

Small Scale Fuel Production

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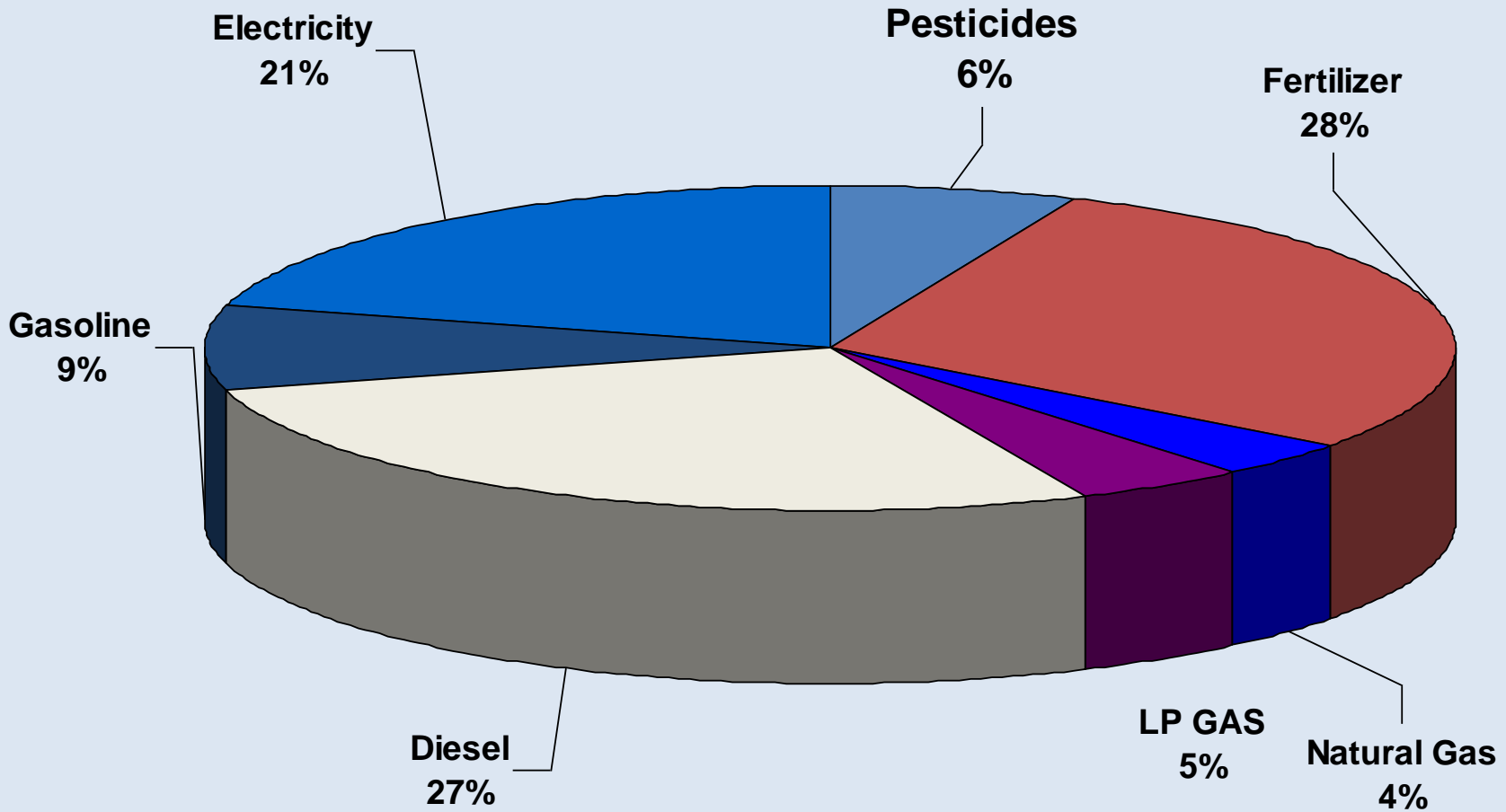
Sustainable Agriculture
Research & Education

A green tractor with a red implement attached, parked on a grassy field under a blue sky with white clouds. The tractor is a John Deere 3020 Diesel, as indicated by the text on its side. The red implement is a complex piece of machinery, possibly a tillage implement, with multiple wheels and a large red housing. The scene is set outdoors on a bright day with scattered white clouds in the sky. A gravel path and a fence are visible in the background.

