Patterns of Seedling Establishment in *Cynara cardunculus*

Robin Marushia

Dept. of Botany and Plant Sciences, UC Riverside

Outline

- Introduction to *Cynara cardunculus:* observations
- Research questions
- Methodology and experimental design
- Results
- Discussion, implications for future work

C. carduncululs: artichoke thistle

- Mediterranean perennial thistle
- Invades coastal grasslands
- Resprouting, ample seed production make long-term control difficult.

Photos: CalPhotos at http://calflora.org

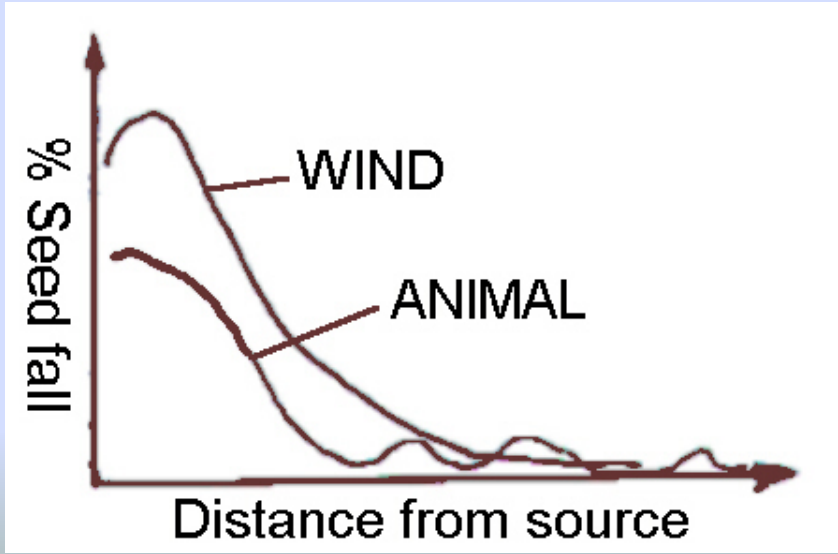
Seed dispersal in *Cynara cardunculus*

- Seeds < 50 mg.
- Wind-dispersed via pappus, but detach easily.
- Most seeds may fall within 2 m. of parent, but has not been quantified.
- Seedlings occur near rosettes.
- Rosette deposits litter, inhibits other spp.

Artichoke thistle control could be more effective with dispersal and seedling establishment knowledge!

Seed Ecology

- Gadgil (1971): *"An organism should disperse if the chance of reaching a better site exceeds the expected loss from the risk of death during dispersal and the chance of reaching a poorer habitat."*
- **Rephrased**: if fitness is greater by depositing seeds at, or near, the home site than through dispersal, selection should act to decrease dispersal.



- Dispersal curves show that most seeds disperse short-distance!
- Could short-distance dispersal be an adaptation with facilitation of seedling establishment?

