acre
- Dicamba
  - Best controls young plants less than 2” in diameter at .25 lb AI/acre
  - Larger plants require .5 to .75 lb AI/acre

*** Active Ingredient**

And More on Controls

- Triclopyr
  - Best for seedling & rosettes at .5 lb AI/acre
  - Bolting requires up to 1.5 lb AI/acre
- Glyphosate
  - Non-selective
  - Kills most plants; grasses & broad leaf included
  - Grazing restrictions after application
  - Seedlings & rosettes at .5 lb AI/acre
  - Early flowering at 2 lb AI/acre



Effect of late season Glyphosate and Triclopyr

Post Emergent Strategies for Use – Herbicides

- Kill all vegetation – or some
- Last year's YST skeletons
- Herbicide resistance

Pre/Post Emergents – Herbicides

- Clopyralid (Transline)
- Aminopyralid (Milestone)

Selective Chemicals: Only work on certain plants

- Clopyralid – Transline, Yellow starthistle killer
  - Asteraceae (Sunflower) Family
  - Legume (Pea) Family

- Aminopyralid – Milestone
  - Asteraceae (Sunflower) Family
  - Legume (Pea) Family
  - Some annual grasses
  - Expanded plant list – on the label

Herbicides – Pre/Post Emergent

Clopyralid – Transline or Starthistle Killer

- Provides both pre & post emergent control
- Most effective timing Feb-Mar – no surfactant needed
- Earlier applications mat not provide full season control – re-spray needed
- Later applications Apr-May require higher application rates & surfactant
- Best applied right after rain
- Requires 24 hrs between application & next rain

Clopyralid – Advantages

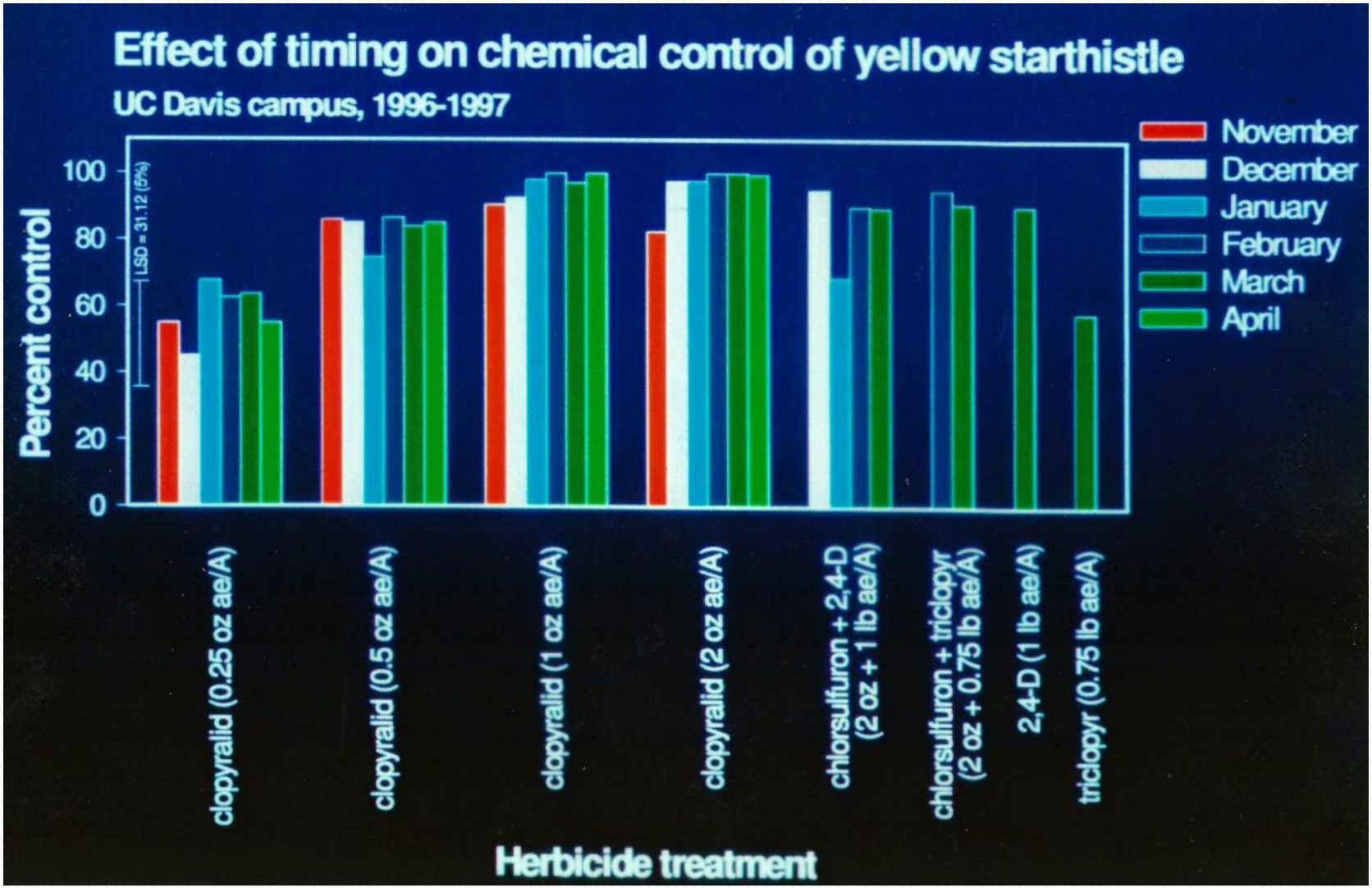
- Soil activity lasts 3-4 months as a Pre-Emergent
- Kills hardly anything but YST, sunflower family & most legumes
- Used at very low application rates, about 4-8 oz/acre
- No known toxicity to animals

