Canada Thistle Biology and Management

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Milt Haar, National Park Service, DOI

Judy Markl, Dennis Opdahl, Luke Skinner, and Laura Van Riper, MnDNR

Lee Klossner, Brad Kinkaid, Jeanie Katovich and Mary Marek-Spartz, U of M

Scott Glup, J.B. Bright, USFWS

Paul Bockenstedt, Stantec

Mary Halstvedt, Louanne Brooks, Corteva

Bob Hartzler, ISU

Surrender of General Burgoyne (John Trumbull US Capitol Rotunda)

Canada thistle possibly introduced in hay brought to the US for General Burgoyne's horses

USFWS https://commons.wikimedia.org/wiki/File:Bison_herd_grazing.jpg

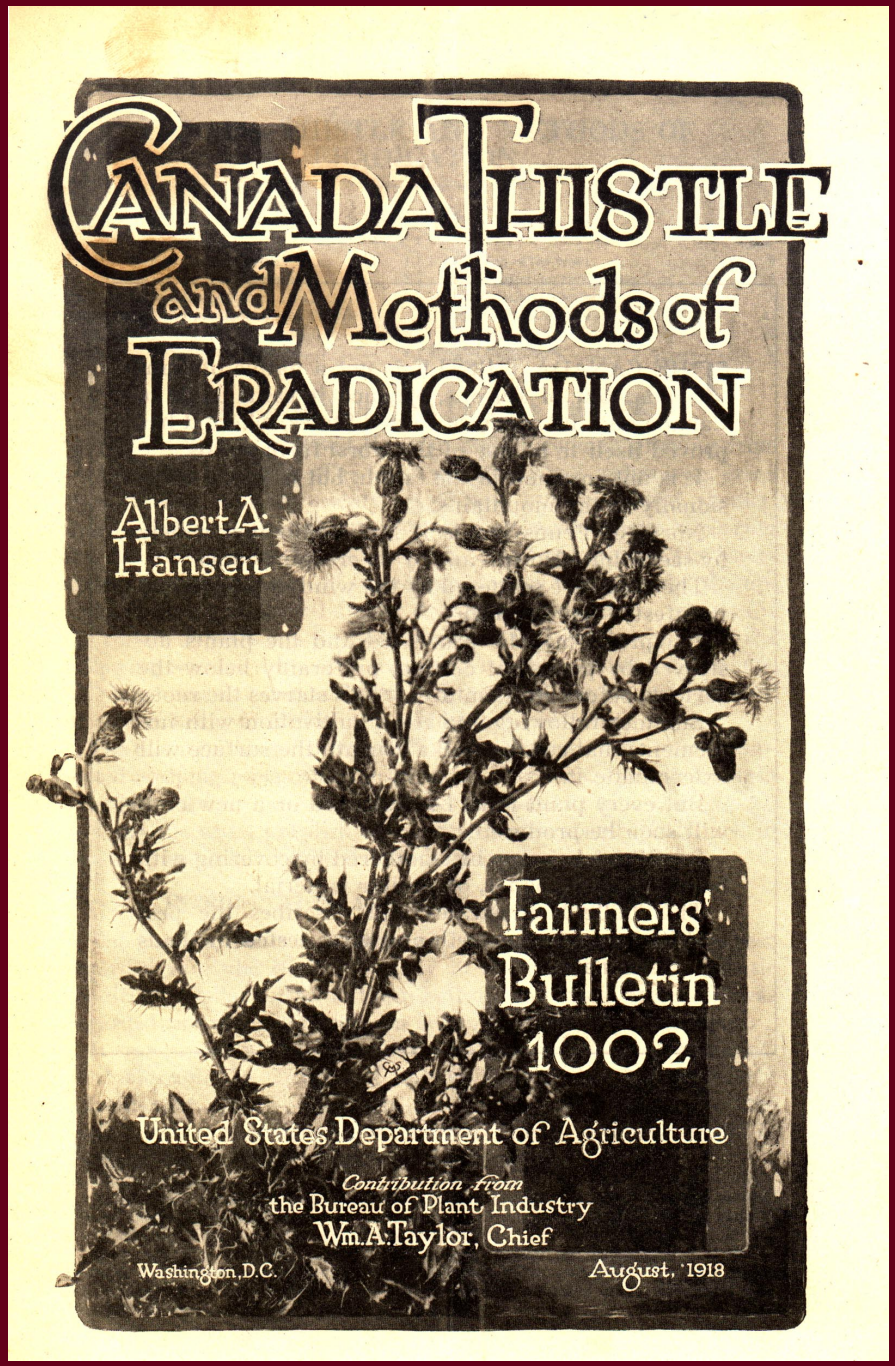
Homesteading Family 1886

Very disturbance oriented individuals…

http://www.usdakotawar.org/history/multimedia/homesteading-family

The Elusive Holy Grail of Weed Management

- **Eradication!**



The first state or province weed law? Canada thistle!

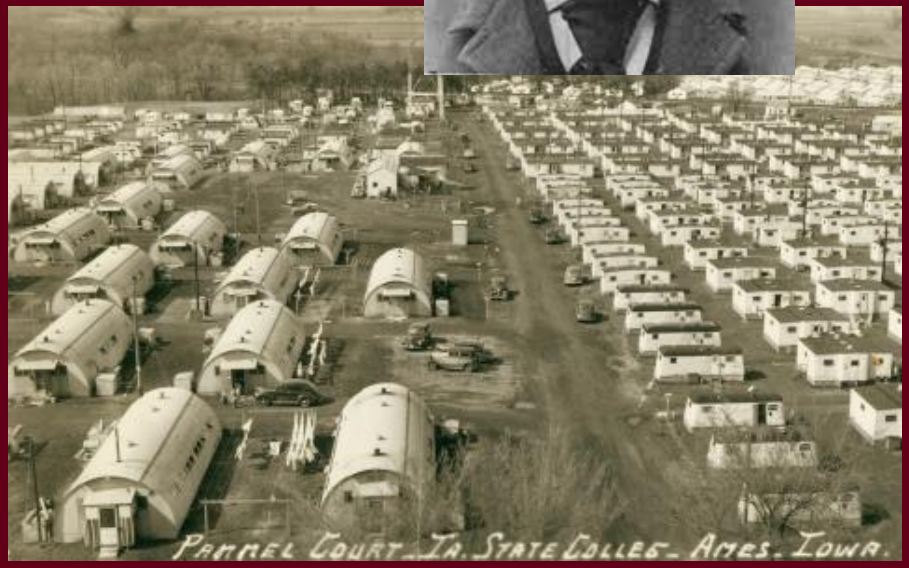
Iowa's First Weed Law
April 7,1868
(statehood 1846)

Minnesota's First Weed Law
1872
(statehood 1858)

North Carolina Botanical Garden

George Washington Carver
National Monument. nps.gov

Iowa Natural Heritage Foundation



Ames History Museum

Iowastatedaily.com

Canada Thistle - Hayden

Amer. J. Bot. 21:355 - 373. 1934.

C. thistle distribution – 1898, Louis Pammel

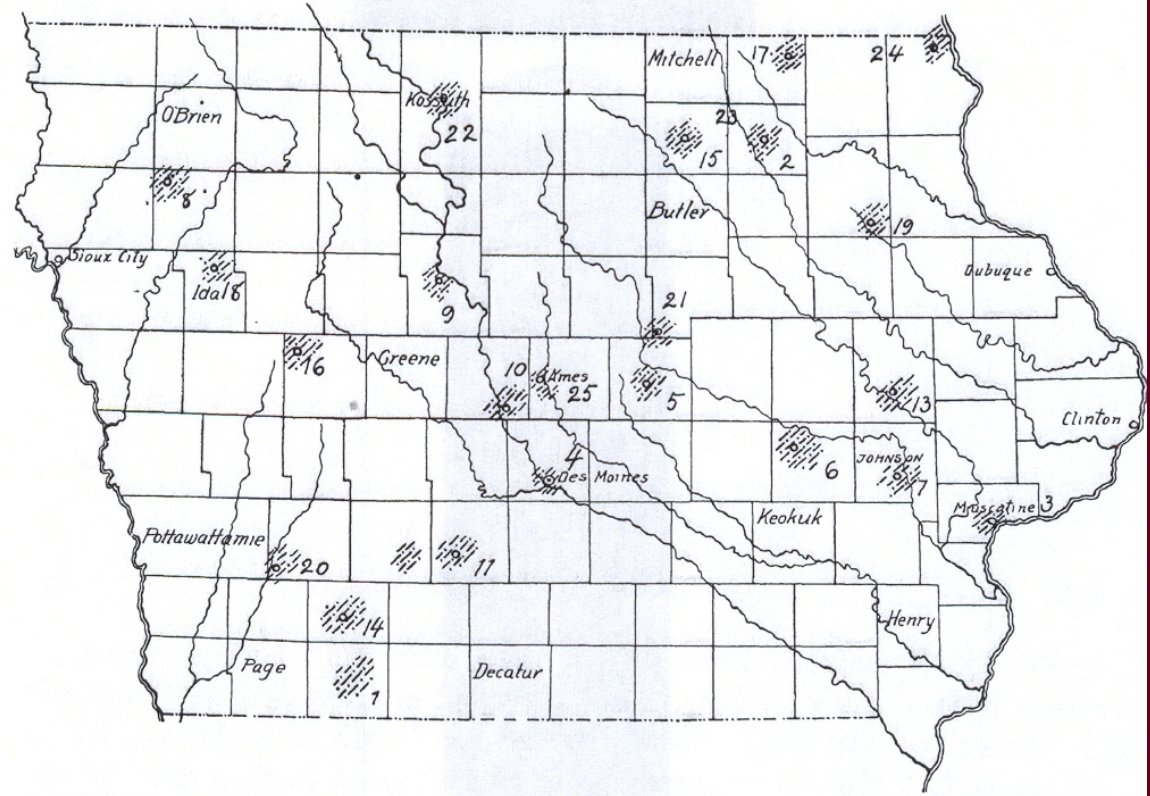


Fig. 1. Diagram showing the distribution of Canada thistle in Iowa in 1898: (1) Taylor Co., (2) Chickasaw Co., (3) Muscatine, (4) Des Moines, (5) Marshalltown, (6) Iowa City, (7) Johnson Co., (8) Marcus, (9) Ft. Dodge, (10) Randall, (11) Winterset, (12) Ladora, (13) Cedar Rapids, (14) Corning, (15) Charles City, (16) Maple River, (17) Cresco, (18) Sac City, (19) Oelwein, (20) Griswold, (21) Conrad Grove, (22) Bancroft, (23) Lawler, (24) New Albin, (25) Ames. (After Pammel, 1898.)

Bob Hartzler, ISU

Canada Thistle – Hayden

Amer. J. Bot. 21:355 - 373. 1934.

C. thistle distribution – 1934, Ada Hayden

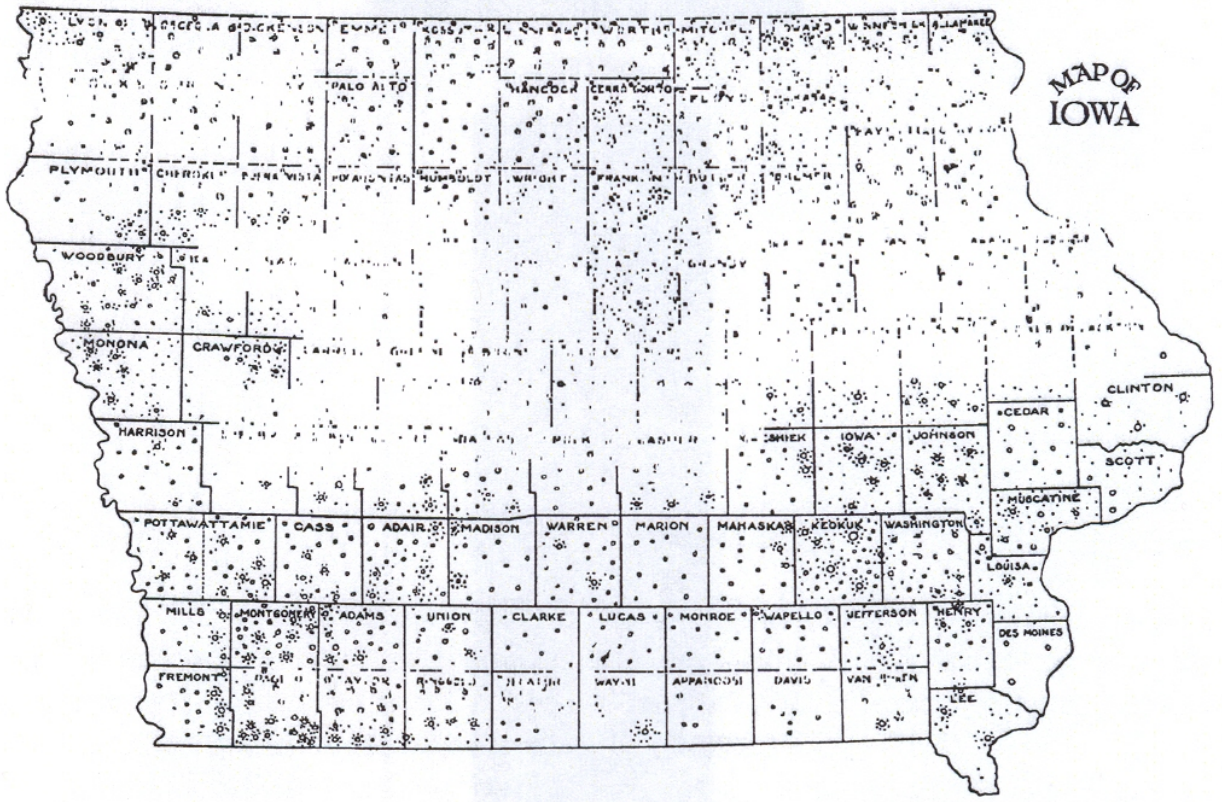


Fig. 2. Diagram showing the approximate distribution of Canada thistle in Iowa. The relative presence of the plant is shown in terms of dots representing occasional plants; and circles representing patches of one or more acres. The approximate distribution is diagrammed to locate districts where Canada thistle is known to be infrequent, frequent, or abundant.

Canada Thistle - Hayden

Amer. J. Bot. 21:355 - 373. 1934.