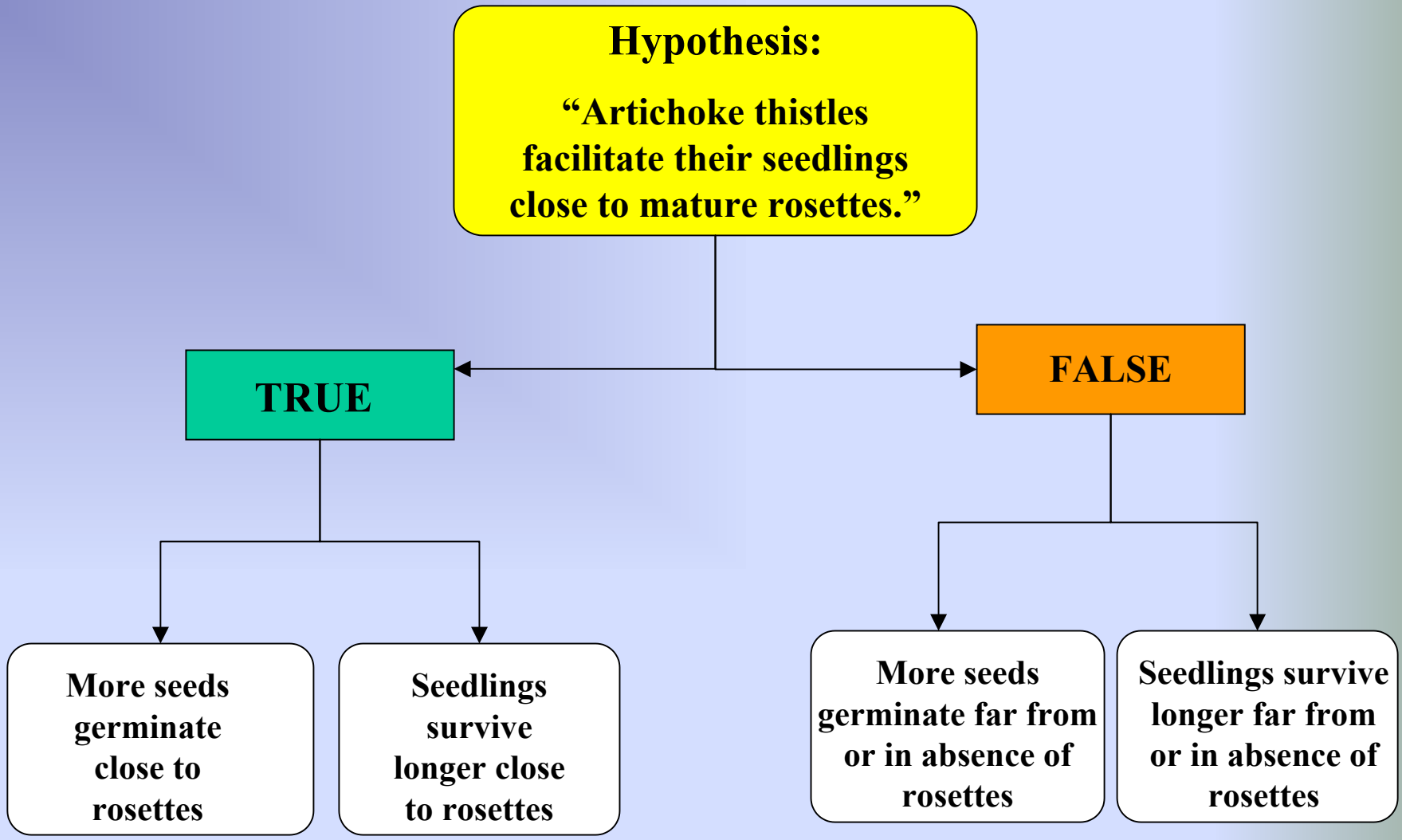
[Modified from Benzing, 1990]:

http://biology.bangor.ac.uk/treborth/Epiphytes/Epiphytes_Travelling_Dispersal.html

Research Questions

1. How far do artichoke thistle seeds disperse?
2. Do artichoke thistles facilitate their seedlings?
3. If so, do dispersal and facilitation interact to increase artichoke thistle invasion?

2. Hypothesis: Artichoke thistles facilitate their own seedlings by either A) mechanical inhibition, B) chemical inhibition (allelopathy), or C) both.