FARMING is Mostly Dependent on Fossil Fuels

Generally NO ONE to Pass the Cost

U.S. Farm Energy Use by Source



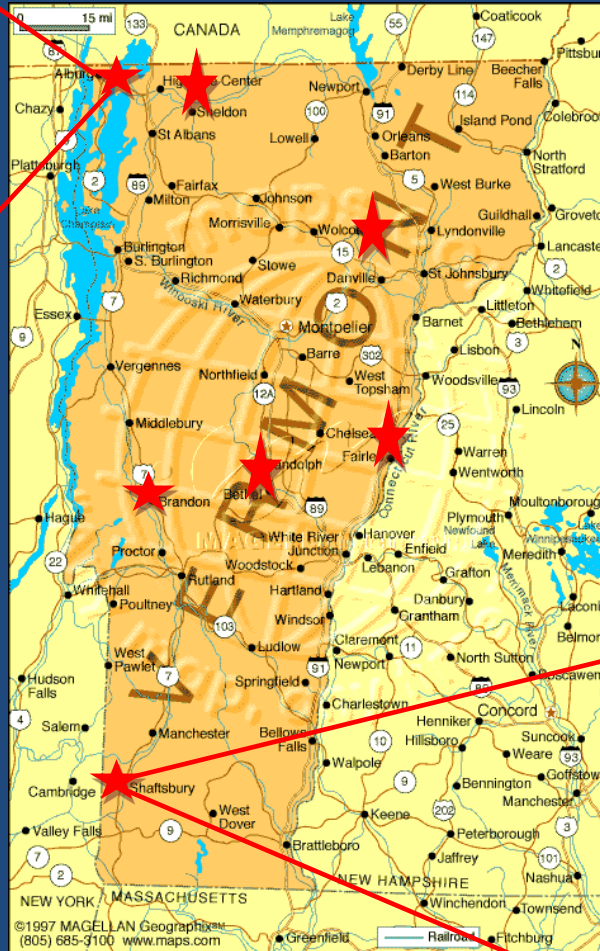
Source: Miranowski, 2004

The Goal

To assess the potential production and processing of oil seed crops for use as a renewable energy source on a scale that would support small groups of local farmers working together.



Borderview Farm
Alburg, VT



State Line Farm
Shaftsbury, VT

Identifying specific oilseed crops and varieties suitable to local conditions



Canola



Sunflower



Canola seed pods







Can Oilseed Crops Yield in Vermont?

National
Average

Vermont
Average

Canola:

1374 lbs/acre

1500 lbs/acre

Sunflower:

1349 lbs/acre

1500 lbs/acre

Canola Production

Winter & Spring Seed Sources

Croplan Genetics

Pioneer and Mycogen

Spring planted in April/May

Fall planted in mid to late August

Grain Drill – ½ to 1 inch depth

Seeding rate – 5 to 8 lbs per acre

Fertility – similar to small grains except high S needs

Canola and Soil

- Canola has traditionally been produced on lighter texture or well drained clay.
- Not highly sensitive to soil pH 5.7 to >8.
- Weak root system and does not tolerate water logged soils