Infestations in Iowa studied extensively from 1890's - 1930's

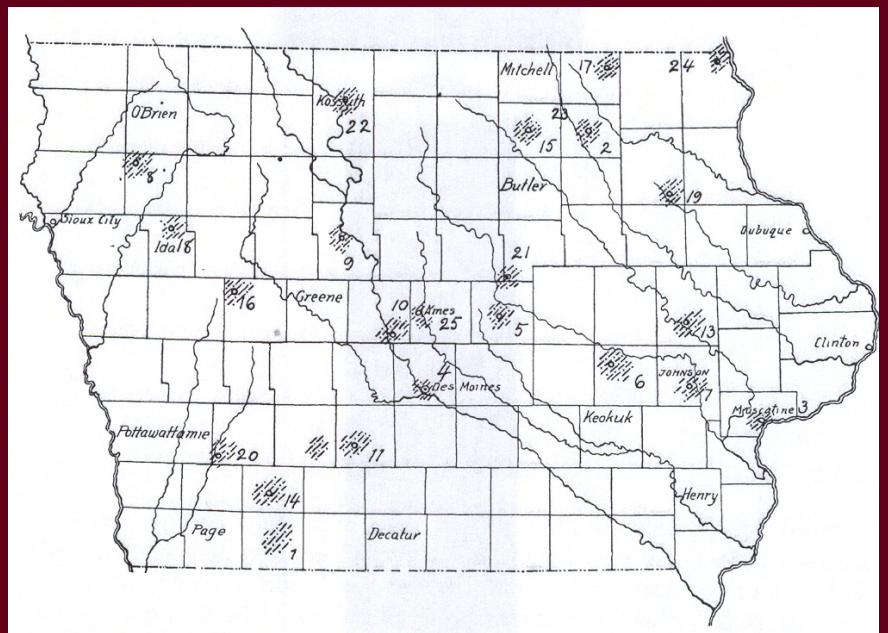
Pammel, 1898

"I have repeatedly examined thistles in WI, IA, IL and MO, and with few exceptions seeds have not been found."

Canada Thistle – Hayden

Amer. J. Bot. 21:355 - 373. 1934.

C. thistle distribution – 1898, Louis Pammel



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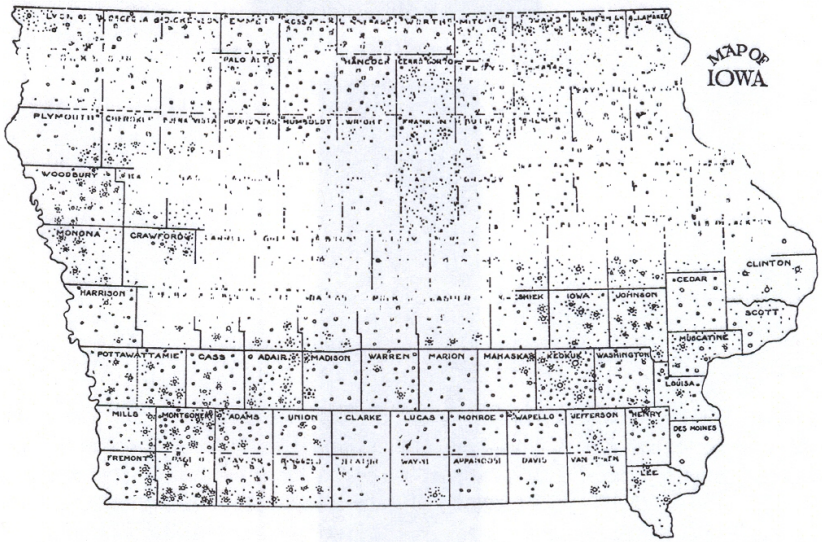
– 1934, Ada Hayden



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Canada Thistle - Hayden

Amer. J. Bot. 21:355 - 373. 1934.

Ada Hayden -
Her work is still one of the best characterizations of Canada thistle biology today.

Rosemount Funct. Grp. By Sept. 2005

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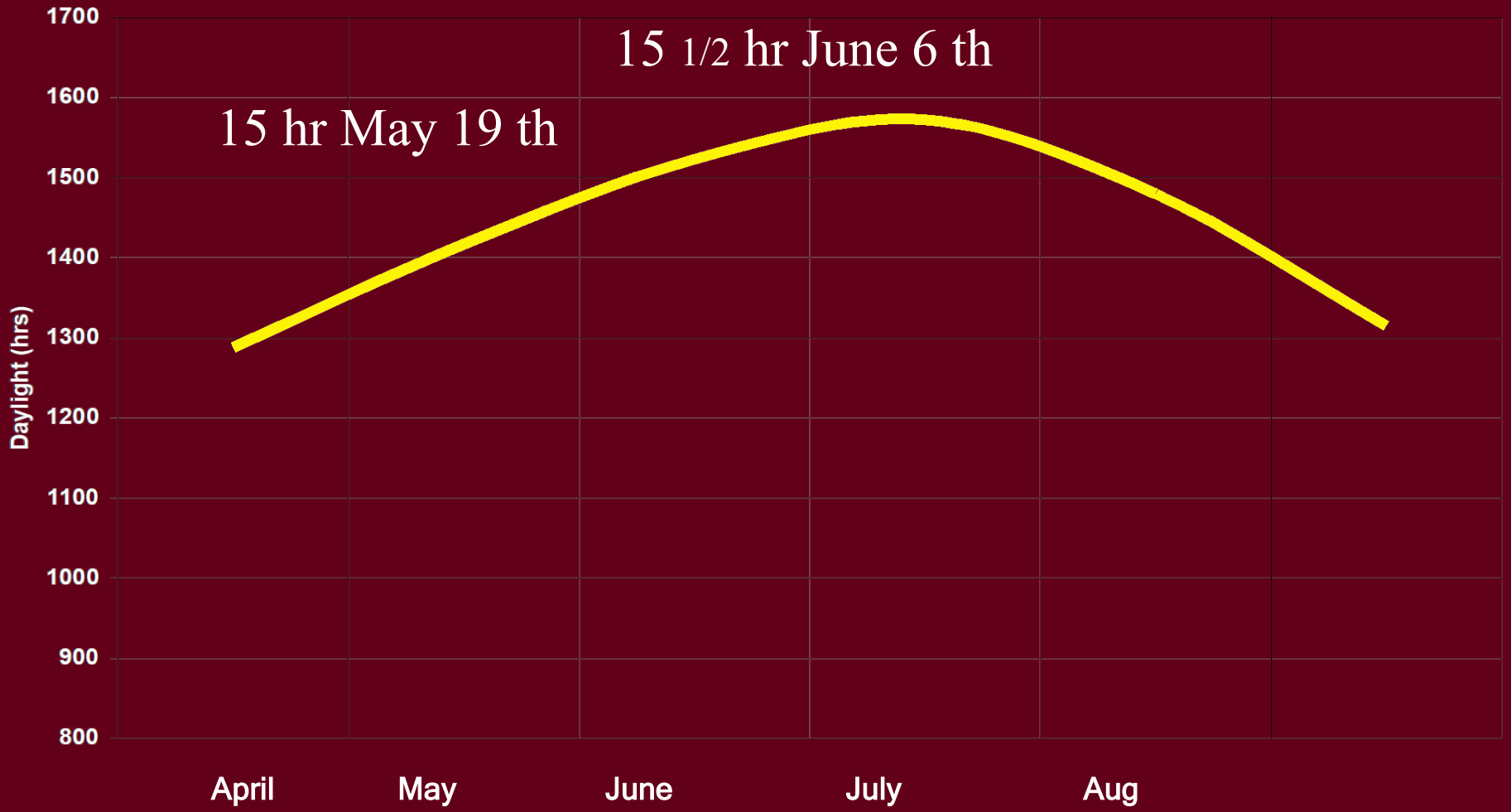
Male Flower

Female Flower

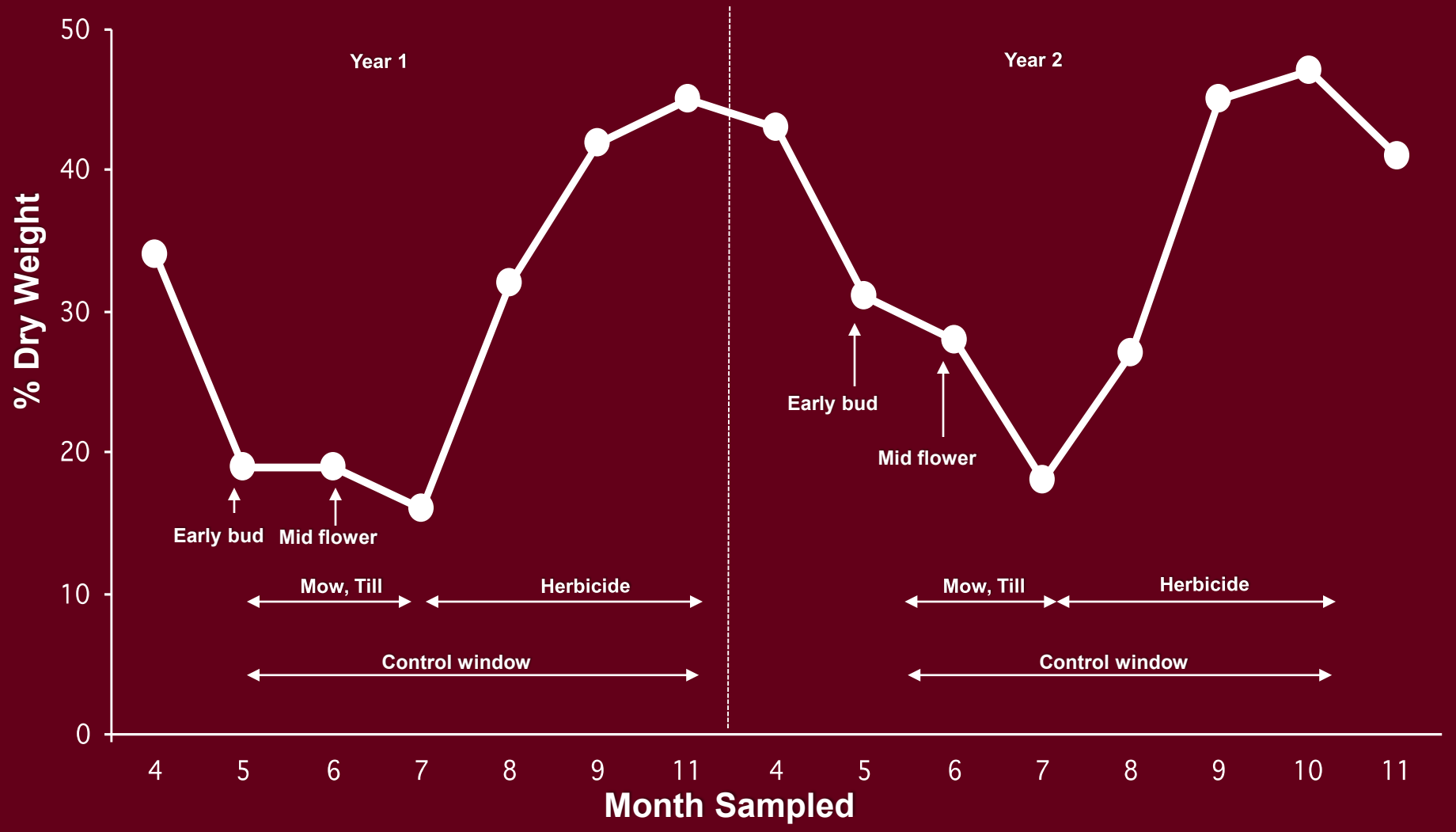
April-September Daylength Photoperiods for Mpls/St. Paul Location W093 16 N4458



Varied biotypes

One year of root growth!

Seasonal Carbohydrate Levels In Hemp Dogbane Root Crowns



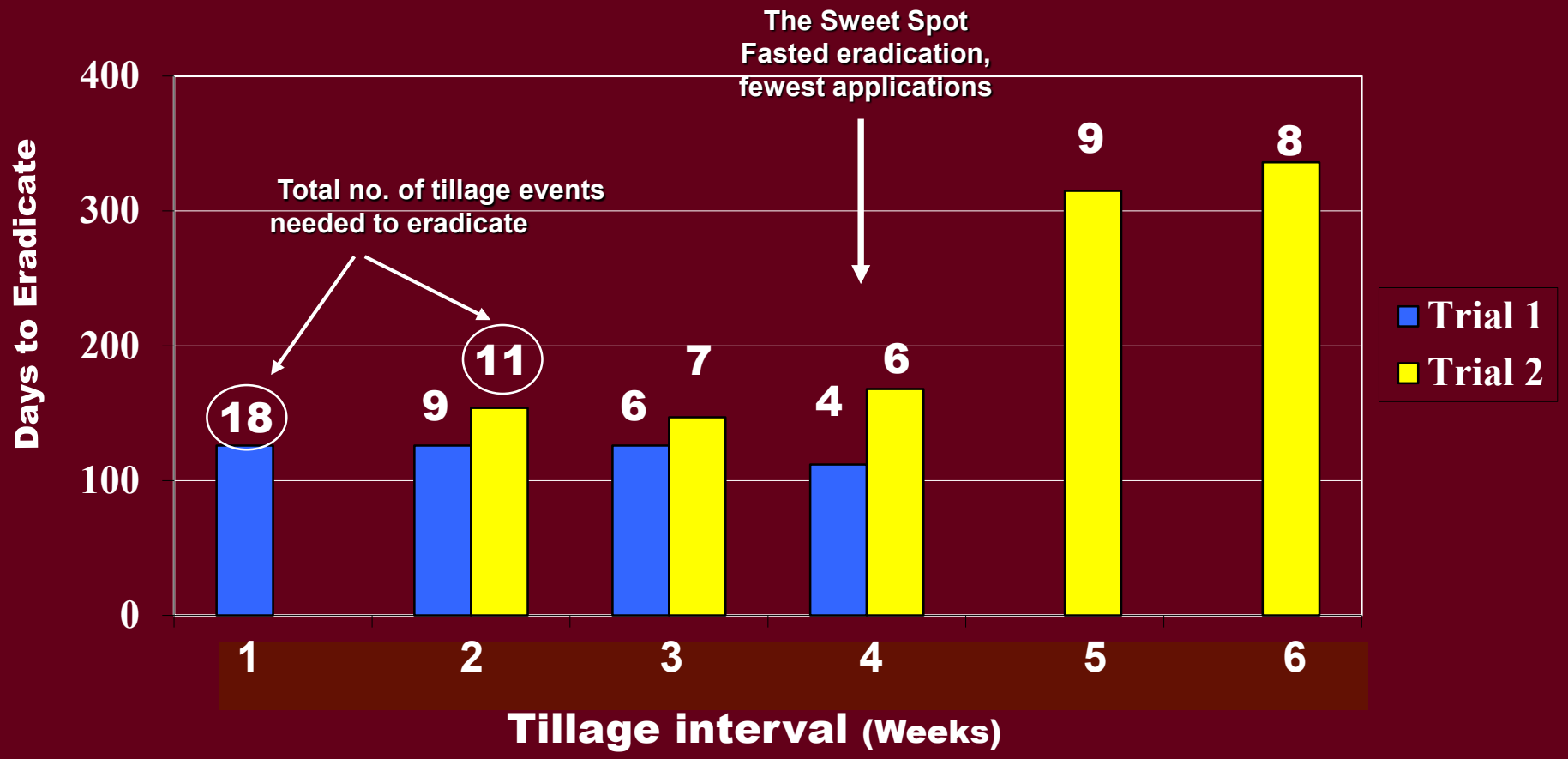
Becker and Fawcett. 1980-1981. Cumberland IA.