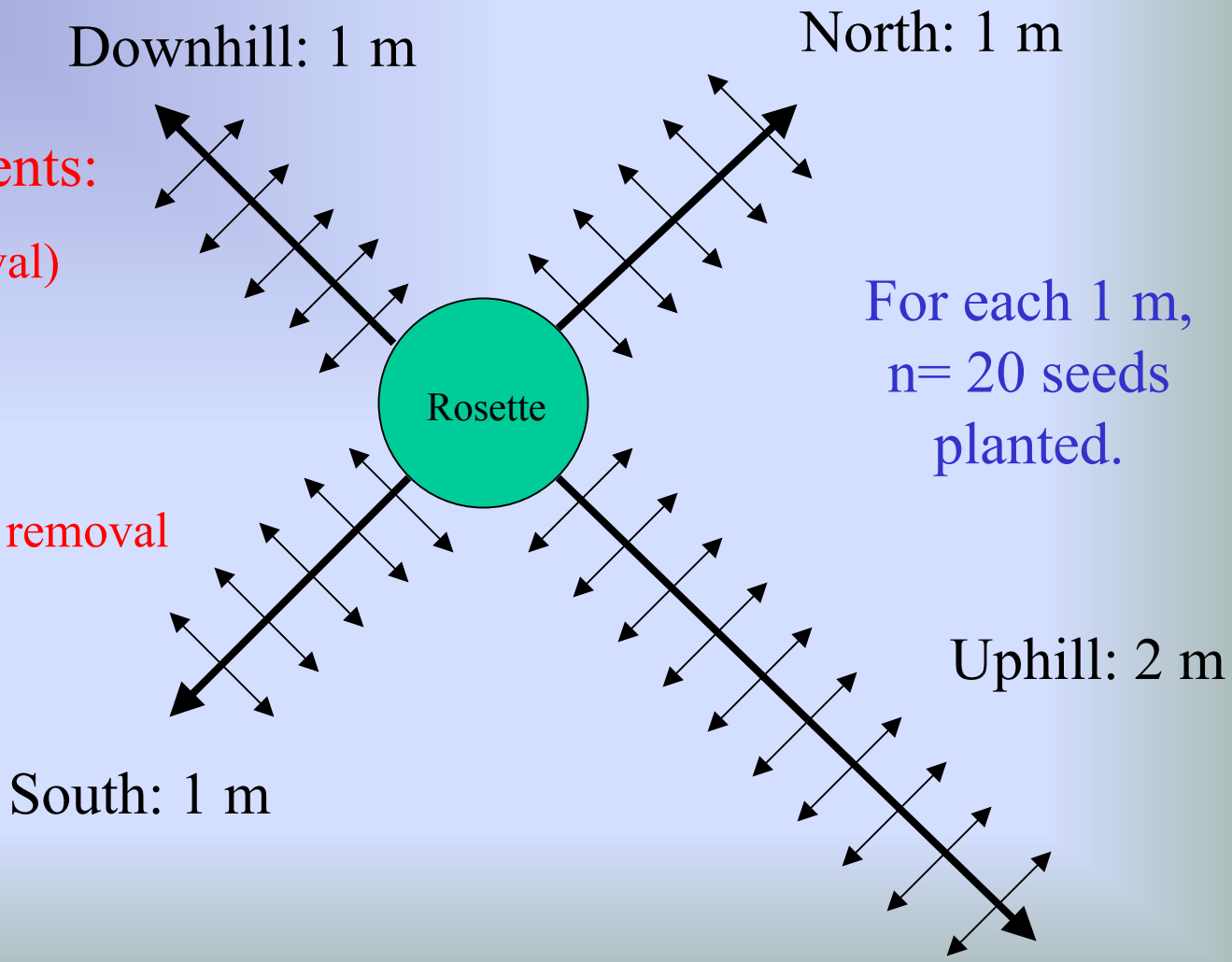
In either situation: **either the live rosette, the leaf litter, or the two in combination may influence the establishment and/or survivorship of seedlings.**

Artichoke Thistle: Litter and Rosette

Experimental Design

Rosette Treatments:

- Control (no removal)
- Litter removal
- Rosette removal
- Litter and Rosette removal



For each 1 m, n= 20 seeds planted.