Canola Production

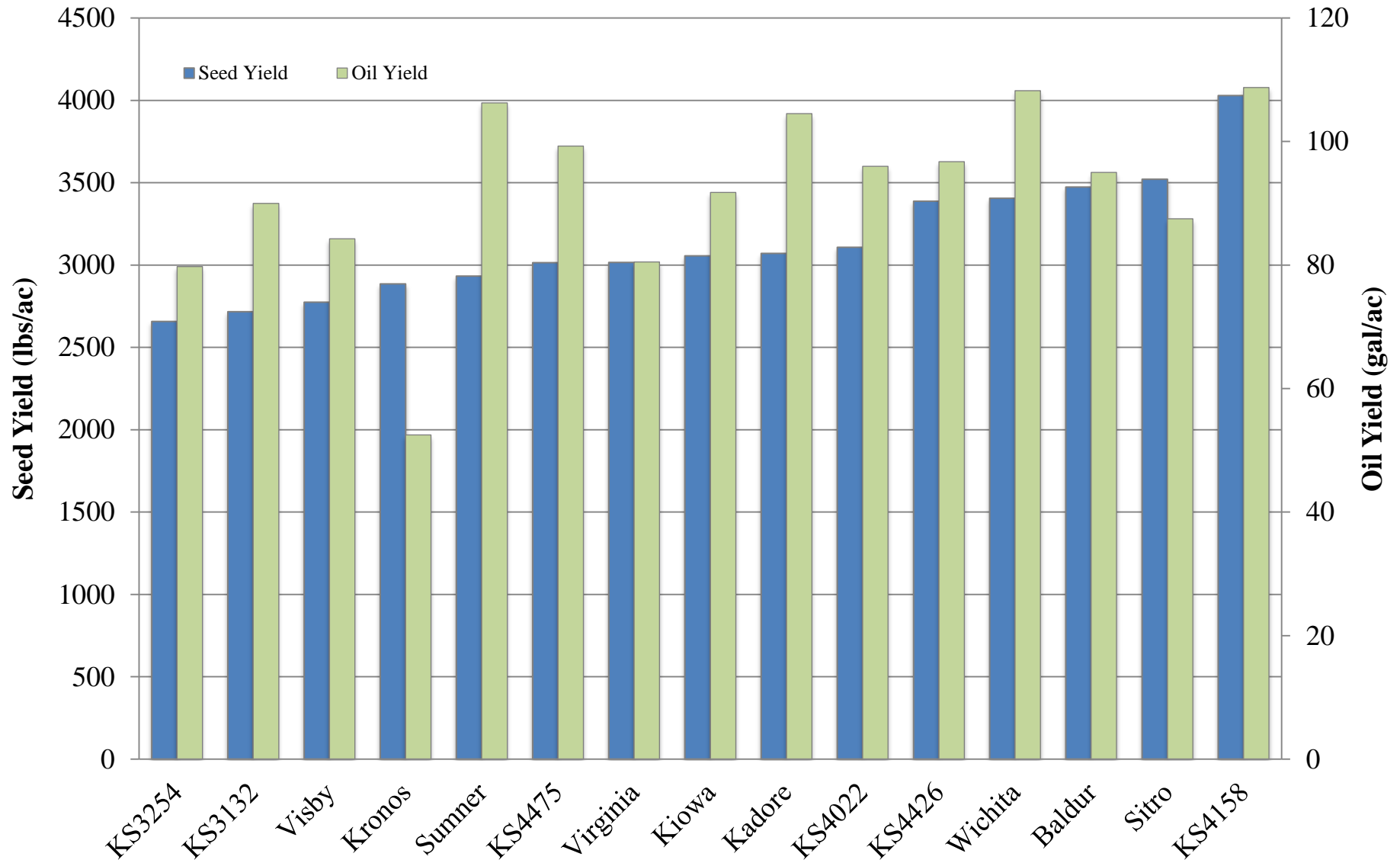


Harvest in August

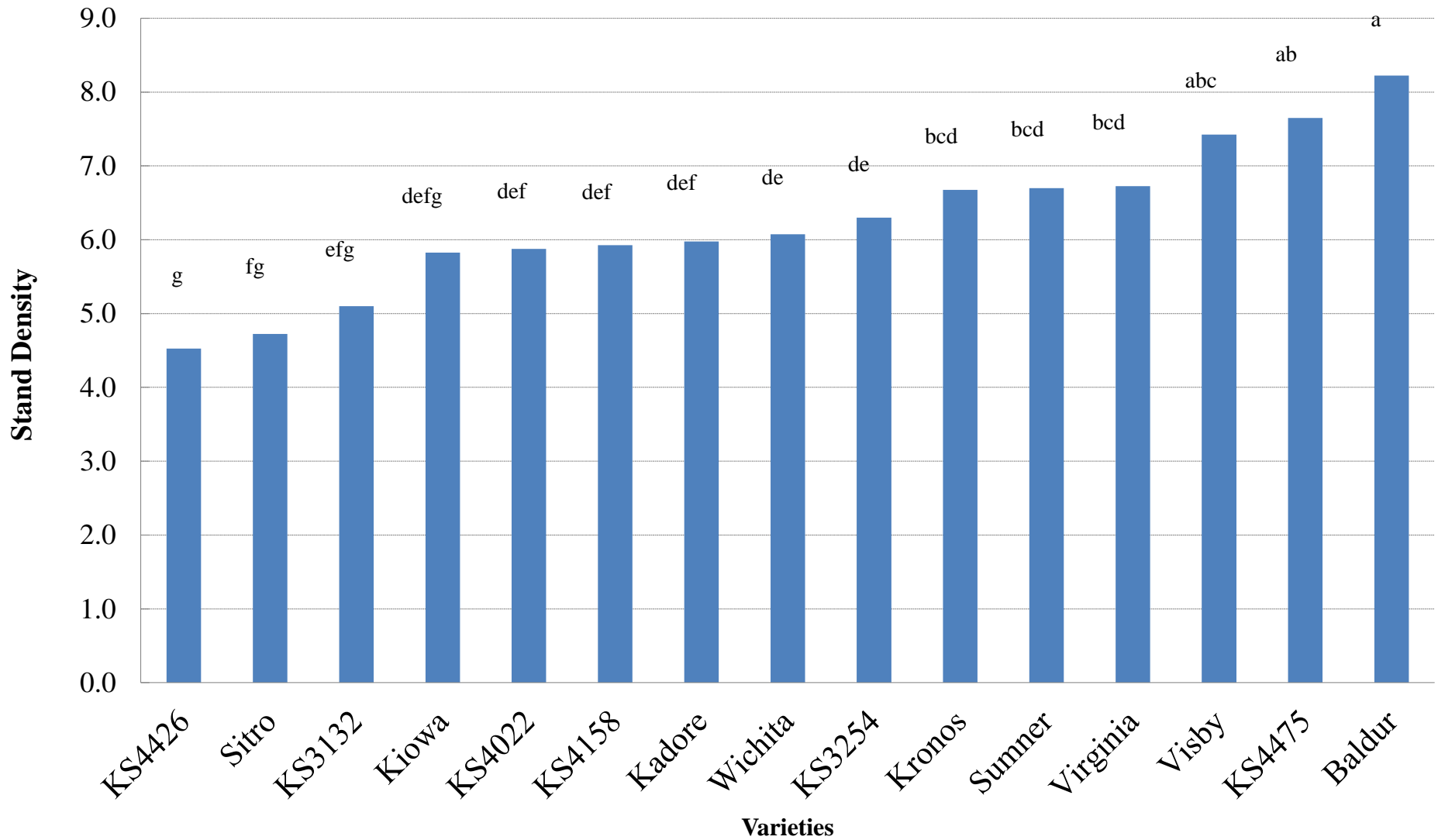
Dry to 10-12% moisture

Easy to dry – heat not needed

Winter Canola Yields



Winter Canola Survival



Sunflower Production



Seed Sources

Seeds2000

Croplan Genetics

Mycogen

Blue River Organics

Seed size very important (sizes 2,3,4)

Planted in May and early June

Corn planter – 30” row

Seeding rate – 30,000 to 32,000 seeds per acre

Fertility – high N requirements, low P and K requirements

deep taproots to pull up nutrients

Sunflower and Soil

- Sunflower has traditionally been produced on heavy clay soils with good physical structure and high in nutrients.
- Not highly sensitive to soil pH 5.7 to >8.
- Drought tolerant through deep rooting

Sunflower Production

A vibrant field of sunflowers with bright yellow petals and dark brown centers, set against a clear blue sky. The sunflowers are in various stages of bloom, with some fully open and others still budding. The green leaves are large and healthy, filling the lower portion of the frame.