University of Minnesota Extension

Control Options For Canada Thistle

- Mechanical / physical
- Biological
- Cultural
- Chemical

Tillage to Eradicate Canada Thistle



Plowed 6” deep when 5 ” tall, then duckfoot cultivator 5“ deep rest of growing season

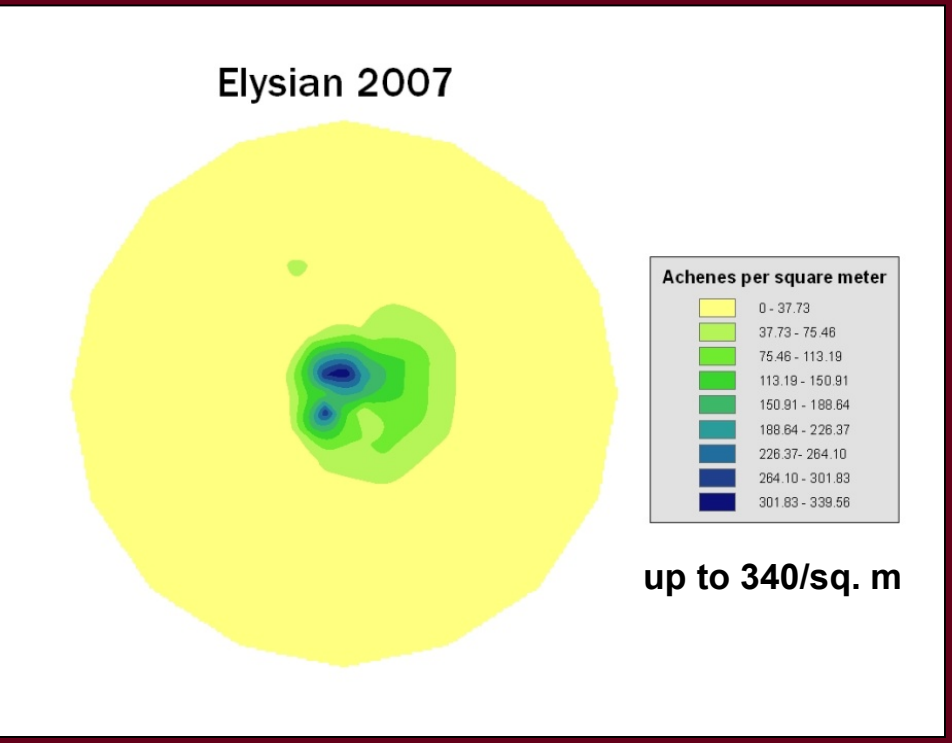
University of Minnesota Extension

Adapted from Seely, C.I. 1952
Univ. Idaho Exp. Stat. Bull. 288

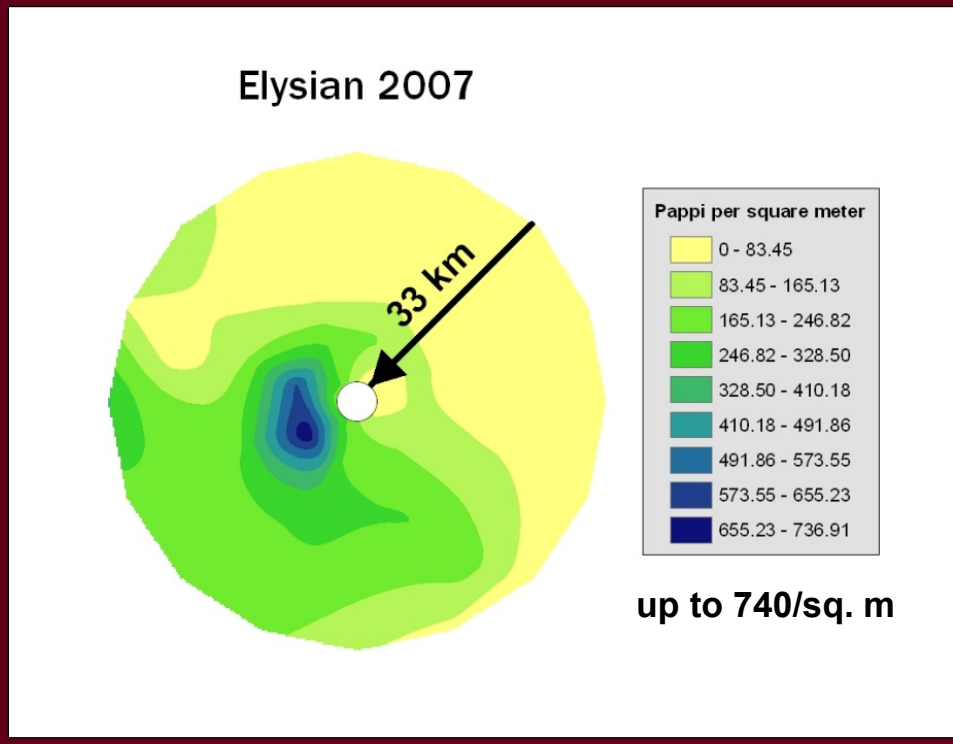
Seeds to Seedlings


Becker U of Mn 2006©
University of Minnesota
EXTENSION

Effect of Wind of direction and distance of Canada thistle dispersal

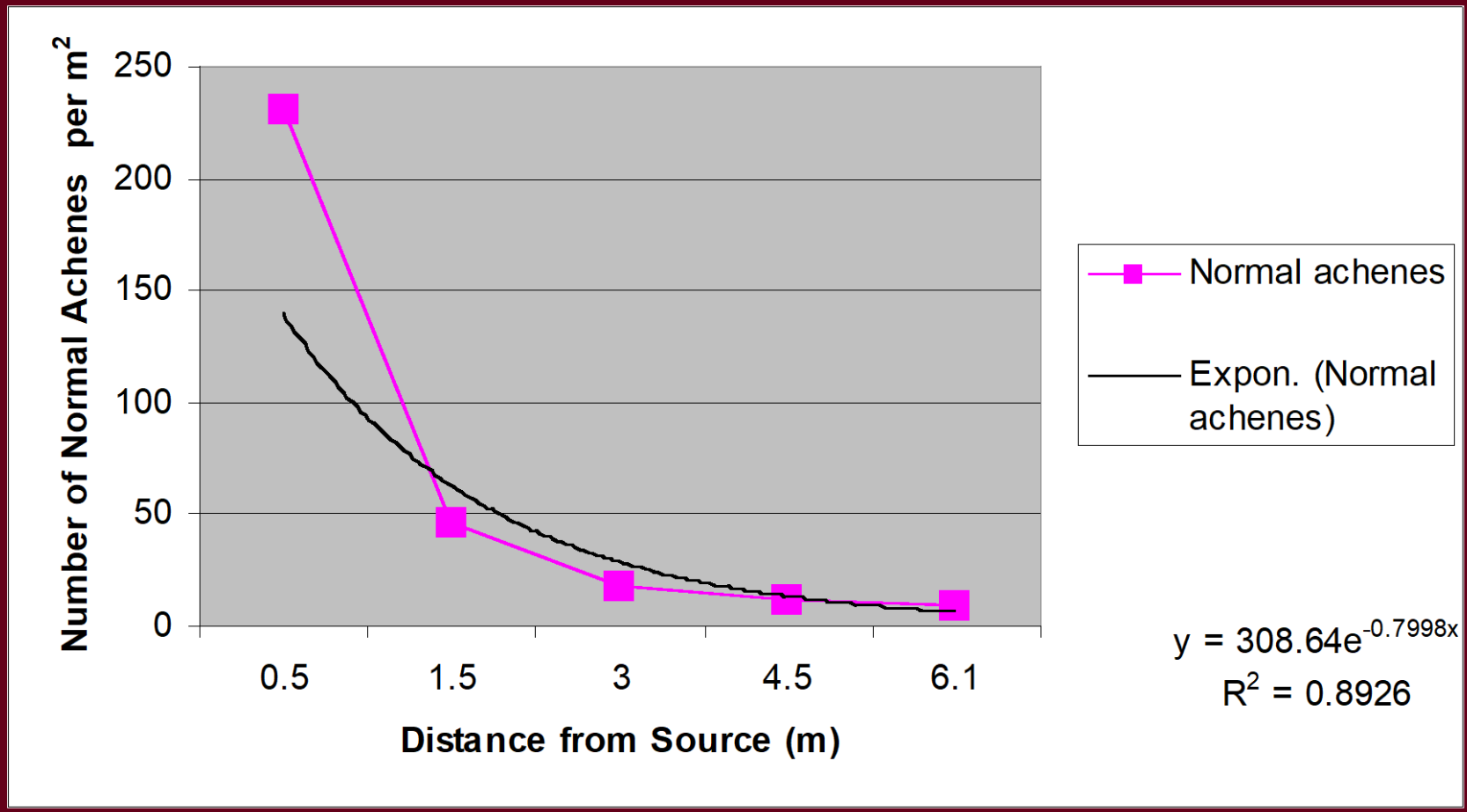


Seeds



Pappi

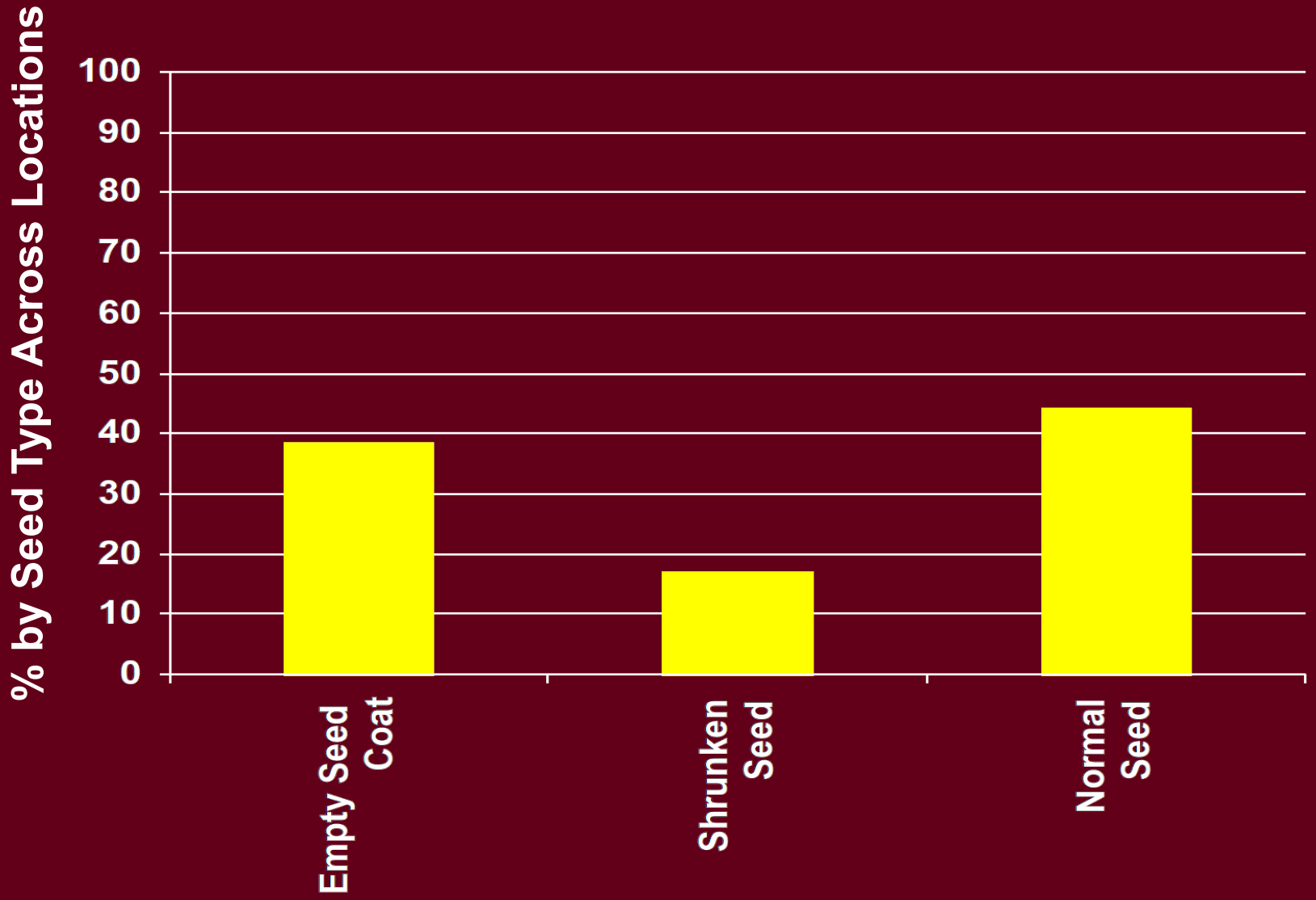
Dilution of seed and pappi as area expands




Normal
Shrunken
Empty

Canada Thistle Seed Production

4 Mn Sites, 2006 and 2007



Put it in the bank!

Timing matters!

- Flowering cues
  - Physical removal
    - kill the roots not the shoots
    - delay until seed pre-milk stage, then two more at 30-day intervals
  - Herbicides
    - post-flowing herbicide tags along with photoassimilates
    - the later the better
- Seeds disperse locally
  - prevent dispersal in new infestation

Control Options For Canada Thistle

- Mechanical
- Biological
- Cultural
- Chemical

Biological Control of Canada Thistle

- Stem-mining weevil, *Ceutorhynchus litura* attacks thistles in *Cirsium, Silybum* and *Carduus* genera of Aster family
- Approved for release in United States
  - Reports in the field, only attacking Canada thistle

Native Thistles in Minnesota

All Minnesota native thistle are *Cirsium* species.