Clopyralid – Disadvantages

- Will hurt alfalfa & clover crops
- Livestock that graze on treated material excrete active compound
- Recommend buffer around water bodies of at least 25 feet
- Will move in sandy soils
- Do not use in potential grape planting sites
- Do not dispose of treated material clippings into compost

Clopyralid – Disadvantages

- Kills most legumes, can lead to soil nitrogen depletion
- Not registered for use around home or crop areas
- Need applicator's license/grower ID number, 530-621-5520, give parcel number, set up appointment
- Must report applications to Ag Dept
- Can develop resistance – use integrated management



Clopyralid vs. 2, 4-D, Triclopyr

Aminopyralid – Milestone

- Provides both pre and post emergent control
- Most effective timing Dec-Feb
- Earlier & later applications have same requirement as Clopyralid

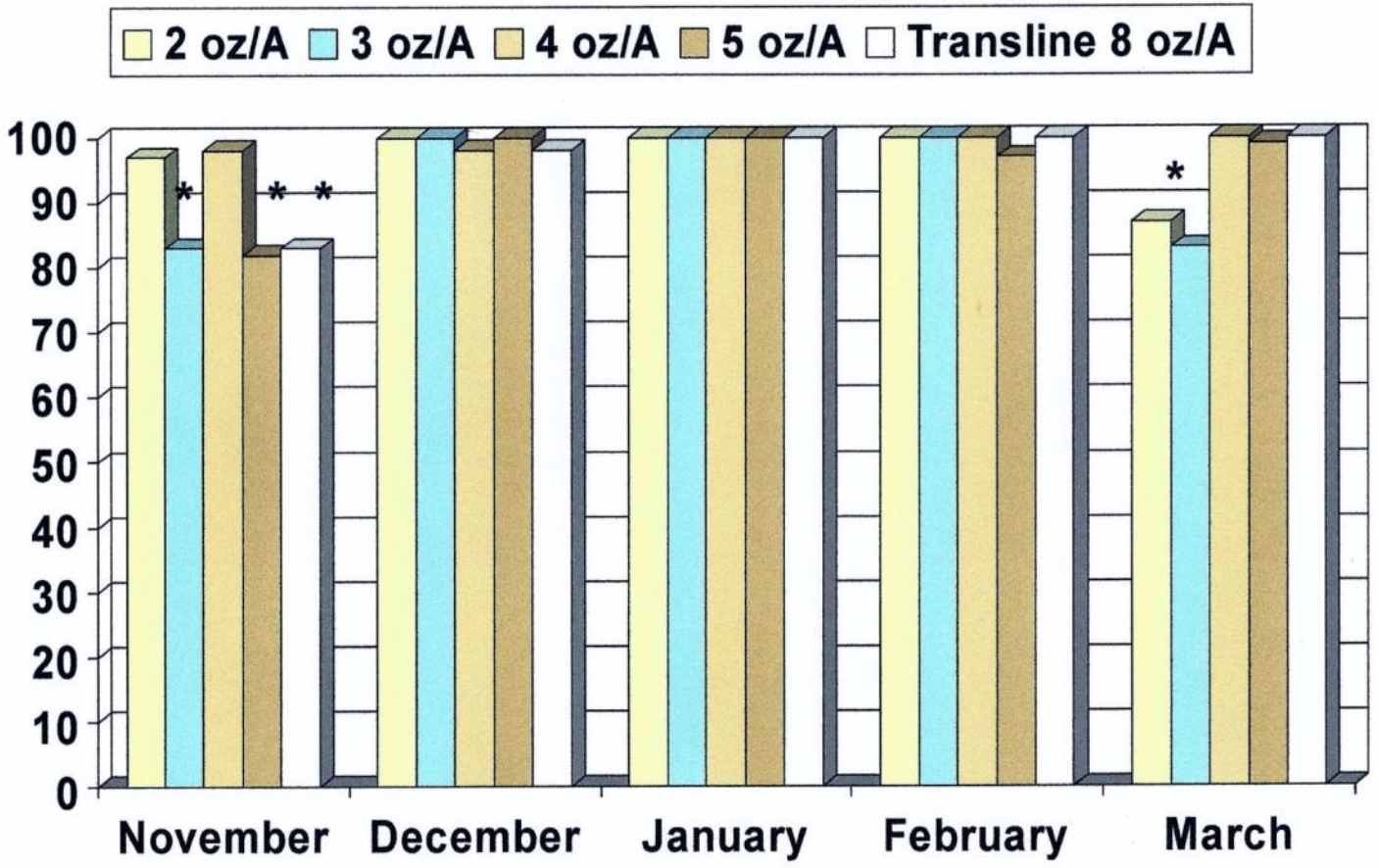
Aminopyralid – Advantages

- Soil activity lasts 4-5 months
- Kills many broad leaf weeds (thistles, fiddleneck, ragweeds, etc.) as well as YST
- Low application rate – 3-7 oz/acre
- No known toxicity to animals
- Can be used to water's edge – do not apply directly to water

Aminopyralid – Disadvantages

- Need Ag license – just like Clopyralid
- Excreted from livestock as an active chemical
- Do not use in potential grape planting areas
- Do not use where loss of legumes or other broad leafs cannot be tolerated
- Can damage newly sown perennial grasses
- Can develop resistance

