# Impacts of Mowing and Bud Destruction on Yellow Starthistle Root Dynamics and Flowering



David Spencer, Stephen Enloe, Mike Pitcairn, Pui-Sze Liow, Wa Ki Chan, Meaghan Donovan, Evelyn Healy, and Greg Ksander





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3 Most Extensively used tools

Grazing Mowing Biocontrol









Hairy weevil (*Eustenopus villosus*)
Released in CA in 1991
Adults feed on 4 bud stages prior to oviposition on capitula
Larvae feed within capitula





Reduction in shoots results in reduction in root biomass.

Reduction in shoots results in increase or no change in root biomass, but may result in increase in root exudates. How does repeated defoliation compare with bud damage in reducing yellow starthistle growth and reproduction?

- Repeated defoliation
  - 4 allocation to roots
  - *I* and delay soil water use pattern
  - ↓ flower number and seed production
- Bud damage
  - 4 allocation to roots
  - Little to no impact on soil water use patterns
  - Little to no impact due to axillary bud release

Volume =  $0.5 \text{ m}^3$ 

0.46 m

3 m

0.3 m



## February 5

## February 17



March 3



### March 20, 2003



March 31, 2003





### April 30, 2003

#### April 15, 2003

Control	Mowed	Smashed
4 columns	4 columns	4 columns



Repeated defoliation to 10 cm 4/30, 5/28, 6/30

BU1-BU4 buds smashed 5/1-6/30 weekly











June 22, 2003



July 10, 2003



July 30, 2003



August 12, 2003



For each of the 108 minirhizotrons, we examined 24, 1.8 x 1.4 cm "quadrats" along its upper surface.

This is 2,592 "quadrats" per sample date.

36,288 images (Jan-Aug) (22% of quadrats had hits)

If roots were present we recorded a digital image.





Claire Glagowski Ryan Detert •We used *RootTracer* (v. 2.2) to measure root lengths and widths in each image

•Root lengths were used to calculate root length density (mm cm<sup>-3</sup>)

•Root widths were used to determine the size distribution of roots





•Plant height taken on each root sampling date

•# of buds smashed weekly

•Biomass removed by mowing

Final harvest (10/04/03)Plant dry weight

•# of developed (> Bu3) and un-developed (< Bu3) flowers present

•Developed flower diameter







**Treatment Period** 

Root Length Density (mm cm<sup>3</sup>



RLT = Root Length Production Mean Living Root Length

de Kroon and Visser, 2003

RLT was greater for fine roots (FN, < 1 mm) than coarse roots (CR, > 1mm). This agrees with previous reports which show that smaller diameter roots turnover more quickly.

RLT was not affected by the mowing or bud smash treatments.







#### Final Aboveground Biomass









# Mowing and bud damage resulted in smaller diameter flowers.

Seeds =  $-18.66 + 4.58 \times \text{diameter} (\text{mm})$ 

 $F_{1,4} = 60.49$ P = 0.0015 R<sup>2</sup> = 0.94

We used the above previously derived equation to estimate the number of seeds per flower and per plant.



# Summary

- Roots had reached 2.7 m depth by March 5
- 40% total root length density by early bolting
- 70% of total root length density by late bolt / early bud
- Treatment had marginal effect on root length density
  - Trend for ↓ due to both mowing and bud damage
  - RLT not affected by treatment

# Summary

- Treatment had no significant impact on soil water use patterns
- Plant height and total aboveground biomass were significantly reduced by mowing, but not bud damage
- The relative proportion of biomass allocated to flower production was not affected by either treatment
- The number of fully developed flowers at harvest was reduced by mowing but was not by bud damage
- ↓ Flower diameter due to mowing and bud damage
   76% and 21% reduction in estimated seed number per plant

# Implications for management Find techniques that attack earlier life history stages and roots.