Hill's thistle

Wavyleaf thistle

Flodman's thistle

Field thistle

Tall thistle

Swamp thistle

Cirsium Native Common Garden, established August 2015

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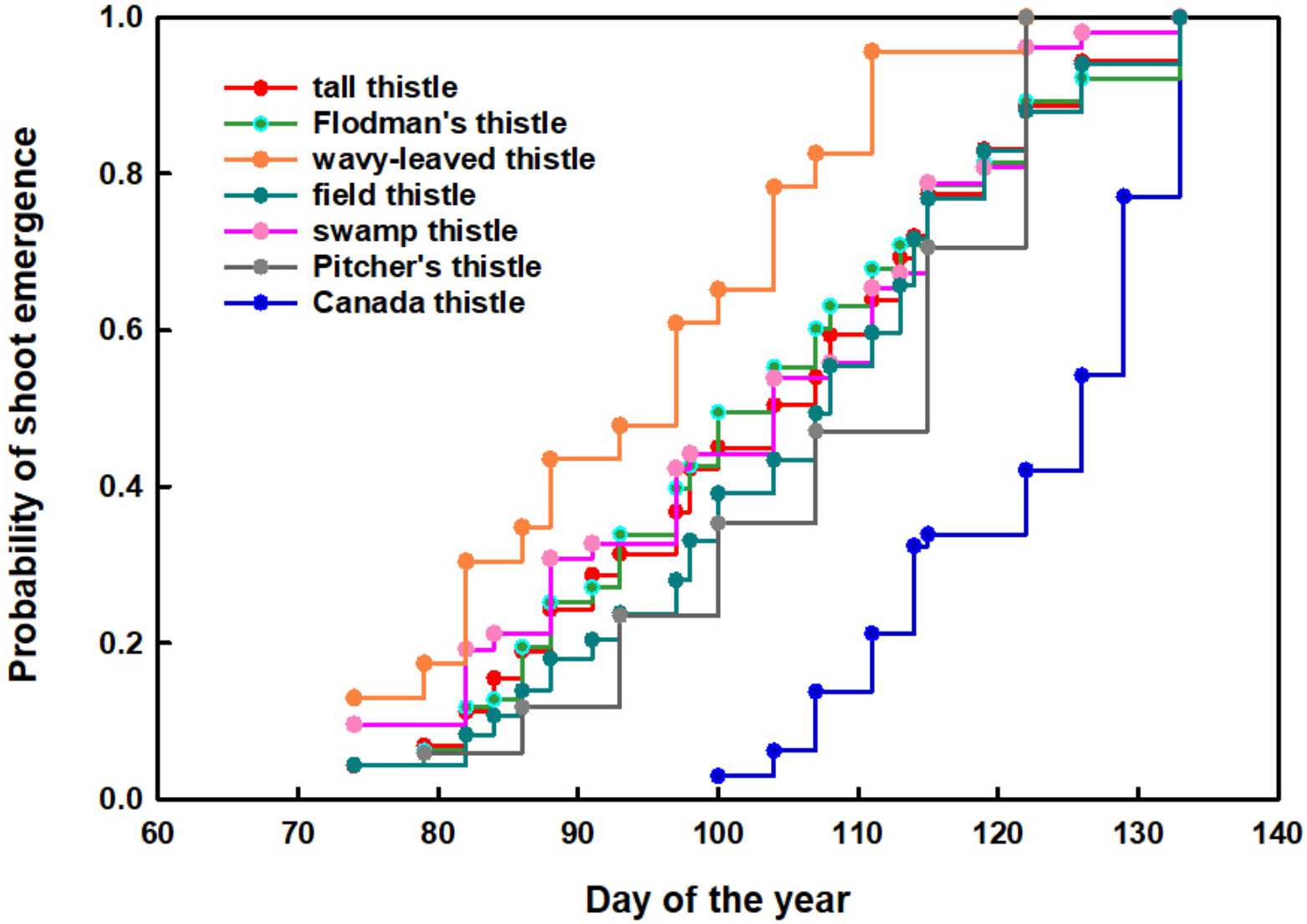
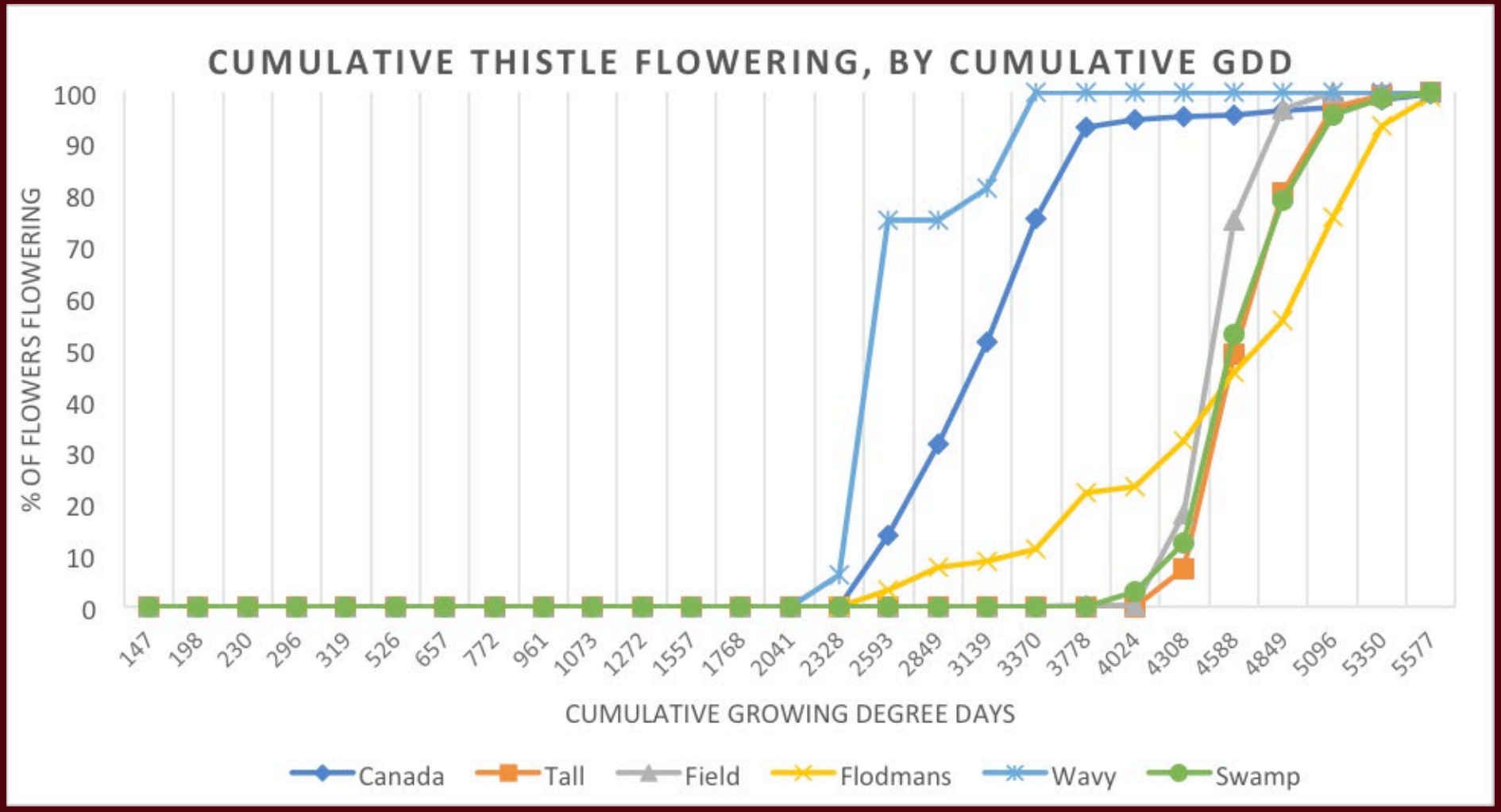


Emergence of *Cirsium arvense* and MN native *Cirsium* species (Kaplan-Meier Cumulative Hazard Curves). 1.0 = 100% shoot emergence. January 1 is Day 1. Common garden, St. Paul, MN. 2016 - 2019. Katovich, Katovich, Becker

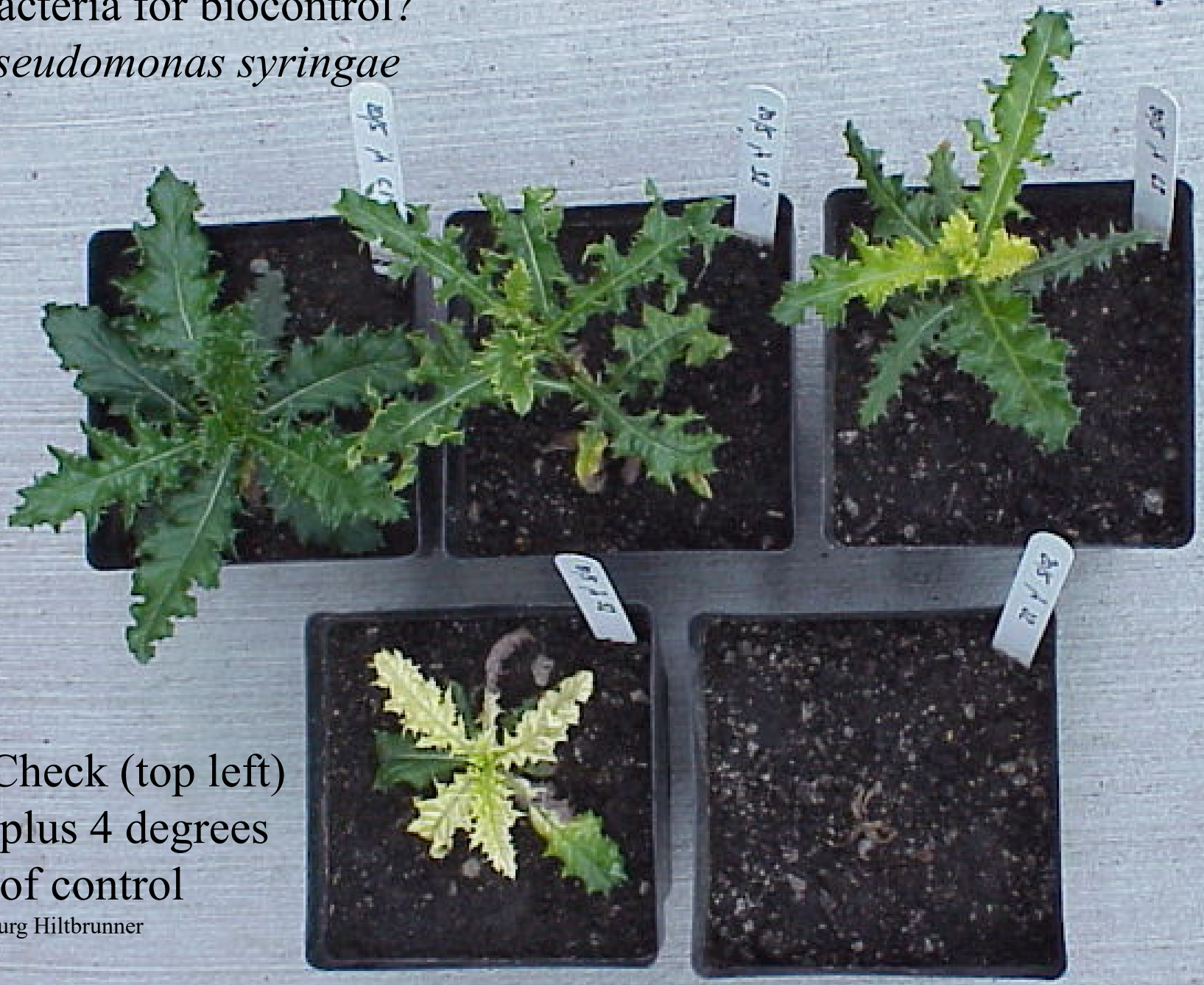
Native *Cirsium* Common Garden 2016



Canada thistle phenology compared to native *Cirsium* species to inform biological control agent synchrony.
University of Minnesota, St. Paul Campus.

Bacteria for biocontrol?

Pseudomonas syringae



Check (top left) plus 4 degrees of control

Jurg Hiltbrunner

Biocontrol of Canada Thistle

- Reassessing *Puccinia*
  - Better understanding of life-cycle
  - May offer suppression

Some dynamics of spread and infection by aeciospores of *Puccinia punctiformis*, a biological control pathogen of *Cirsium arvense*

Put it in the bank!

Biocontrol! .... well maybe

- **Lots of native *Cirsium***
  - Gall fly (*Urophora cardui*)
  - Stem weevil (*Hadroplontus litura*)
  - Rosette weevil (*Trichosirocalus horridus*)
- **PST not going to save us**
- ***Puccinia* rust potential**

Control Options For Canada Thistle

- Mechanical
- Biological
- **Cultural**
- Chemical

Burning

- Help or Hindrance??

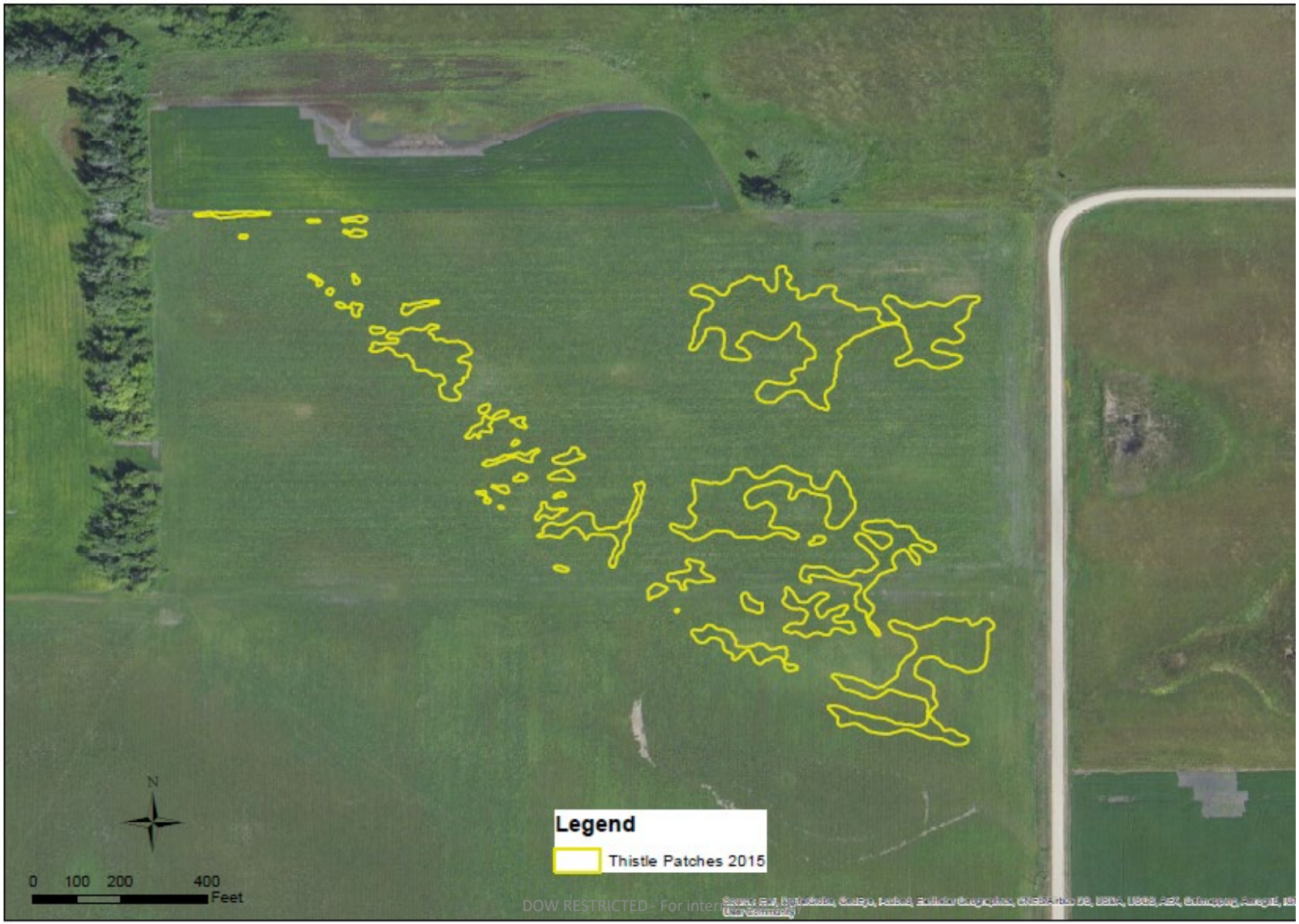
Lee Klossner, UMN
http://prairieu.umn.edu/wp-content/files/burn032.jpg