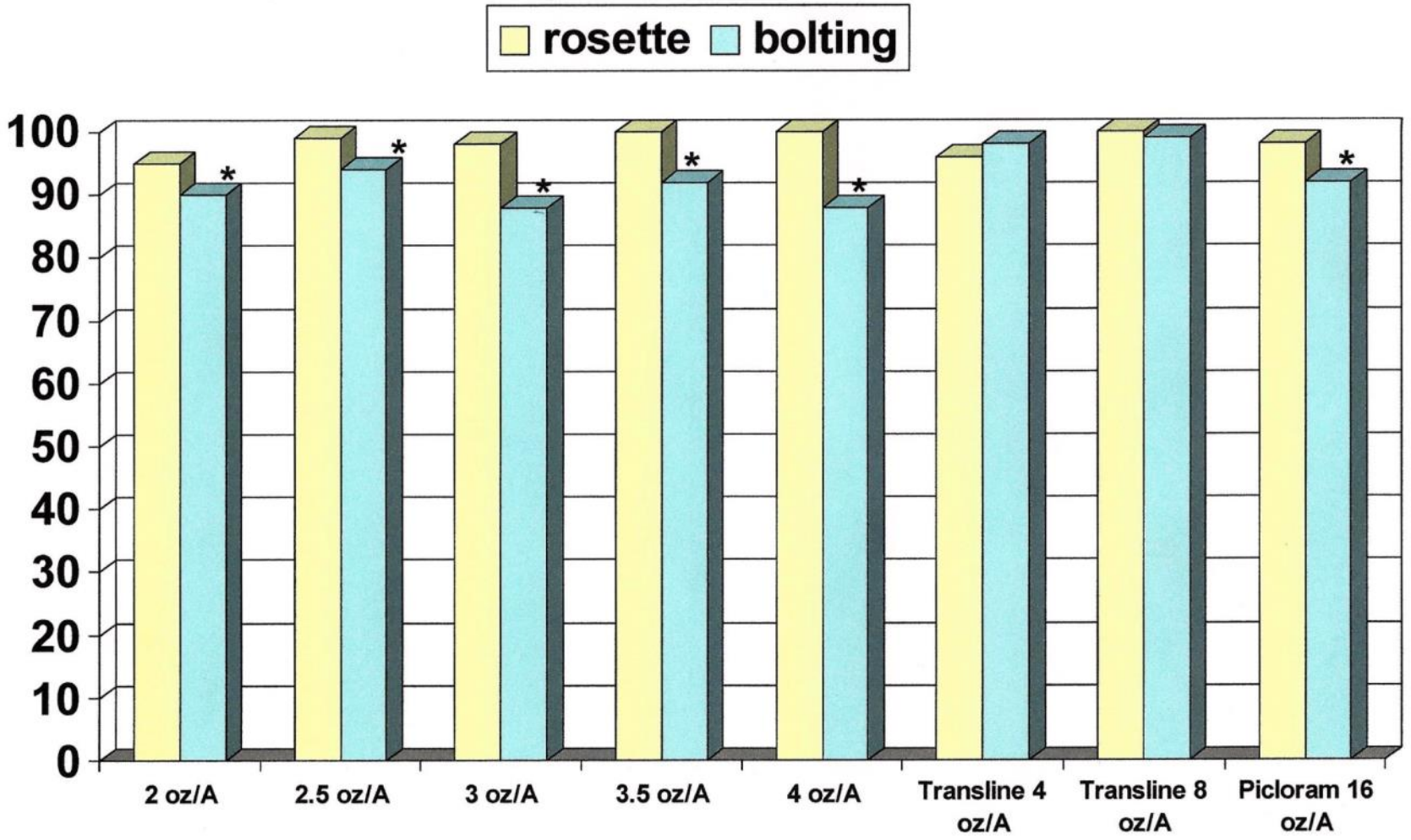
Effect of treatment timing on yellow starthistle control in Davis, California



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

*** LSD (P=0.05)**

Effect of aminopyralid on yellow starthistle control in Davis, California



Evaluated on July 28, 2003

*** LSD (P=0.05)**

Aminopyralid & Clopyralid

- Post emergent control is slow – if plants are large, late in season, use Roundup or other post emergent
- Cost can be a factor
- Can be up to 2 weeks to usual signs of death

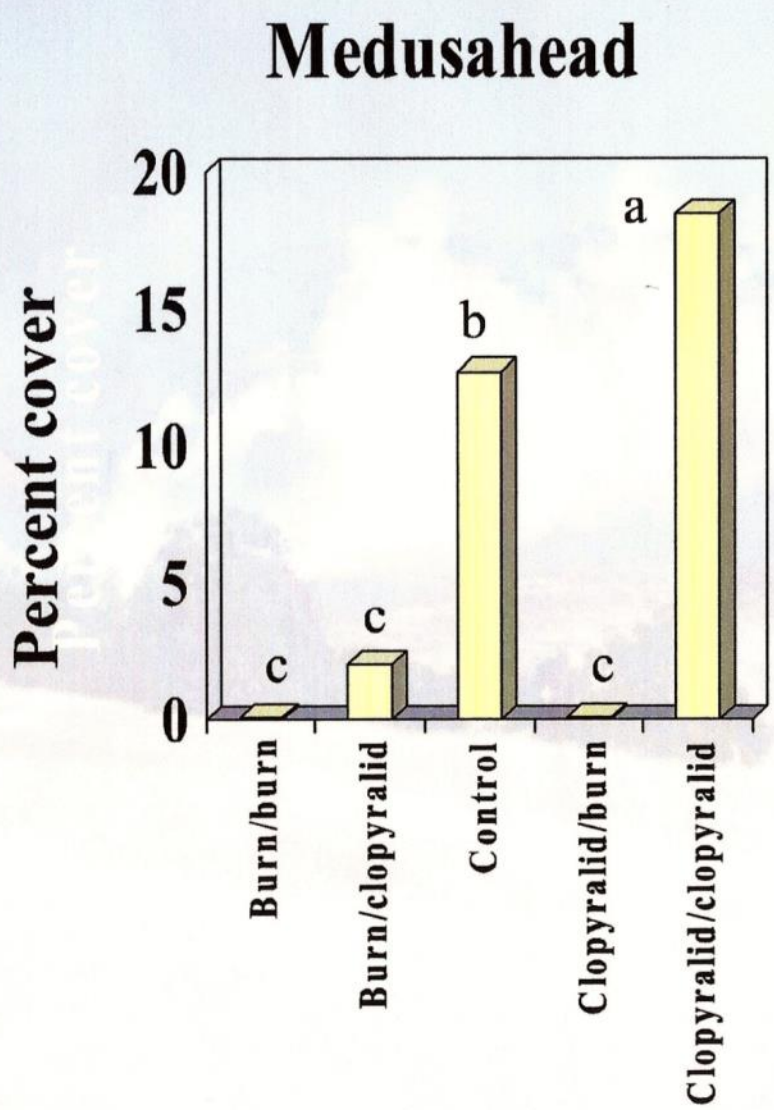
HERBICIDES WARNINGS!