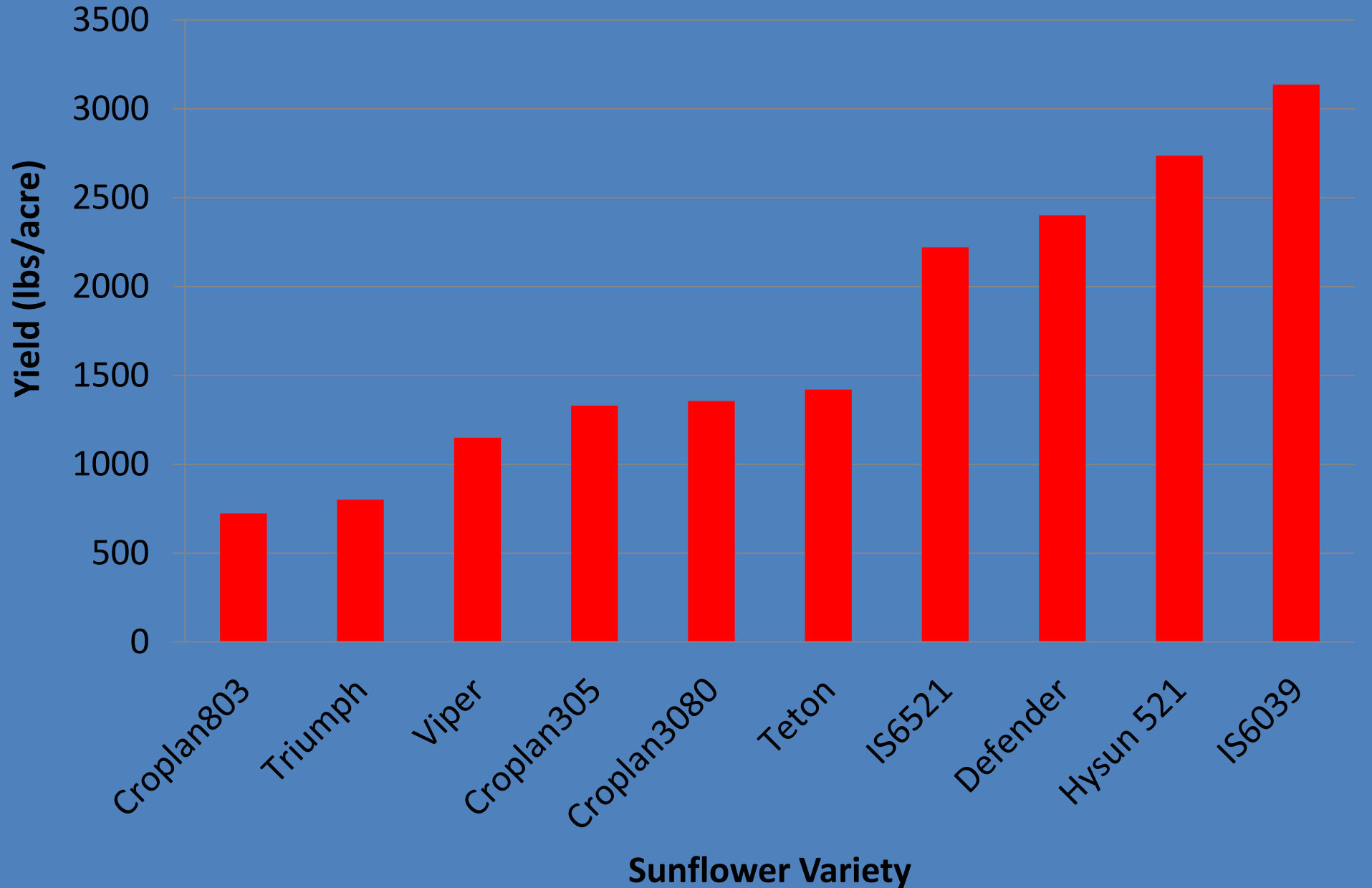
Sunflowers are long season

Harvest in late October – November