Burns often promotes C. thistle seedling est.
- thatch removed, initially open canopy
- 2x no. shoots, but ½ the height
Subsequent warm grass thrives
- C. thistle seedlings can not compete

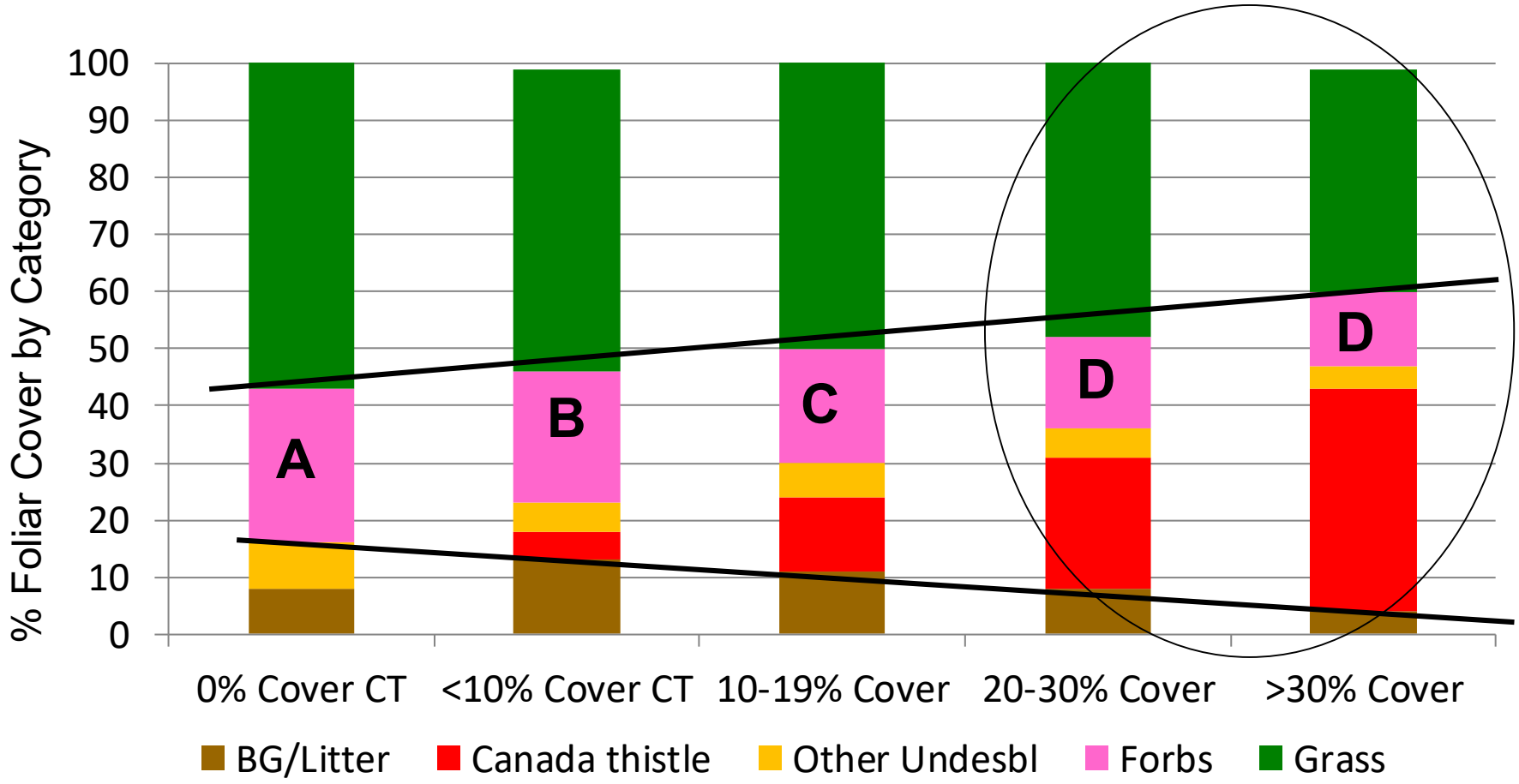
Impact of Canada Thistle Cover on Plant Community Structure in Early Stage Prairie Restoration

Byron B. Sleugh*[1], Mary B. Halstvedt[2], Roger L. Becker[3], Paul Bockenstedt[4]; [1]Dow AgroSciences, Indianapolis, IN,[2] Emeritus, Dow AgroSciences, Billings, MT,[3] University of Minnesota, St. Paul, MN,[4] Stantec, St. Paul, MN

2015 Canada thistle map: Some of the smaller patches are gone and some areas became larger and more defined



Comparison of % Cover of Each Botanical Group at Different Canada Thistle Infestation Levels



Rath Trac All Data (925 Quadrats)

P=0.05

Canada Thistle Management

Functional Groups to Resist Invasion During Prairie Establishment

Roger Becker and Lee Klossner

University of Minnesota

Milt Haar

National Park Service

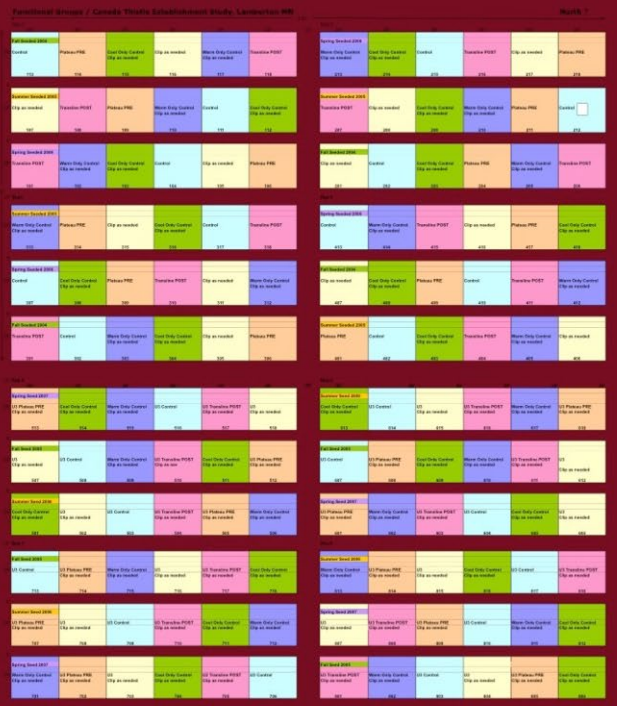
University of Minnesota Extension

National Park Service

Summer Seeded 2005 Transline POST U3 Mix 207	Clip as needed U3 Mix 208	Cool Only Control Clip as needed 209	Warm Only Control Clip as needed 210	Plateau PRE U3 Mix 211	Control U3 Mix 212

Plot size 20 ft by 20 ft

(6.1 m by 6.1 m)

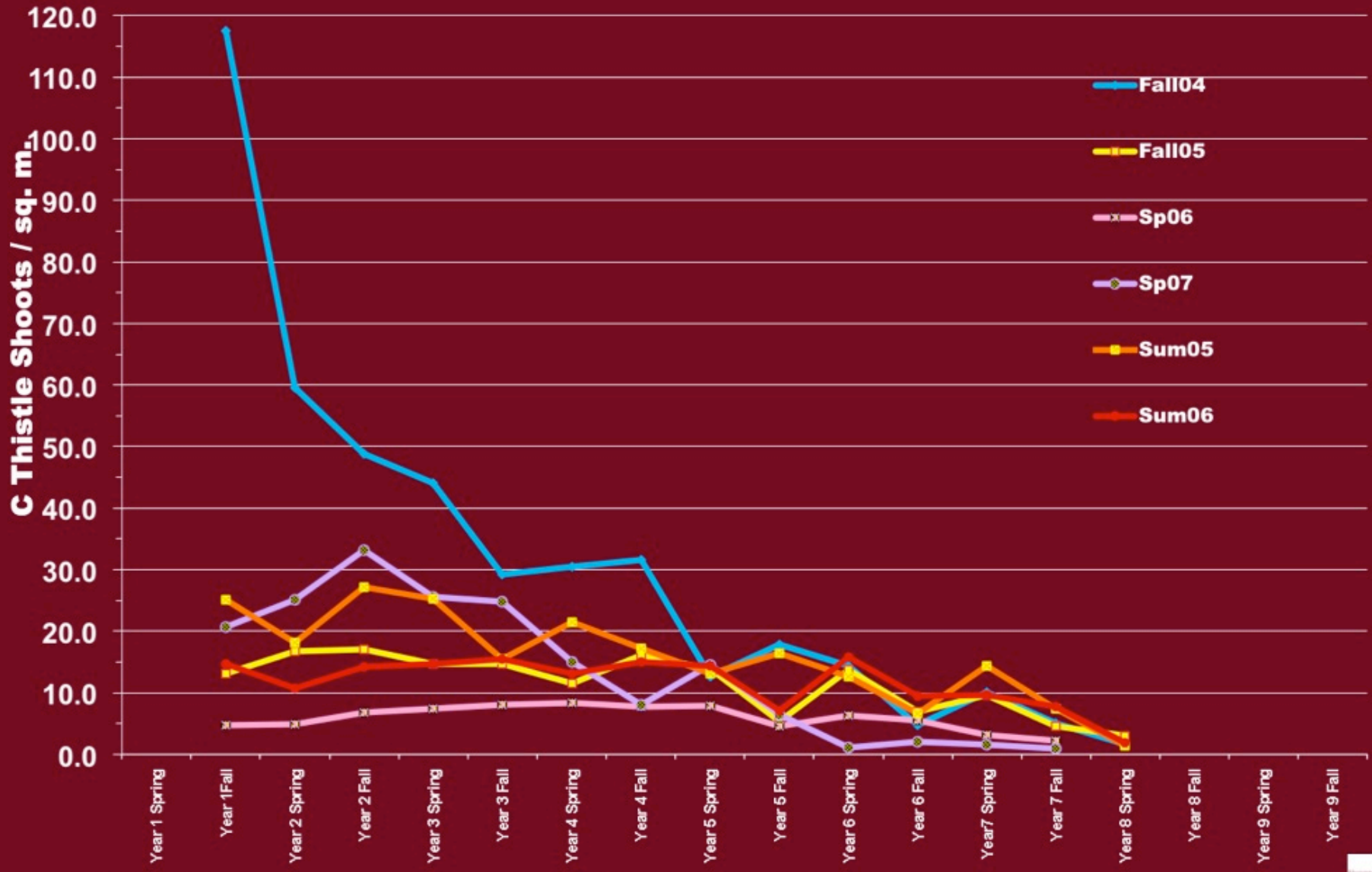


Over seeded
10 Canada thistle /ft² (108/m2)
in center 5 ft² (0.46 m²)
Lightly rake in before seeding prairie species
Borders maintained over time

Canada Thistle Seeded in Center

Functional Group x Canada Thistle Est.

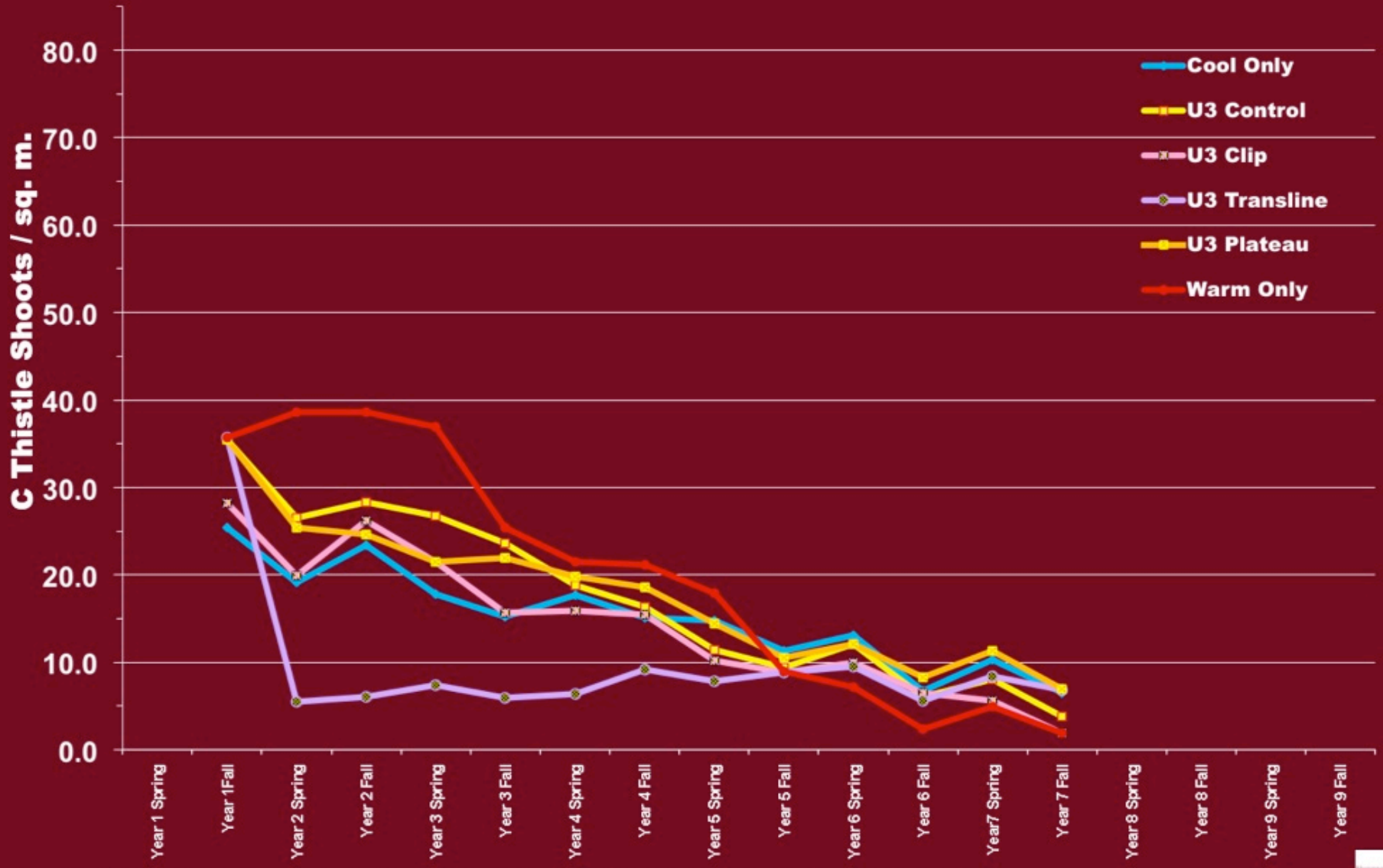
Lamberton, MN. Canth Shoot Cnts. All Funct. Groups Combined.



n = 24. Counts are in the seeded center area. May not characterize entire plot in the early years.