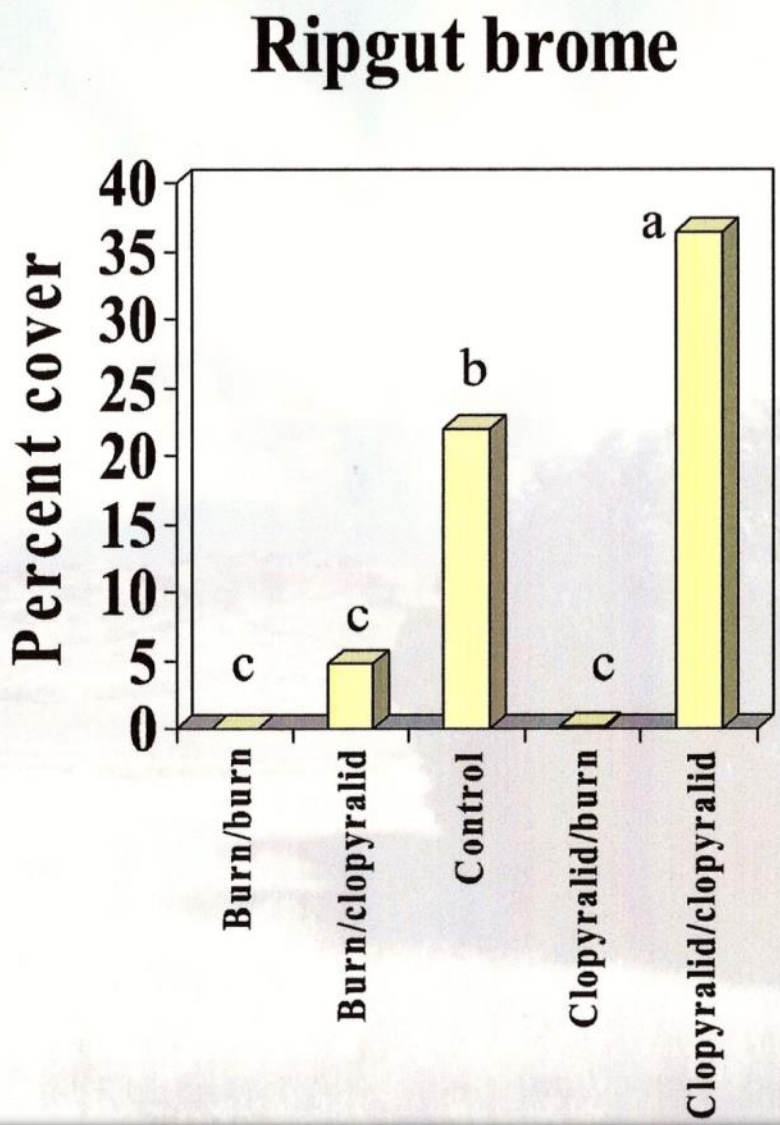
- Please, before using ANY herbicide, READ THE LABEL FOR:
  - Application rate
  - Timing
  - What it is effective against
  - Precautions
- Know what is in the field because:
  - You can kill YST but allow something worse to take over
  - Bromus diandrus – Ripgut Brome
  - Taeniatherum caput – Medusahead

Ripgut brome (*Bromus diandrus*)

Medusahead

Taeniatherum caput-medusae





Integrated Management of Medusahead & Ripgut brome – Right & Wrong Way

Requirements

Agricultural Labeled Products

- Transline, Milestone, and some formulations of Glyphosate
- Need a permit from the El Dorado County Dept. of Agriculture
- Permit allows purchase, use, and storage
- Pesticide use reports required
- Permit must be renewed every year

Products Labeled for Home Use

- Star Thistle Killer and some formulations of Glyphosate
- No permit required
- Purchased at retail stores
- Not for use on agricultural sites.

