LONG-TERM SUCCESS STORY OF INVASIVE WEED CONTROL IN NORTH DAKOTA

WITH A SUMMARY OF ‘ALL’ WEED BIOLOGICAL CONTROL AGENTS RELEASED IN THE STATE
INTIAL DISCOVERY AND INVASION

• FOUND GROWING ALONG A STREET IN FARGO IN 1909

NP Ave from 1909 postcard
NDSU archives
INTIAL DISCOVERY AND INVASION

• NOT ADDED TO THE STATE NOXIOUS WEED LIST BECAUSE THREAT NOT RECOGNIZED

• PORTER AND STEVENS WROTE “IT (LEAFY SPURGE) SEEMS TO SPREAD FREELY FROM THE ROOTS AND SHOULD BE WATCHED CLOSELY”

• ONLY CONTROL OPTIONS WERE SMOTHERING AND CULTIVATION IN CROPS OR MOWING AND HOEING IN PASTURE
• FIRST IN-DEPTH ANALYSIS WAS CONDUCTED BY VELVA RUDD FROM 1931-1932 AS PART OF HER MASTERS DEGREE RESEARCH

HER THESIS CONTAINS A COMPLETE DESCRIPTION OF THE PLANT, SEED PRODUCTION AND SPREAD BY ROOT. DETAILED DRAWINGS OF THE PLANT REMAIN IN USE TODAY.

HER WORK WAS CONDUCTED IN NORTH FARGO, WHERE THE PLANT WAS “GROWING DENSLEY”
Figure 3. DRAWING OF FLORAL PARTS AND FRUIT OF LEAFY SPURGE

A, the gymenium or flower cluster surrounded by involucres; B, cluster of immature staminate flowers; C, mature flower cluster showing pistillate flowers emerging from involucres; D, mature fruit with all three carpels developed; E, mature fruit with only one carpel developed; F, stamens with anthers dehiscing; G, pollen grains; h, bract; j, flower bud; k, filament; l, gynoecium; m, involucral gland; n, involucre; p, pedicel; r, stamens.
PRE-WAR CONTROL AND EDUCATION

• LEAFY SPURGE WAS ADDED TO THE ND NOXIOUS WEED LIST IN 1935 FOLLOWING A SURVEY FOR FIVE “CANCEROUS WEEDS”
PRE-WAR CONTROL AND EDUCATION

CHEMICAL CONTROL RECOMMENDATIONS FROM NDAC

- SODIUM CHLORIDE 2 -13 LB/SQ ROD (320-2080 LB/A)
- SODIUM ARSENPITE, CALCIUM CAYANAMID, ARSENIC PENTOXIDE
- APPLY TO LEAFY SPURGE AT FLOWERING

CHEMICAL RECOMMENDATIONS REMAINED UNCHANGED FOR THE NEXT TWO DECADES

THE USE OF SHEEP TO GRAZE LEAFY SPURGE WAS BEGUN ≈ 1938
Leafy Spurge Acreage in North Dakota (Years)

Leafy spurge (acres)

SHEEP GRAZING

1940 '60 '80 '90 '00 '02 '04 '06 '08 '10 2015
IN A 1944 BULLETIN THE DANGERS OF USING SODIUM CHLORATE WERE NOTED. “WHEN MIXED WITH ORGANIC MATTER, SUCH AS CLOTHING OR WOOD....BECOMES A SERIOUS FIRE HAZARD

“ONE SHOULD USE CAUTION WHEN STARTING THE WOOD STOVE AFTER SPRAYING LEAFY SPURGE!”

ALSO RECOMMENDED USING CULTIVATION WITH CHEMICALS, THE FIRST INTEGRATED APPROACH TO LEAFY SPURGE CONTROL.
Leafy spurge acreage in North Dakota (Years)
POST-WAR CONTROL AND EDUCATION

• EXTENSION SERVICE BEGAN A STATE WIDE LEAFY SPURGE CONTROL DEMONSTRATION PROGRAM IN 1953

• FIRST NORTH DAKOTA FARM RESEARCH ARTICLE SPOKE OF USING GA TO BREAK ROOT BUD DORMANCY

• STATE WEED LAW REVISED IN 1960 – LEGISLATURES TOLD COUNTY COMMISIONERS TO “DESTROY NOXIOUS WEEDS IN THE PUBLIC INTEREST” AND OH BY THE WAY DO NOT SPEND MORE THAN $3000/YEAR.
SECOND RESEARCH ARTICLE LISTED THE SAME CONTROL OPTIONS AS 6 YEARS EARLIER EXCEPT A SECTION CALLED "HOW SERIOUS IS LEAFY SPURGE?" WAS NO LONGER INCLUDED.