Functional Group x Canada Thistle Est.

Lamberton, MN. Canth Shoot Cnts. All Seedings Combined.



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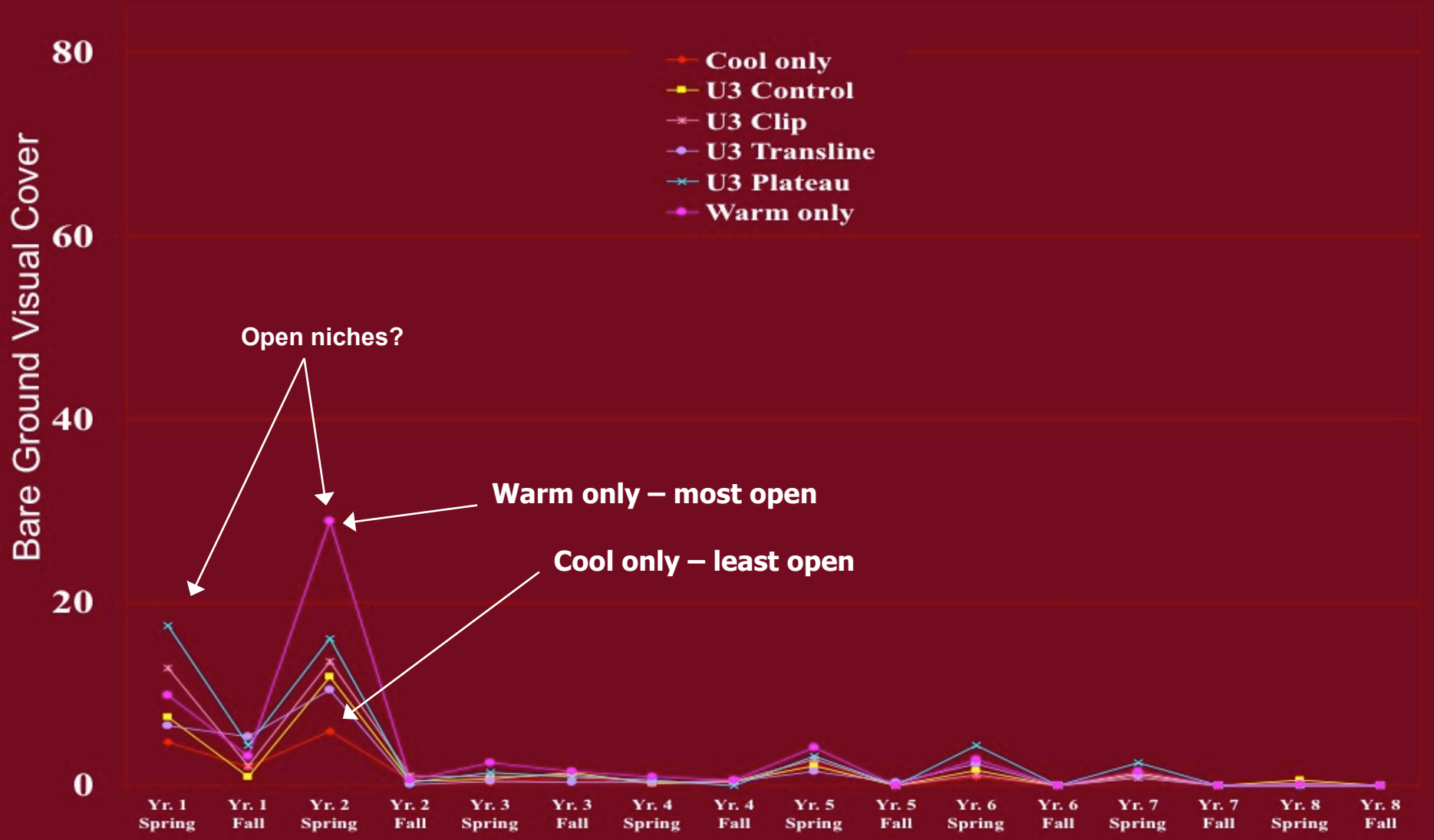
Functional Group x Canada Thistle Est.

Lamberton, MN 2004 – 2012 Cycle



n = 24.

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Functional Group x Canada Thistle Est.

Lamberton, MN 2004 – 2012 Cycle

Small, non-competitive, usually vegetative

n = 24.

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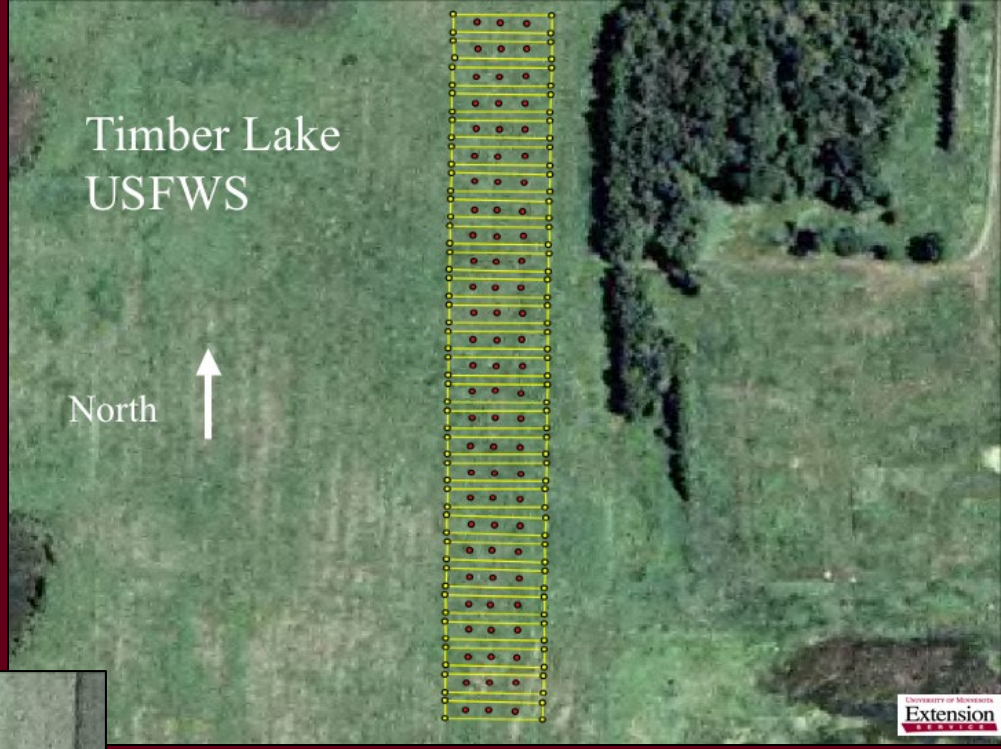
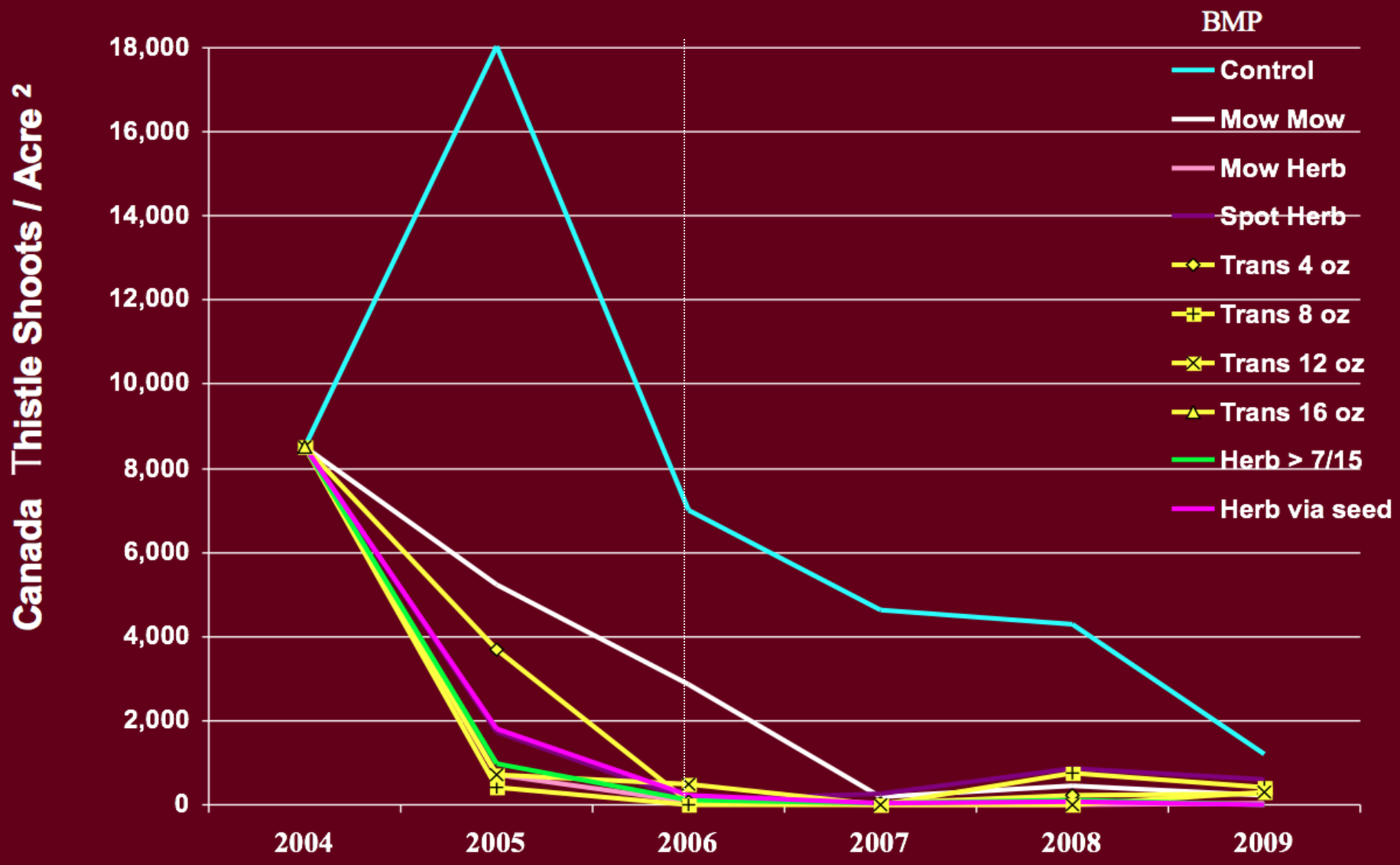
MnDNR Talcot Lake Area Office, est. plots, sprayed in 2003



50 x 150 ft strips
30 ft buffers
3 reps
2 locations
9 or 10 BMP trt.
3 perm. quads/trt.

Canada Thistle BMPs in Native Prairies

June C. Thistle Shoots / Acre Timber Lake USFWS WPA



Reflects effects of treatments 2004, 2005, 2006. 2004 values set to average of 2005 to 2007 control.

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Put it in the bank!

Good things take time!

- Battle of the forbs
- Manage for desirable things, not Canth
- Be patient, stable systems prevent Canth