Biocontrols

- Use of natural enemies to control pest populations
- Not a problem in native habitat
- Lack of natural enemies makes it a problem here
- Care taken when introducing non-native natural enemies of YST

Six Insect Natural Enemies Introduced

- Hairy weevil (right)
- Bud weevil
- Flower weevil
- Gall fly
- Peacock fly
- False peacock fly

Bio-control Insects

Hairy weevil, *Eustenopus villosus*

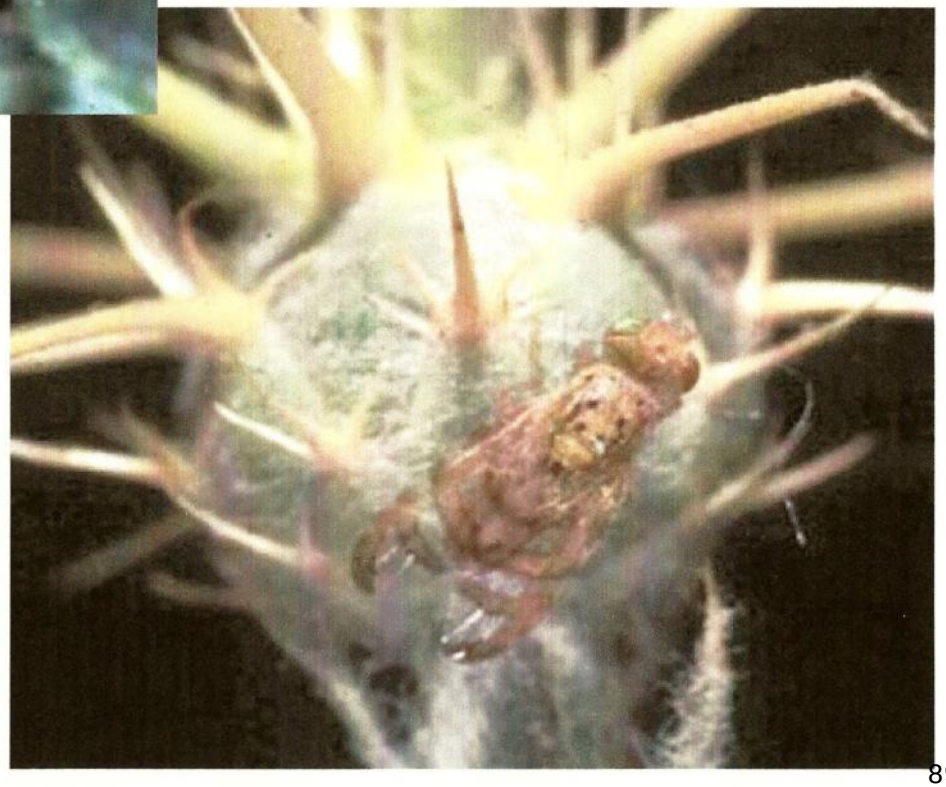
Yellow starthistle bud weevil,
Bangasternum orientalis

Yellow starthistle flower weevil,
Larinus curtus

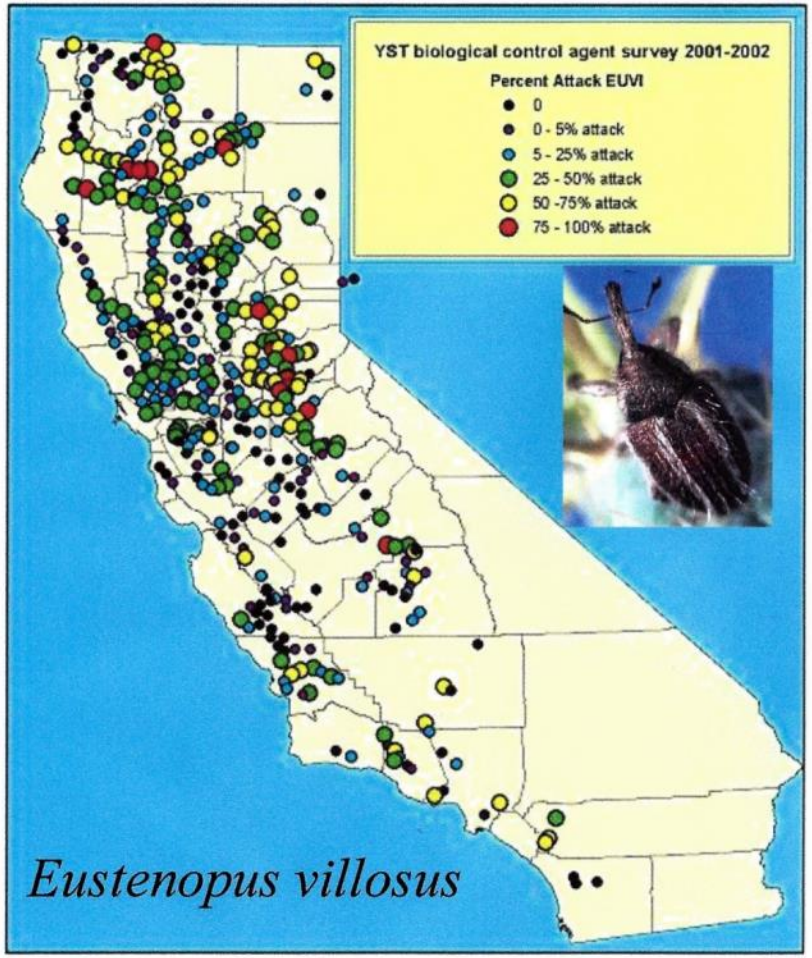
Yellow starthistle gall fly,
Urophora sirunaseva