Easy to dry – forced air works best

Absorb moisture easily in storage

Variety Trials – Alburgh, VT



Sunflower Pans

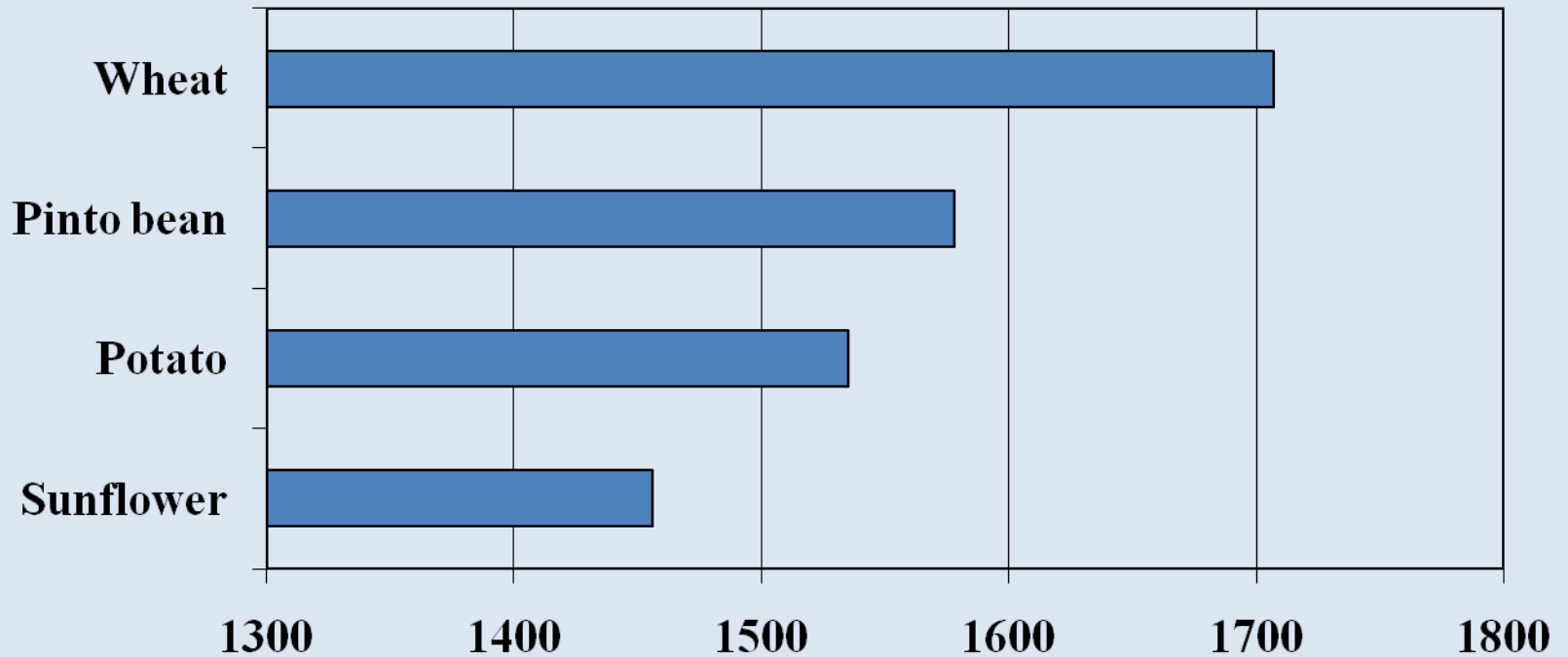