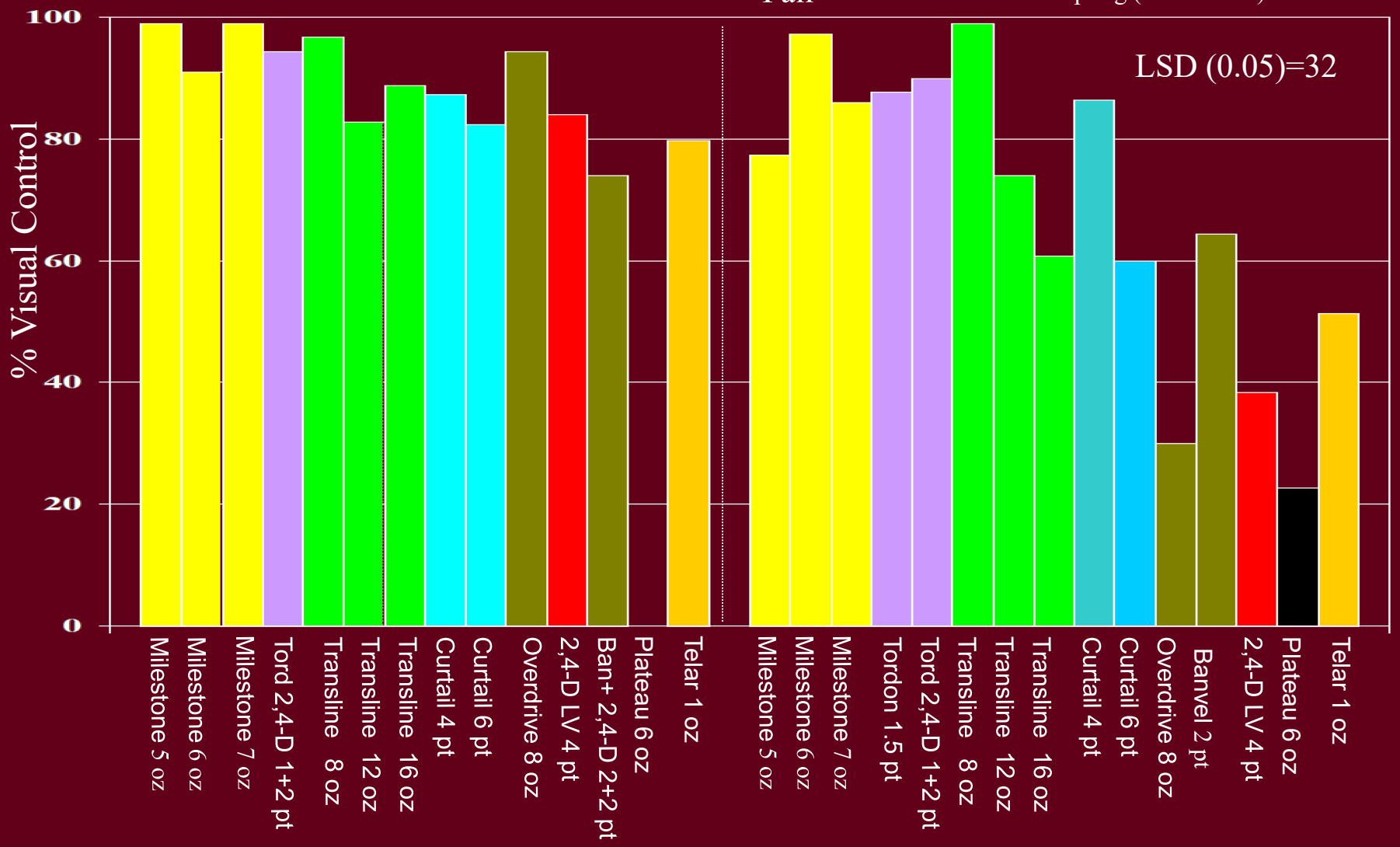
Control Options For Canada Thistle

- Mechanical
- Biological
- Cultural
- Chemical

Canada Thistle Management Trial
Spring vs. Fall, Waseca MN 2004 - 2005

Rated Sept. 21, 2005

Fall ~ 12 MAT
Spring (Bud/Bloom)~ 3 MAT



Herbicides for Canada Thistle

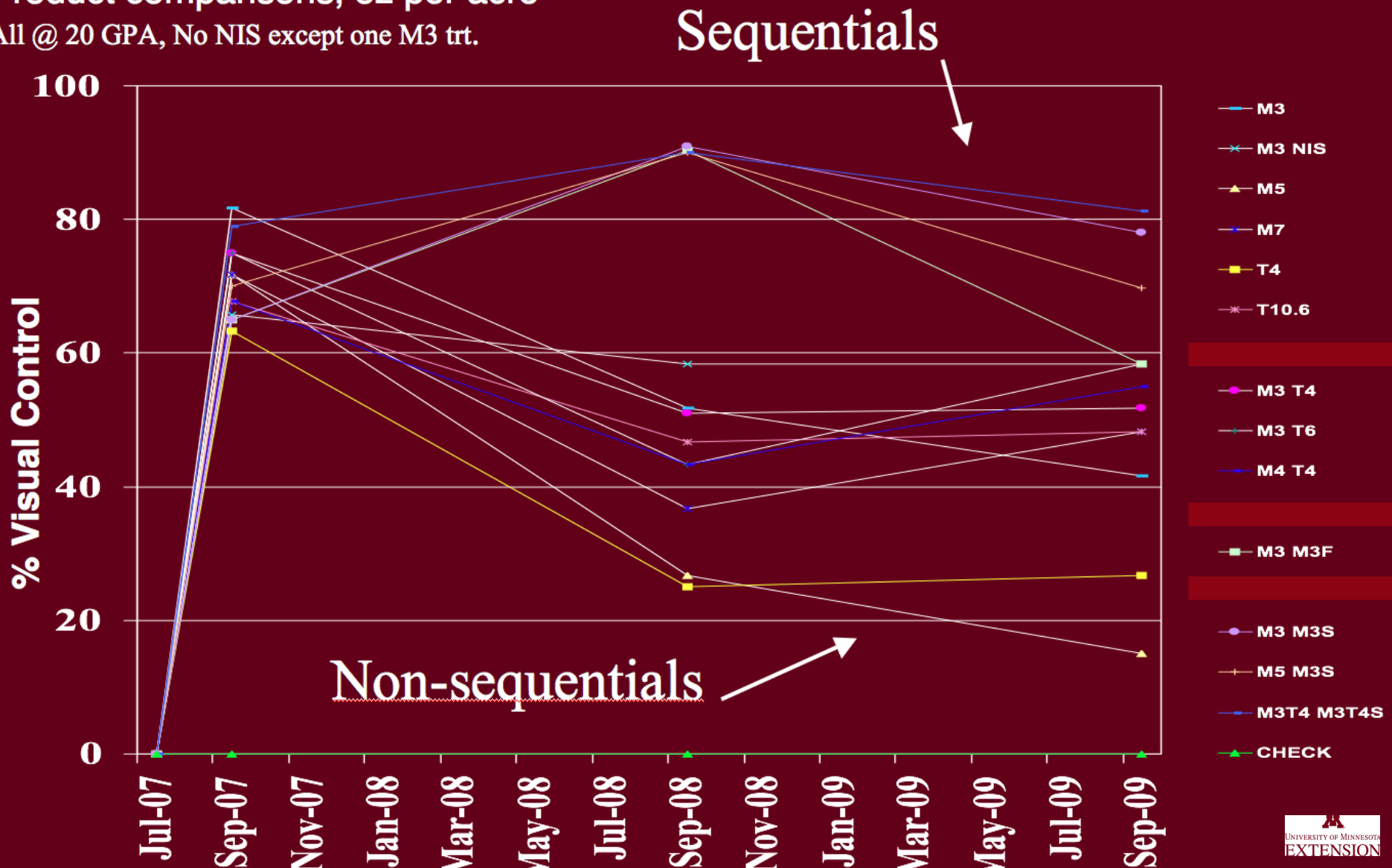
Picolinic acids In order of introduction:	Rank for Canth Cntr.:
• Picloram (Tordon, Grazon)?	#3
• Clopyralid (Stinger, Transline, Curtail)	#2
• Aminopyralid (Milestone, Forefront)	#1
• Aminocyclopyrachlor +SU	#4
– Method (Streamline, Perspective)	
Sulfonyl ureas, Imidazolinones	?
Uracils	?
Other PGRs	?

Canada Thistle Fall Regrowth Control

Milestone Transline Sequential Trial, Rosemount MN 2007 - 2009

Product comparisons, oz per acre

All @ 20 GPA, No NIS except one M3 trt.



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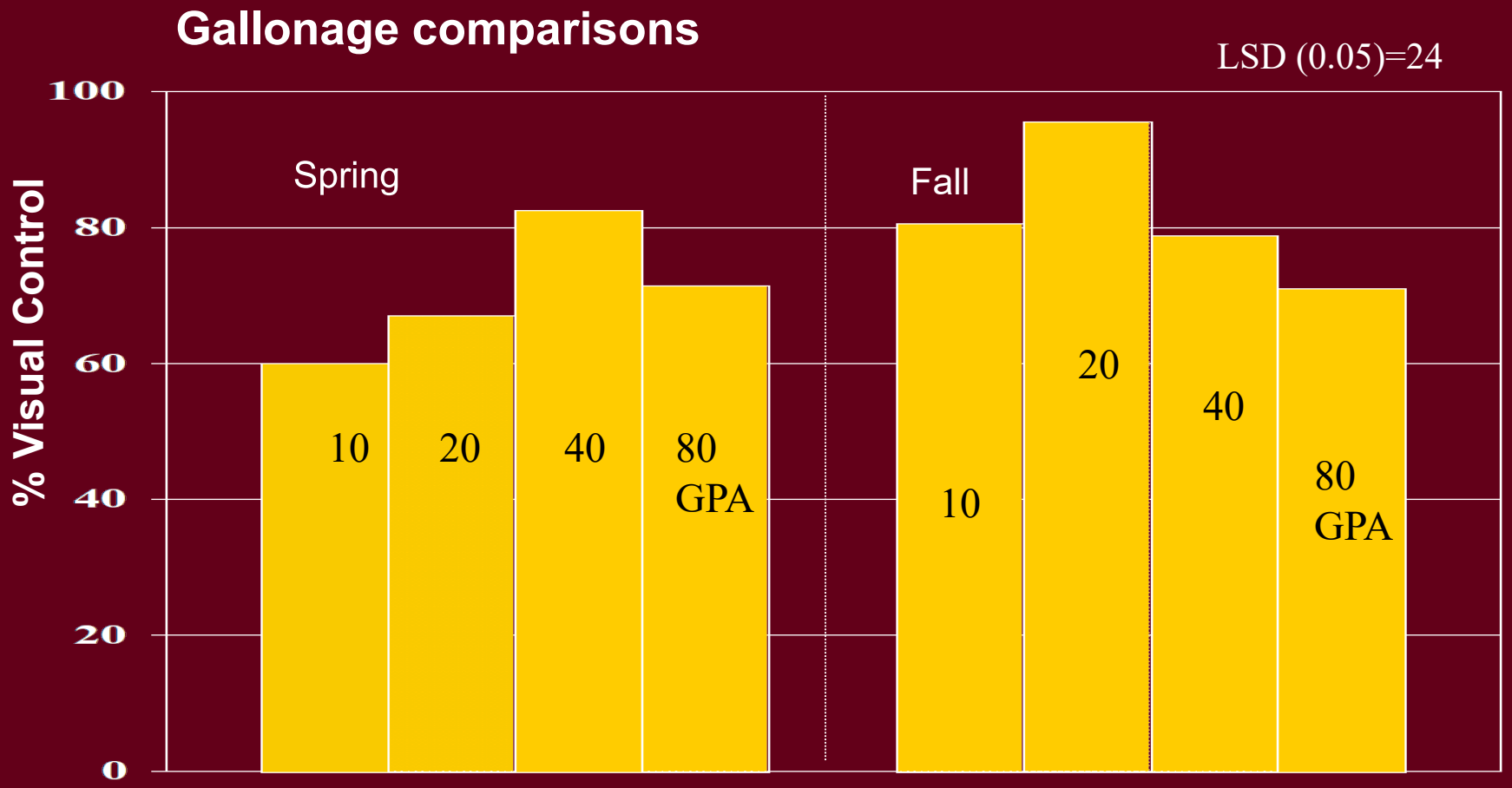
Canada Thistle Management Trial
Transline Use Study West Graham WMA 2004 - 2005

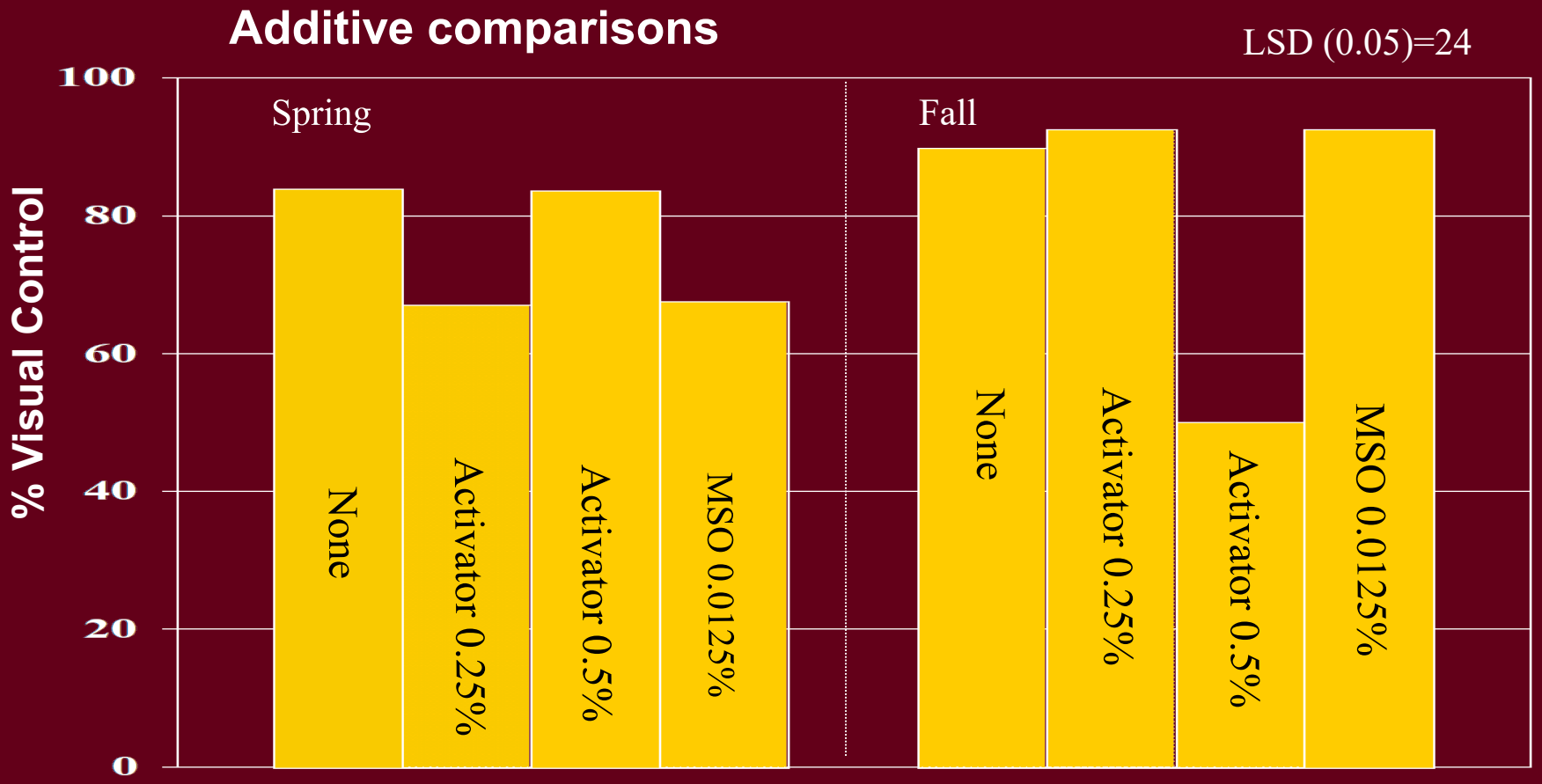


Rated July 7, 2005

Fall ~ 10.5 MAT
Spring ~ 12.5 MAT

All @ 8 oz Transline / A and 0.25% Activator 90

Canada Thistle Management Trial
Transline Use Study West Graham WMA 2004 - 2005



Rated July 7, 2005

Fall ~ 10.5 MAT
Spring ~ 12.5 MAT

All @ 8 oz / A Transline and 20 GPA

Transplanted Forb Tolerance Study

Sept 24, 2008 Trial Est. 2007, Repeated in 08-10

West Newton Sand Prairie – 2 yr. old stand
Kurt Brownell US Army Corp
Louanne Brooks, Dow AgroSciences