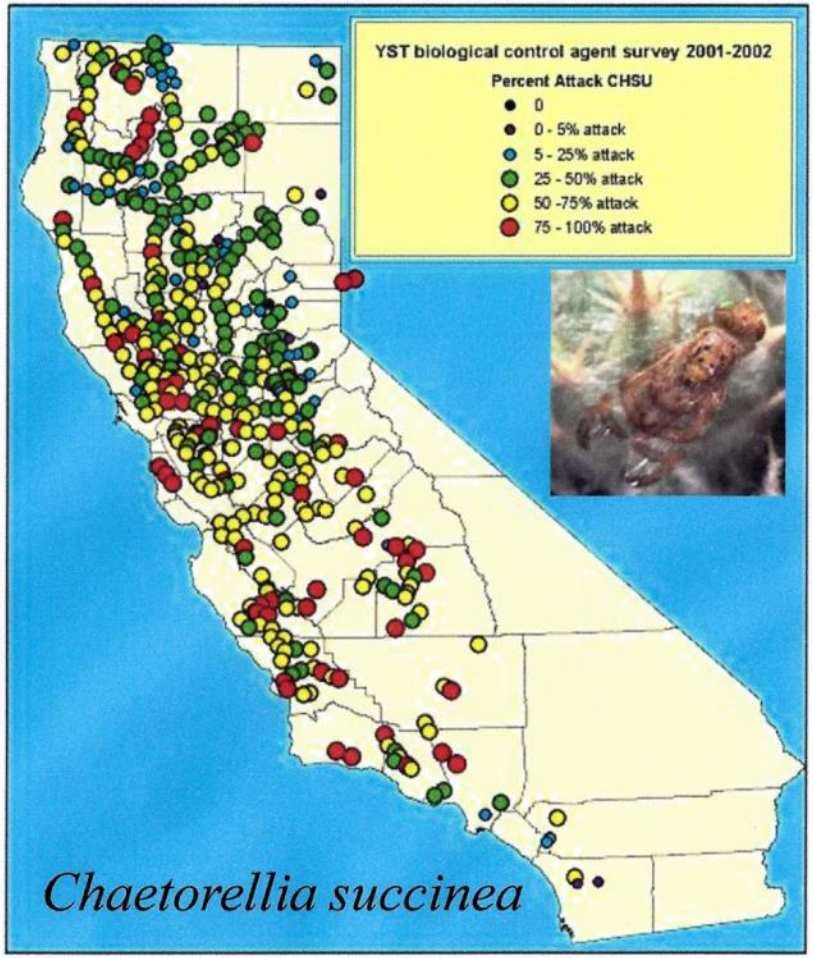
Hairy weevil
Eustenopus villosus

False Peacock Fly
Chaetorellia succinea



Biocontrol agent distribution and attack rates in California





The Rust Fungus

- *Puccinia jaceae* var. *solstitialis*
- Found in Turkey; Approved for released by CDFA in 2003
- Attacks vegetative part of plant

Biocontrols – Efficacy

- Insects or fungi – none particularly effective, though widespread
- At best, total control over a season about 50% in small areas
- Biocontrols alone not ultimate solution

Control Mechanisms – Manual

- Hand-pulling, hoeing, weed whip
- Can be very effective
- Use on small populations or isolated infestations
- Use to eliminate survivors from other control methods
- Weed whip least effective
  - Regrowth
  - Spread of seed
  - Must be done continuously

Control Mechanisms – Competition

- Relying on plant competition alone probably won't work because of YST's growth habit & adaptability
- Other control measures used first to reduce or eliminate YST
- Once YST controlled, something else must replace or YST returns
- Choice of replacement must reflect site conditions, management, & future use

Competition – Perennial Grasses

- Once established, provide excellent competition

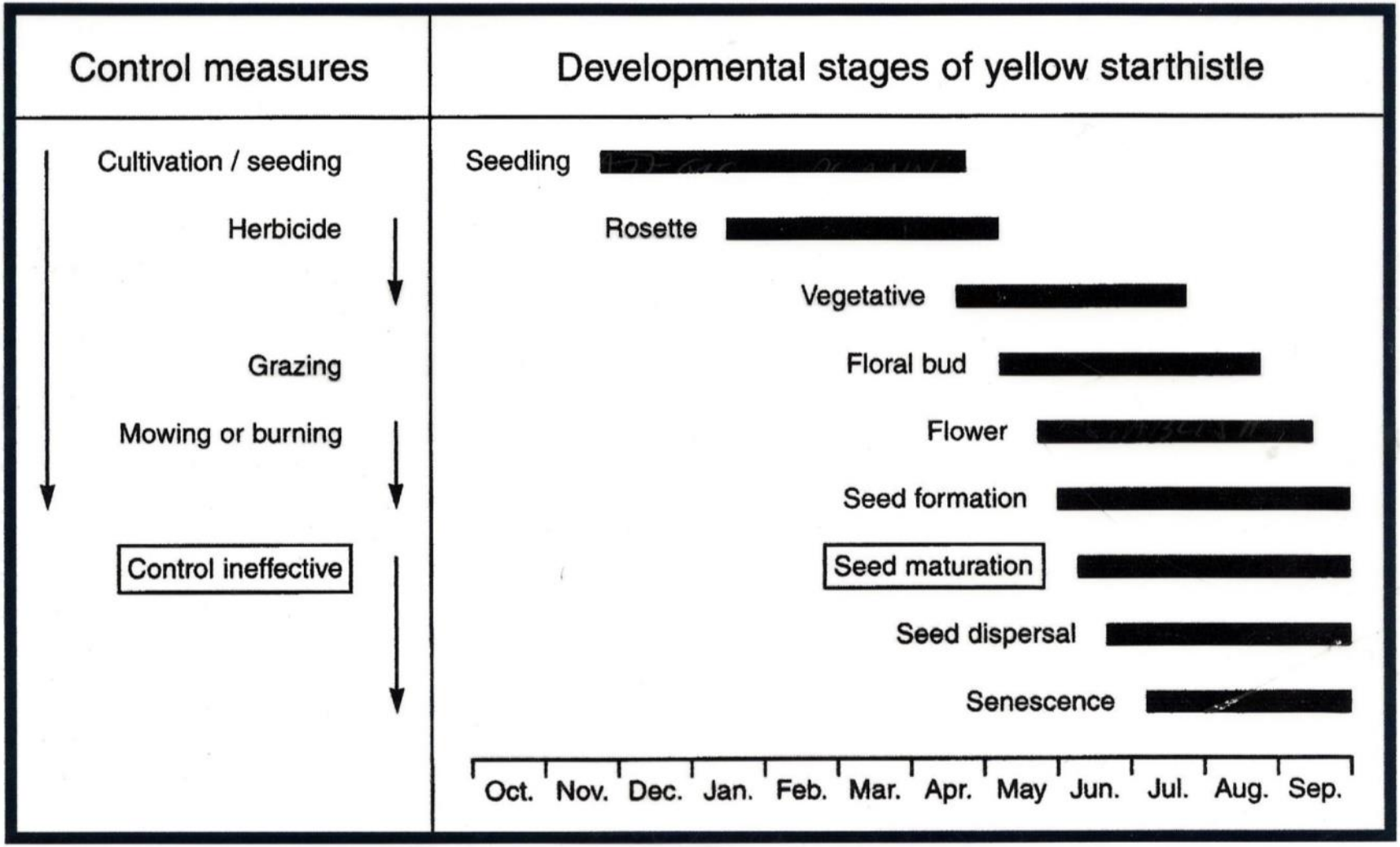
  BUT: Seedlings slow to establish & easily outcompeted in seedling stage
- Some other control mechanisms – pre/post emergent – must be used until grasses establish – integrated management plan
- Usually requires two years to establish