SURVEY OF LANDOWNERS SHOWED ONLY 30% CONSIDERED LEAFY SPURGE A BIG PROBLEM, 30% HAD NEVER HEARD OF THE WEED.
FIRST STATE WIDE CONTROL PROGRAM IN 1966
JUNE WAS DECLARED LEAFY SPURGE CONTROL MONTH

HERBICIDES INCLUDED
- BANVEL D AT 6 YO 8 LBS/A
- TORDON AT 1 TO 2 LBS/A
- 2,4-D UP TO 40 LBS/A IN THE FALL
- LARRY MITICH BEGAN A SMALL RESEARCH AND DEMONSTRATION TRIAL IN THE LATE ’60’s. LETTERS IN HIS FILE NOTE THAT LEAFY SPURGE HAD INFESTED 377,215 A STATE WIDE OF WHICH 133,468 WERE TREATED. THE INFESTATION WAS INCREASING BY 6700 A/YR!!!

BY THE EARLY 1970’S OVER 500,000 ACRES HAD BEEN INVADED AND THE INFESTATION WAS DOUBLING IN SIZE EVERY 10 YEARS.
Leafy spurge (acres)

Estimated infestation in 2018 without control program – 4.9 million A

Leafy Spurge Acreage in North Dakota (Years)

Leafy spurge (acres)
Dan McIntyre, supervisor with the Custer National Forest worked with NDAES director H. R. Lund to initiate the symposium.

A cooperative project of the Agricultural Experiment Stations from five states was begun, Montana, Nebraska, South Dakota, and Wyoming, with North Dakota as the lead state.

Major boost to the program was through redirection and enhancement of research efforts by the Agricultural Experiment Stations and by the USDA, initially by the ARS and then APHIS.
1979 LEAFY SPURGE SYMPOSIUM

• NDSU BEGINS INTEGRATED PROJECT
  • CAL MESSERSMITH – HERBICIDES
    • ROD LYM HIRED AS A POST-DOC
  • BOB CARLSON – ENTOMOLOGY
  • BOB HOSFORD – PLANT PATHOLOGY
  • DON KIRBY – RANGE SCIENCE
  • LARRY LEISTRITZ and JAY LEITCH - ECONOMICS
  • DON GALITZ – BOTANY

• USDA-ARS in Fargo reassigned D. G. Davis and D.S. Frear with S.E. Lingle hired as a post-doc to conduct leafy spurge research
Leafy spurge infestation
Western North Dakota - 1979
Leafy spurge infestation Western North Dakota - 1985
Leafy Spurge Acreage in North Dakota (Years)

- NDSU Begins IPM Res. Prog.
- Sheep Grazing
- High Herbicide Rates
Leafy Spurge Acreage in North Dakota (Years)

- NDSU Begins IPM Res. Prog.
- ND State Weed Law & Assoc.
- Sheep Grazing
- High Herbicide Rates

Leafy spurge (acres)
1980’s EMPHASIS WAS ON HERBICIDES
THE STATE HAD A COST SHARE PROGRAM
BIOCONTROL WAS IN RESEARCH AND DISCOVERY PHASE
Tordon at 1 qt/A
Cost was $20/A

Became known as the 60¢ war!
Leafy Spurge Acreage in North Dakota (Years)

- NDSU BEGINS IPM RES. PROG.
- ND STATE WEED LAW & ASSOC.
- TORDON + 2,4-D BECAME STD TRT
- SHEEP GRAZING
- HIGH RATES
- NDSU BEGINS IPM RES. PROG.
Promise of biological control revitalized the control efforts in the late 1980s.

Kelly Miller, a Towner, ND rancher and Bob Thoft, a Montana state legislator went to Europe to explore possibilities.

Russ Lorenz of USDA-ARS in Mandan wrote a proposal to the federal gov.
Accidental overspray of A. nigriscutis insectary near Minot.
APHTHONA POPULATION INCREASE

APHTHONA / M²

YEARS

INSECTS ALONE

Herbicide Applied

YEARS

HERBICIDE + INSECTS
Fall regrowth after *Aphthona* feeding.
Leafy Spurge Acreage in North Dakota (Years)

- NDSU BEGINS IPM RES. PROG.
- ND STATE WEED LAW & ASSOC
- NDSU BEGINS IPM RES. PROG.
- SHEEP GRAZING
- HIGH RATES
- TORDON + 2,4-D BECAME STD TRT
- APHTONA SPP. WIDELY AVAILABLE