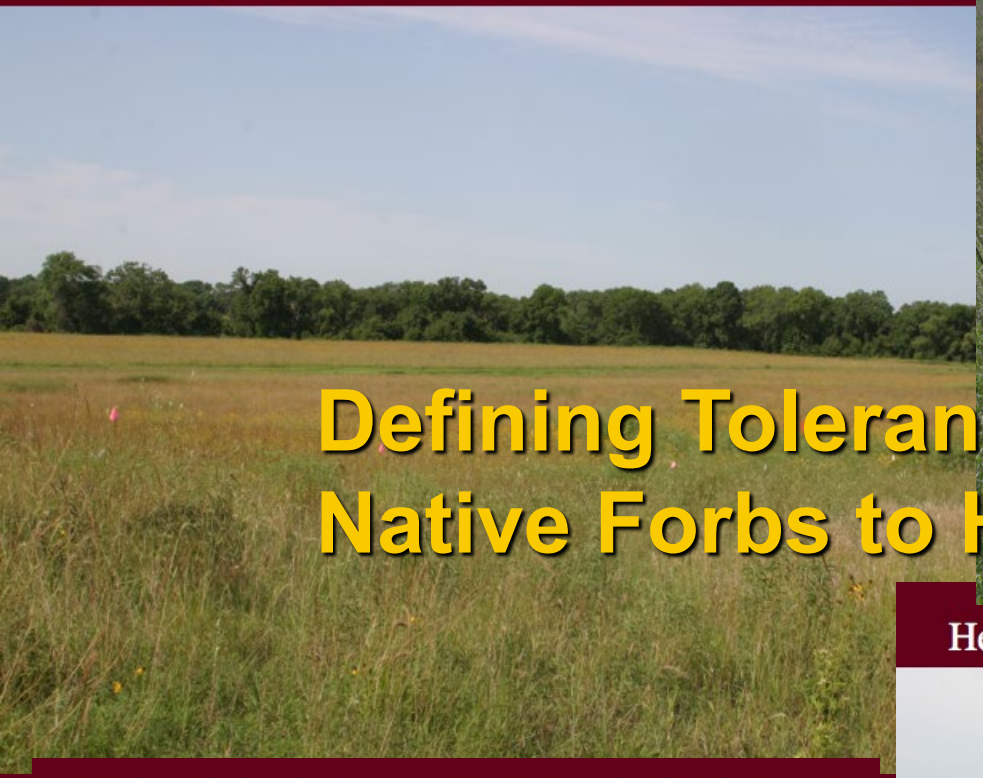
University of Minnesota
EXTENSION

Kufrin WPS

2 yr. old stand

University of Minnesota
EXTENSION

Two Rivers Forb Tolerance Site



Defining Tolerance of Native Forbs to Herbicides

Hedquist Forb Tolerance Site

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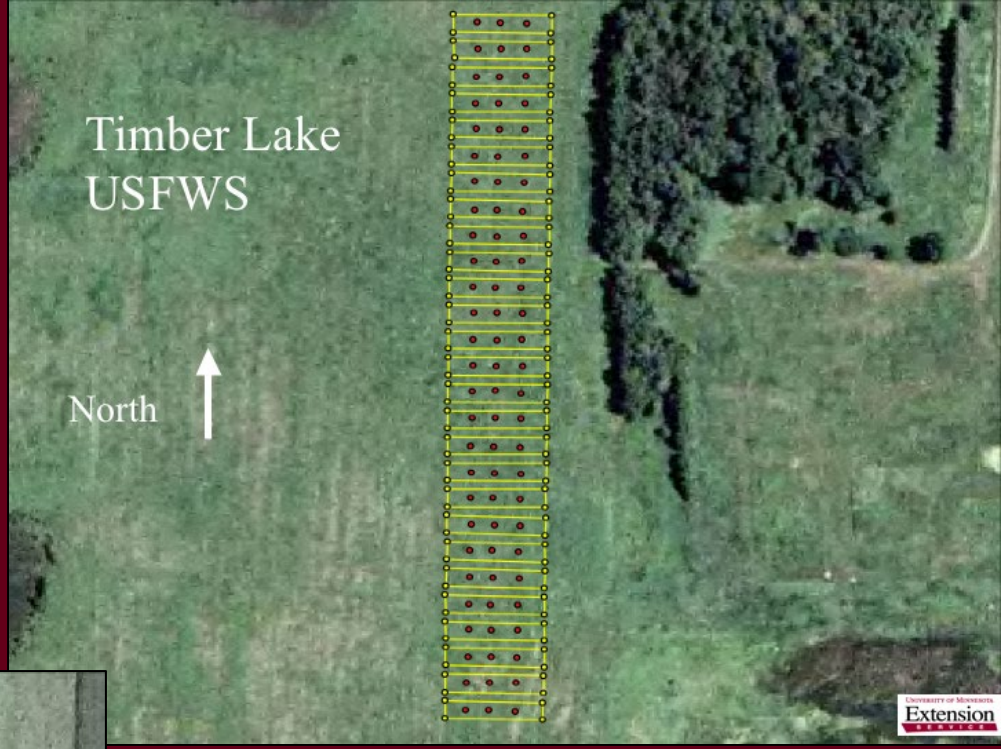
MnDNR Talcot Lake Area Office, est. plots, sprayed in 2003

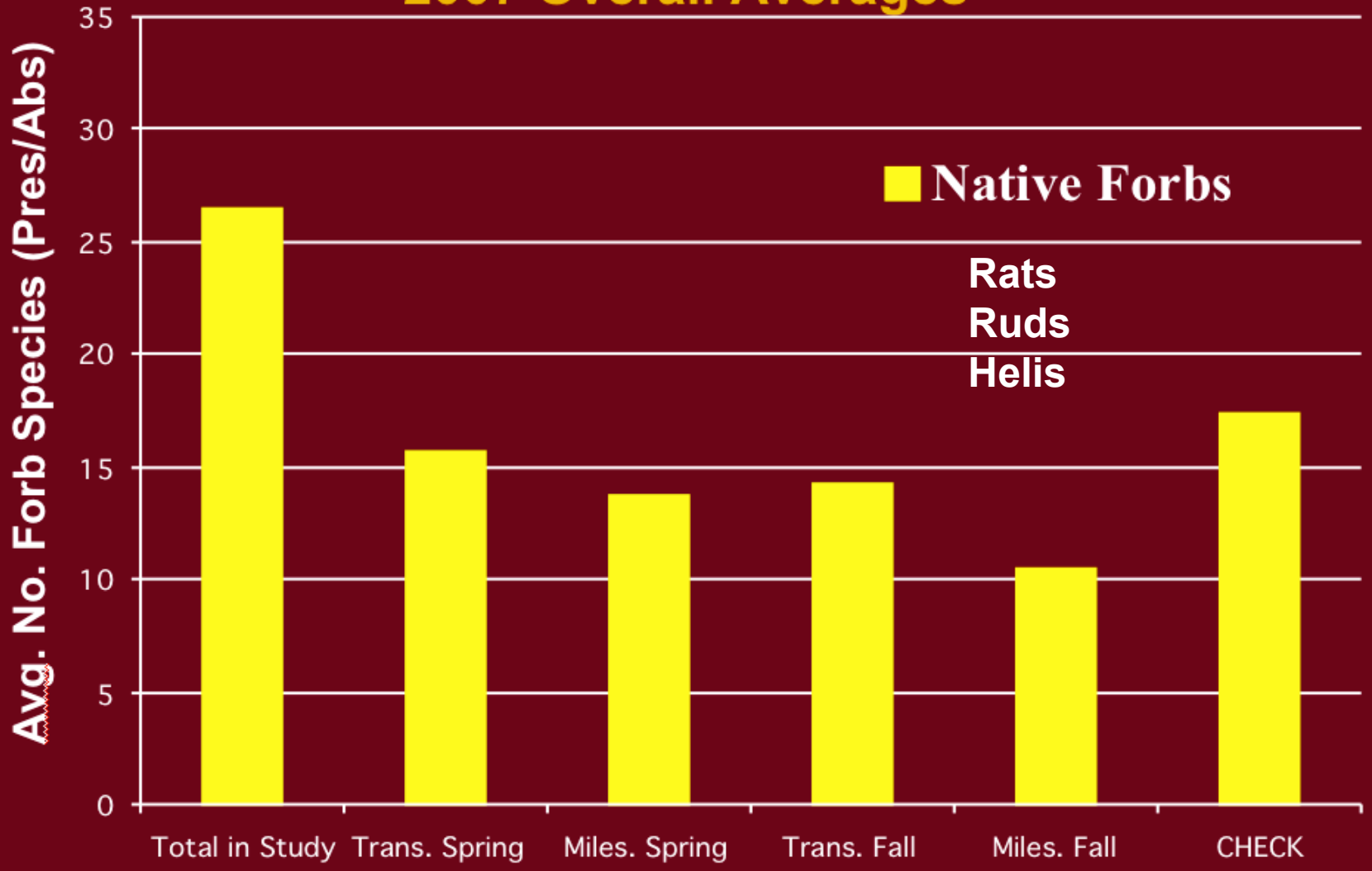


50 x 150 ft strips
30 ft buffers
3 reps
2 locations
9 or 10 BMP trt.
3 perm. quads/trt.

Native Forbs Tolerance to Milestone vs. Transline

Hedquist and Two Rivers WMAs MN Species Richness

2007 Overall Averages



Milestone 2 SL 5 oz./A and Transline 3 SL 10.3 pts./A spring or fall 2006.
30 x 150 ' plots walked in June and Sept 2007 for presence absence ratings.

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Minnesota Rankings for Native Forb Tolerance to Aminopyralid and Clopyralid Herbicides

This table reflect estimates of native forb tolerance to aminopyralid (Milestone VM™) and clopyralid (Transline®) based on field observations. Generally speaking, native forbs tolerated these herbicides better with spring applications compared to fall applications. If viable seed were present in the seedbank, neither herbicide prevented seedlings of susceptible species from establishing the growing season following herbicide application. These rankings reflect our experiences as of Fall 2008 and will be updated as more data becomes available.

T : Tolerant
M: Moderate tolerance
M-S: Moderate to Susceptible
S : Susceptible

Common Name	Aminopyralid	Clopyralid	Family	Genus	Species
Alexanders, Golden	T	T	Apiaceae	Zizia	aurea
Alexanders, Heart-leaved	T	T	Apiaceae	Zizia	aptera
Aster, Heath	M	M	Asteraceae	Aster	ericoides
Aster, Panicled	M	M	Asteraceae	Aster	lanceolatum
Aster, Smooth Blue	M	M	Asteraceae	Aster	laeve
Bergamot, Wild	T	T	Lamiaceae	Monarda	fistulosa
Blazingstar, Prairie	M	M	Asteraceae	Liatris	aspera
Cinquefoil, Prairie	S	T	Rosaceae	Potentila	arguta
Clover, Purple Prairie	M - S	M - S	Fabaceae	Dalea	purpurea
Clover, Round-headed Bush	M - S	M	Fabaceae	Lespedeza	capitata
Clover, Silky Prairie	M - S	M	Fabaceae	Petalostemum	villosum
Clover, White Prairie	M - S	M - S	Fabaceae	Dalea	candida
Coneflower, Yellow Prarire	S	S	Asteraceae	Ratibida	pinnata
Cup Plant	M	M	Asteraceae	Silphium	perfoliatum
Dewberry, C. (Rubus)	M	M	Rosaceae	Rubus	flagellaris
Dock, pale	S	M	Polygonaceae	Rumex	altissimus
Equisetum	T	T	Equisetaceae	Equisetum	arvense
Fleabane, Daisy	M	M	Asteraceae	Erigeron	strigosus
Goldenrod, Canadian	M	M	Asteraceae	Solidago	canadensis
Goldenrod, Giant	M	M	Asteraceae	Solidago	gigantea
Goldenrod, Stiff/Rigid	M	M	Asteraceae	Solidago	rigida
Groundcherry, clammy	S	M	Solanaceae	Physalis	heterophylla
Marestail (Conyza)	S	S	Asteraceae	Conyza	canadensis
Meadow Rue, Purple	T	T	Ranunculaceae	Thalictrum	pubescens
Milkweed, Common	M	T	Asclepiadaceae	Asclepias	syriaca
Nettle, Stinging	M	M	Urticaceae	Urtica	dioica
Onion, Prairie	T	T	Liliaceae	Allium	stellatum
Oxeye, Sweet Smooth	M	M	Asteraceae	Heliopsis	helianthoides
Primrose, Common	S	S	Onagraceae	Oenothera	biennis
Ragweed, Common	S	S	Asteraceae	Ambrosia	artemisiifolia
Ragweed, Western	S	S	Asteraceae	Ambrosia	coronopifolia
Rudbeckia, Black-Eyed Susan	S	S	Asteraceae	Rudbeckia	hirta
Spurge, Flowering	T	T	Euphorbacae	Euphorbia	corollata
Sage, White		T	Asteraceae	Artemisia	ludoviciana
Spiderwort, Prairie	M - S	M	Commelinaceae	Tradescantia	occidentalis
Sunflower, Maximilian's	S	S	Asteraceae	Helianthus	maximiliani
Sunflower, Prairie	S	S	Asteraceae	Helianthus	pauciflorus
Sunflower, Stiff/Sawtoothed	S	S	Asteraceae	Helianthus	grosseserratus
Sunflower, Tall	S	S	Asteraceae	Helianthus	giganteus
Tickfoil, Showy	M - S	M	Fabaceae	Desmodium	canadense
Trailing Wild Bean	T	T	Fabaceae	Strophostyles	helvola
Vervain, Blue	T	T	Verbenaceae	Verbena	hastata
Vervain, Hoary	T	T	Verbenaceae	Verbena	stricta
Wild Indigo, White	M	M	Fabaceae	Baptisia	alba
Yarrow, Common	M	T	Asteraceae	Achillea	millefolium

September 2008 R. Becker and M. Haar, University of Minnsota.

UNIVERSITY OF MINNESOTA EXTENSION

Minnesota Rankings for Native Forb Tolerance to Aminopyralid and Clopyralid Herbicides

Key:

T = Tolerant:	Minimal symptoms - may result in slight cupping but less than 15%. Occasionally may inhibit flowering.
M = Moderate tolerance:	Symptoms include cupping, yellowing, and twisted stems. Often will inhibit flowering. Plants may be stunted. May reduce stand with recovery of surviving plants the first growing season after application.
M - S = Moderate to Susceptible	Severity of response has been variable ranging from moderately tolerant to susceptible depending on environment, plant age, and site characteristics.
S = Susceptible:	Injury greater than 75%. Injury can be severe. May kill established plants. Sensitive plants have been shown to reestablish from seedlings if an adequate seedbank is present as early as the first growing season after application.

UNIVERSITY OF MINNESOTA EXTENSION

Put it in the bank!

- Milestone, Transline
  - C. thistle specialists!
  - Milestone more efficacious
  - Transline more forb tolerance
- No matter what you do, need to repeat it
  - Fall slight edge
- 20 to 40 GPA, no additives needed

We're In Ft. Knox!

C. Thistle thrives on low-level disturbance

- Focus on the margins
- Be patient, things are going to work out
- Strive to have a few around
  - Just not the whole family!

Questions?