SUNFLOWER PANS

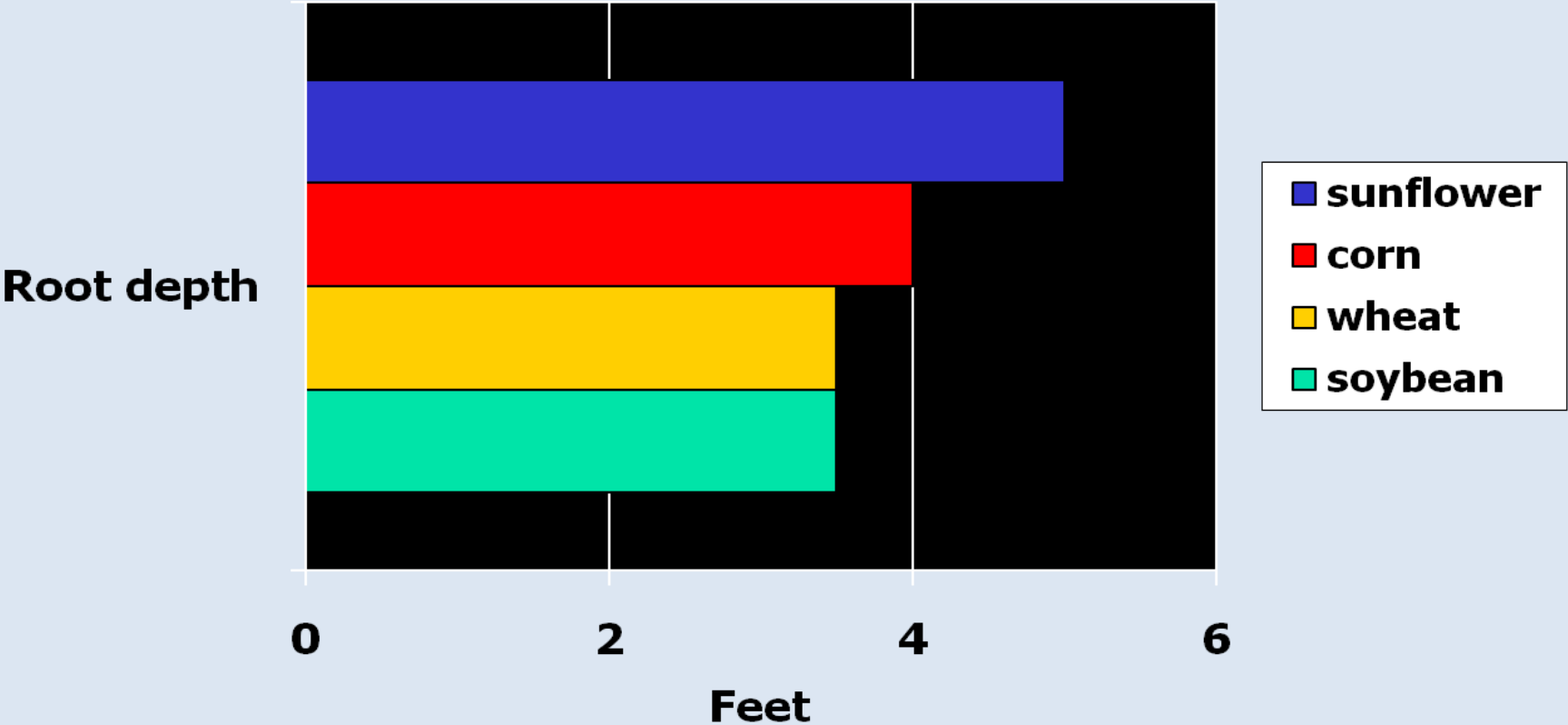


Sunflower following crops, Crookston, MN.