Leafy spurge (acres)
Gall midge (*Spurgia esula*)

Useful in wooded and moist areas

Long-horned beetle (*Oberea erythrocephala*)

Very slow to increase in pop.
Leafy Spurge (acres)

Leafy Spurge Acreage in North Dakota (Years)

- 1940
- '60
- '80
- '90
- '00
- '02
- '04
- '06
- '08
- '10
- 2014

- TORDON + 2,4-D BECAME STD TRT
- APHTHONA SPP. WIDELY AVAILABLE
- IPM – FLEA BEETLES, GRAZING & HERBICIDES (9)
- NDSU BEGINS IPM RES. PROG.
- ND STATE WEED LAW & ASSOC
- HIGH RATES
- SHEEP GRAZING

NDSU BEGINS IPM RES. PROG.
The Ecological Area-wide Management Leafy Spurge project.
Theodore Roosevelt NP – ND

Badlands NP – SD

Ekalaka Range – MT

Devils Tower NM – WY
TEAM Program

- TEAM members included BLM, Forest Service, NPS, BIA, Reclamation, USGS, State Ag Depts, Ag Colleges
- Approximately $5.5 million for the 5 year project – 13 partners
- Research and outreach programs coordinated with the four states
WPFO treated with imazapic 10 MAT
Leafy Spurge Acreage in North Dakota (Years)

- NDSU begins IPM Res. Prog.
- ND State Weed Law & Assoc.
- Tordon + 2,4-D became STD TRT
- High rates
- Sheep grazing
- IPM – Flea beetles, Grazing & Herbicides (9)
- ND 3-WAY
- Aphytis spp. widely available
WE HAVE BEEN MONITORING RESULTS SINCE THE 1999 APHTHONA RELEASES
Leafy Spurge Stem Density

YEAR

STEMS / M²

1999 2004 2009 2014 2018

Lowland
Upland

0 10 20 30 40 50 60 70 80 90 100 110 120
Percentage of Leafy Spurge Seedlings

Seedling density %

Year

1999  2004  2009  2014

Lowland
Upland

Percentage of Leafy Spurge Seedlings
## Changes in Native and Introduced Species

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<td><strong>Native species</strong></td>
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<td><strong>Introduced species</strong></td>
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Leafy spurge (acres)

Leafy Spurge Acreage in North Dakota (Years)

ESTIMATED INFESTATION
4.9 MILLION A IN 2018

18 HERBICIDE TRTS LISTED IN ND WEED GUIDE
750,000 A EST 2012

NDSU BEGINS IPM RES. PROG.
ND STATE WEED LAW & ASSOC
APHTHONA SPP. WIDELY AVAILABLE
TORDON + 2,4-D BECAME STD TRT
SHEEP GRAZING
HIGH RATES
IPM – FLEA BEETLES, GRAZING & HERBICIDES (9)
Lythrum – Purple loosestrife

- Introduced into North America in the 1800s from Eurasia and Africa
- Horticultural value
  - Brilliant color
  - Hardiness
  - Low maintenance
Horticultural Plant

Planted throughout North Dakota
Added to the State Noxious Weed list in 1999, last state in the northern tier
Galerucella calmariensis and G. pusilla

- First released in North America in 1992 for biological control of purple loosestrife
- Host specific leaf-feeding beetle
- One generation/yr

Photo by Bob Richard, USDA-APHIS-PPQ
Galerucella spp. Feeding Damage
CANADA THISTLE HAS MANY VARIETIES AND ECOTYPES. LEAF SHAPE, FLOWER COLOR, SPINES VARY. SOME ECOTYPES ARE HARDER TO CONTROL.
BIOLOGICAL CONTROL OF CANADA THISTLE

- PAINTED LADY BUTTERFLY IS NATIVE, PROVIDES VERY GOOD CONTROL, BUT IS INCONSISTENT
Several agents released for Canada thistle control

- *Ceutorhynchus litura* – stem weevil most potential
  - Research results are mixed, released in 1972, so how affective could it be?
Other thistle agents

- Musk thistle – *Rhinocyllus conicus*
  - Released in 1969, terrible poster child for biocontrol programs
Pseudomonas syringae may release a toxin into the stem.

Infection is most wide spread during wet periods.
SUMMARY

• Leafy spurge biological control program recognized as one of the most successful in the world
  – All of the A. lacerstosa came from Valley City release
  – Lost track at somewhat over 75 million
  – Example of an integrated success story
• Lythrum successful
• Toadflax not successful
• Thistle control program not especially helpful
Questions?