Experimental Design: Field Plot, October 2002

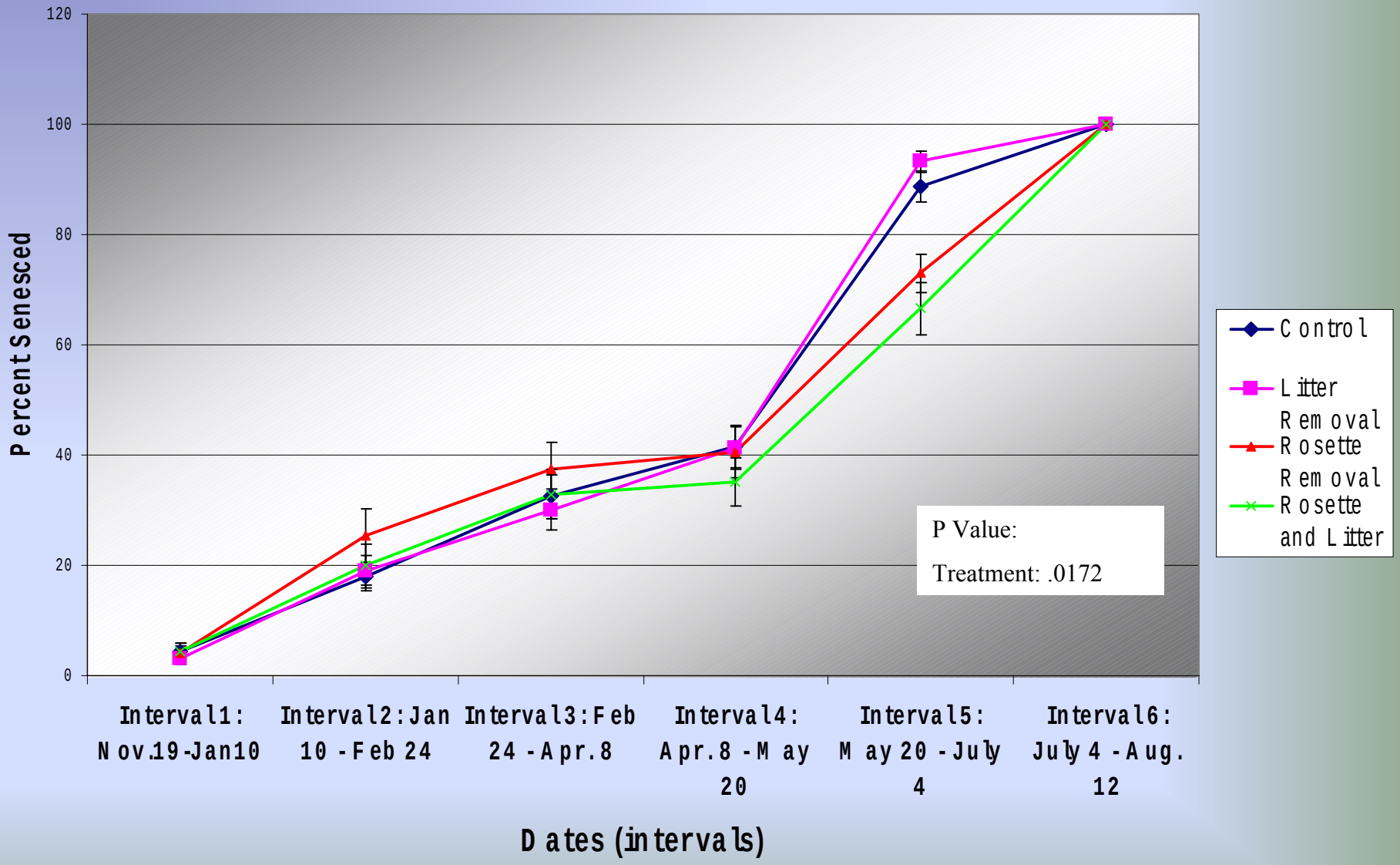
Experiment: 2002-2003

- Litter removal treatment applied once during seeding, live rosette treatment applied biweekly.
- Soil moisture recorded biweekly, air temperature recorded continuously.
- Data collected biweekly from Nov. 2002 through August 2003 (from first emergence to last senescence).