Competition – Legumes

- Must be seeded heavily
- Dense enough stands difficult to establish
- Tend to decline over time so competitive qualities degrade, allowing return of YST

Competition Notes

- Choose plants that either have:
  - Vigorous cool season growth to shade YST seedlings & rosettes
  - Deep rooted systems with warm season growth that deplete soil moisture
- Trees & shrubs that:
  - Shade site
  - Develop competitive root systems
  - Produce leaf litter to act as mulch



Control Mechanisms - Timing

VIII. Strategic Planning for Control

- Strategic Plan Factors:
  - Know long term objectives
  - Are there management limitations
  - Inventory & map of infestation
  - Know biology of YST
  - Know biology of ecosystem
  - Coordinate efforts among interested parties

Develop Your Plan

- What are you willing to spend?
  - Time
  - Money
  - Priorities
- Develop a multi-year plan
- Integrate tools you can use:
  - Mechanical
  - Cultural
  - Chemical

Implement Your Plan

- Emphasize:
  - Prevention – how it is introduced
  - Are you creating a susceptible landscape?
  - Detection & monitoring populations – yours and your neighbors
  - Education – you and your neighbors

Successful Outcomes

- Eradication?
  - Early identification of problem
  - Rapid response to prevent seed production
  - Proper use of control methods
  - Site monitoring – is plan working?
- Follow up to prevent reinfestation
- If you do not monitor & follow up, you will be reinfested

What to remember about Yellow Starthistle

- Multiple flushes
- Deep roots
- Plants can regrow
- Plants die off late
- Many seeds
- Plant is *tenacious*!

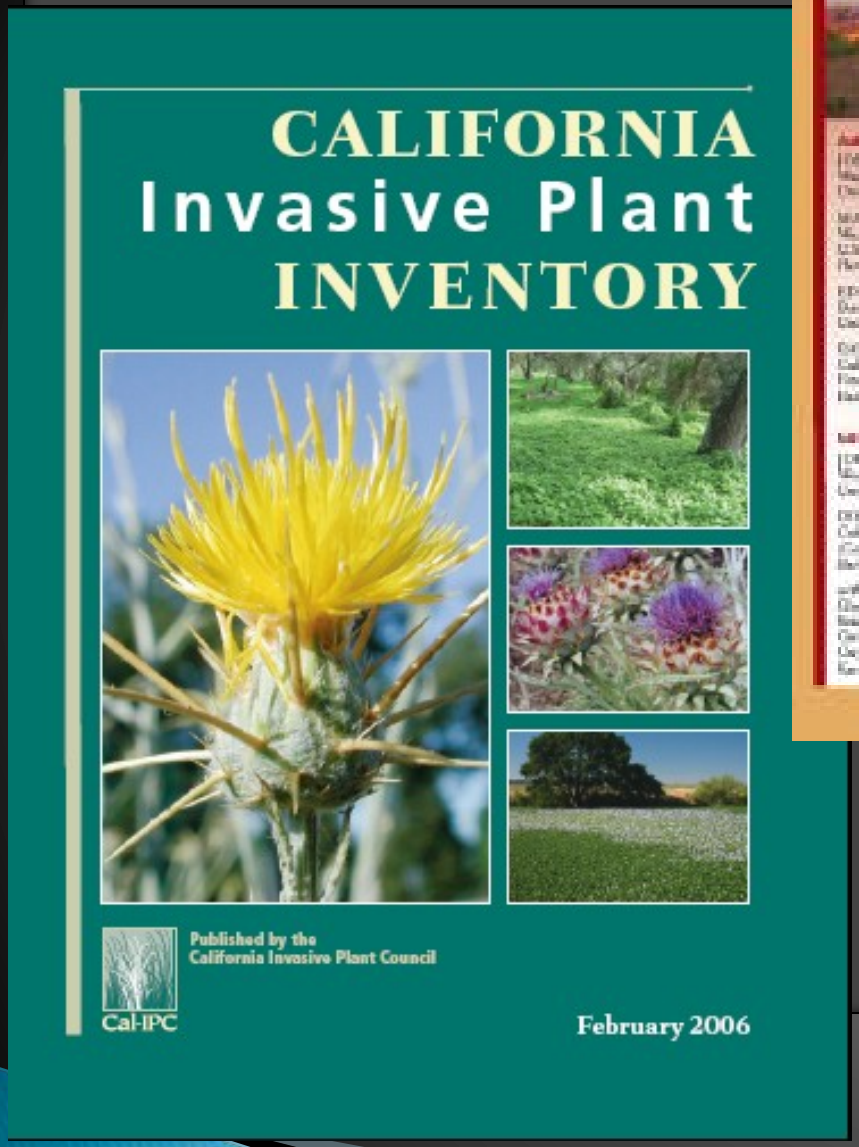
Summary of yellow starthistle management