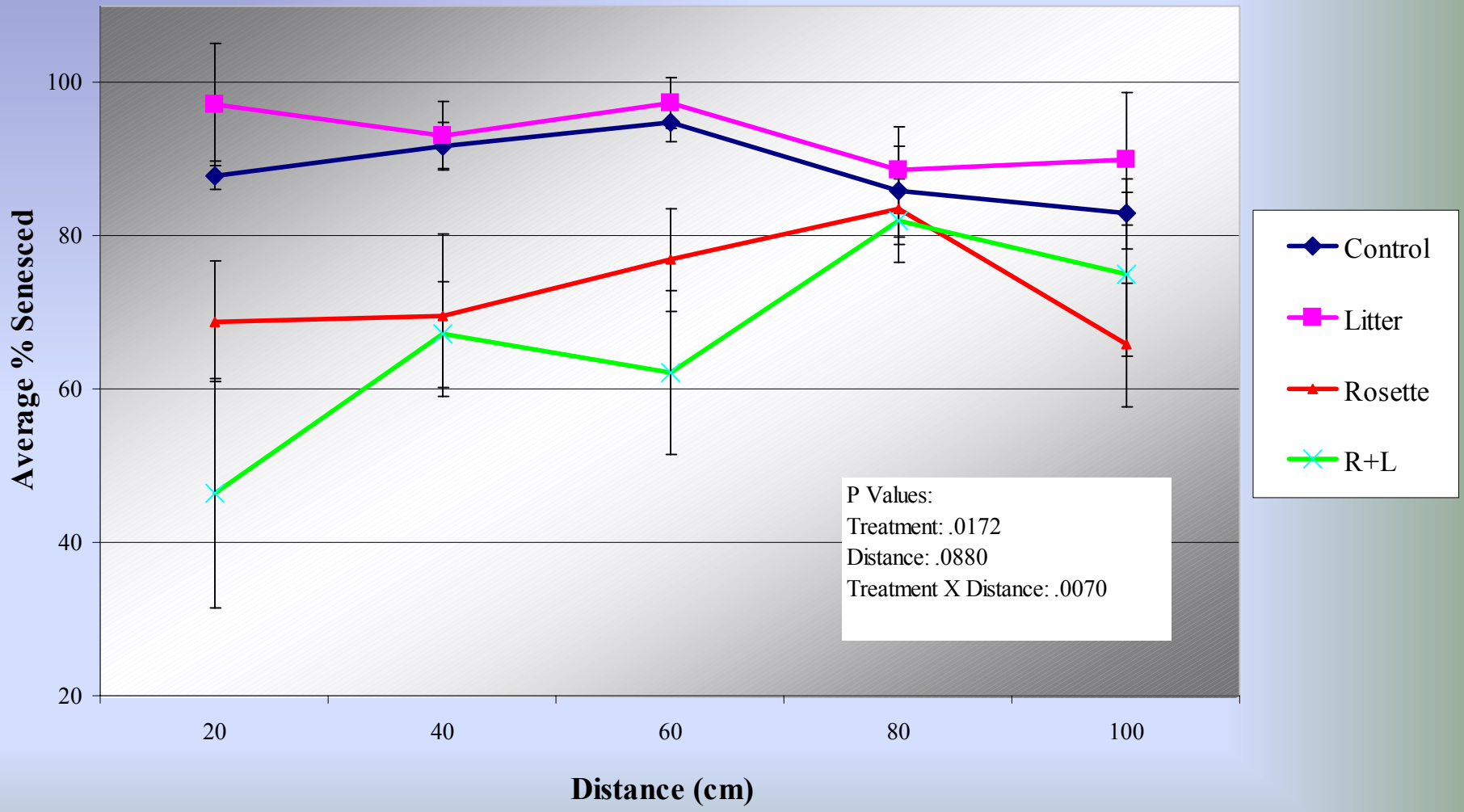
Results:

- Emergence is not significantly affected by either treatment or distance.
- Senescence is significantly (P=.0171) affected by treatment and distance, but only during the summer months (from May to August).
  - Live rosette removal results in later seedling senescence, especially close to the rosette.
  - Effect of rosette removal treatment intensifies as summer proceeds.

Average % Senesced at 6 Week Intervals, by Treatment



Day 227 (Interval 4): Average Percent of Seedlings Senesced by Distance from Central Rosette



Discussion

- *Hypothesis is false*: Based on this experiment, artichoke thistle does not facilitate its own seedlings.

→ Why are seedlings grouped around rosettes?

- *Dispersal:* short-distance dispersal alone may explain seedling patterns.

- *Spatial Distribution?:* seedlings may not be significantly associated around rosettes, or may survive better away from rosettes in natural distributions.

- *Water availability:* drought conditions may create better seedling conditions near mature rosettes.

Current and Future Work

- Currently producing a wind dispersal curve specific to artichoke thistle.
- Continue analysis to incorporate extension transects, orientation, and finer resolution of senescence data.
- Re-measure the spatial relationship of naturally occurring seedlings to adult thistles.
- Seeded rosette experiment will be repeated over the 2003-2004 growing season.

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