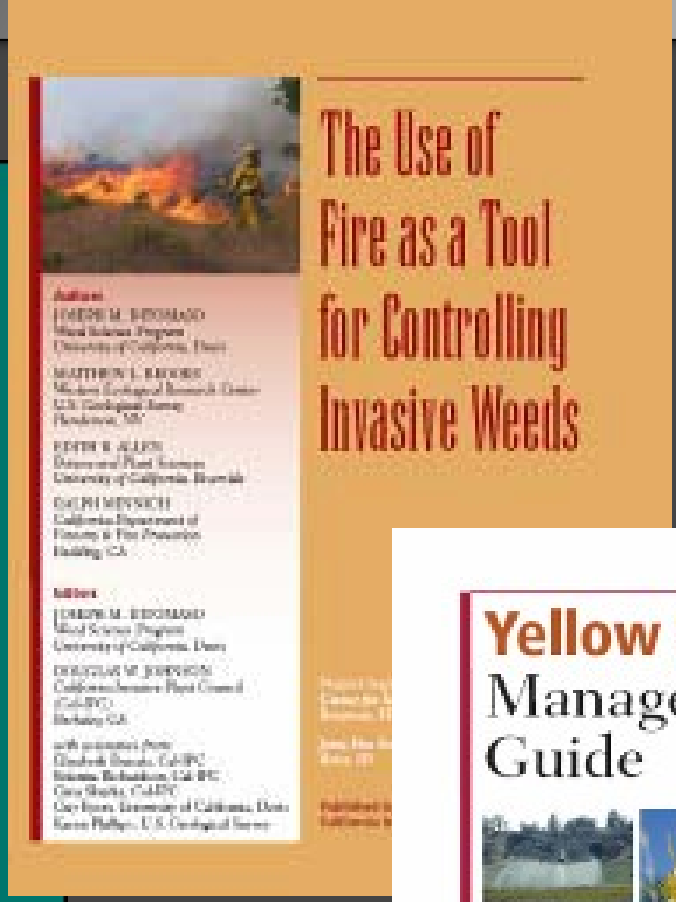
- Numerous successful control options
  - Transline, Milestone, burning, mowing, tillage
- Keys to long term success
  - Deplete the seedbank
  - Prevent new seed recruitment
    - Off site recruitment
      - Livestock, vehicles, wind
    - On site escapes
      - Skips, fringe areas, fencelines, satellite populations
  - Monitor and detect new YST plants and populations
  - Spot treatment or follow-up program
  - Integrated program using competitive perennial grasses can be effective

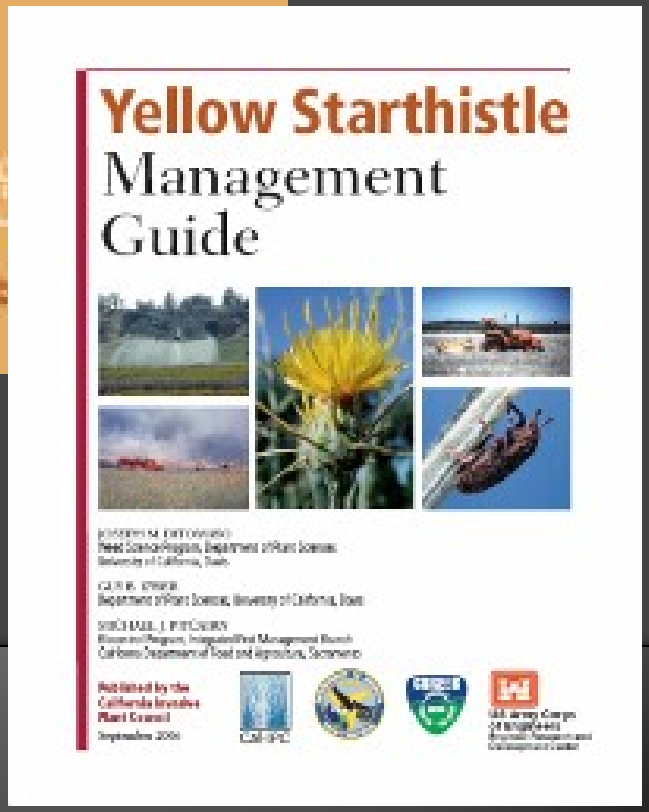
YOU MUST BE AS TENACIOUS AS THE YELLOW STARTHISTLE.

If you are not, you LOSE!

Good luck!







Cal-ipc.org

Source: http://wric.ucdavis.edu/YST/YST.html

Questions?

THANK YOU!

HEALTHY ENVIRONMENTS

University of California
Agriculture and Natural Resources
California Master Gardener
Cooperative Extension
El Dorado County

Making a Difference for California