Sunflower Yield (pounds per acre)



Average Crop Rooting Depth





Nitrogen Management

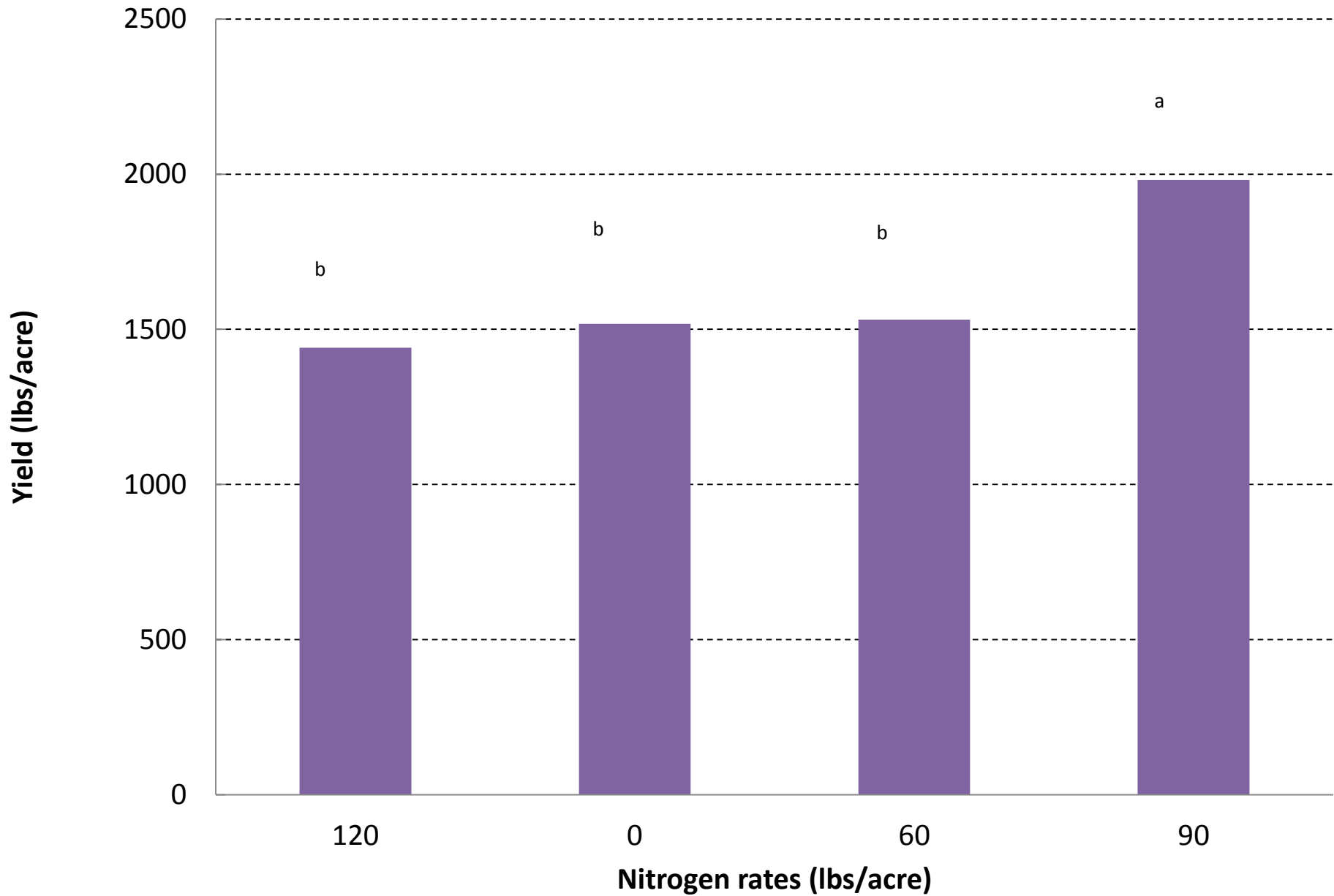
Sunflowers require 90 lbs/acre

Excellent scavengers of nutrients

Soil samples to a 2 - 3 foot depth

Too much nitrogen making stems weak





Integrated Pest Management in Oilseeds

CULTURAL

- varietal selection
- agronomic management

MECHANICAL

- cultivation
- removal of pests by hand

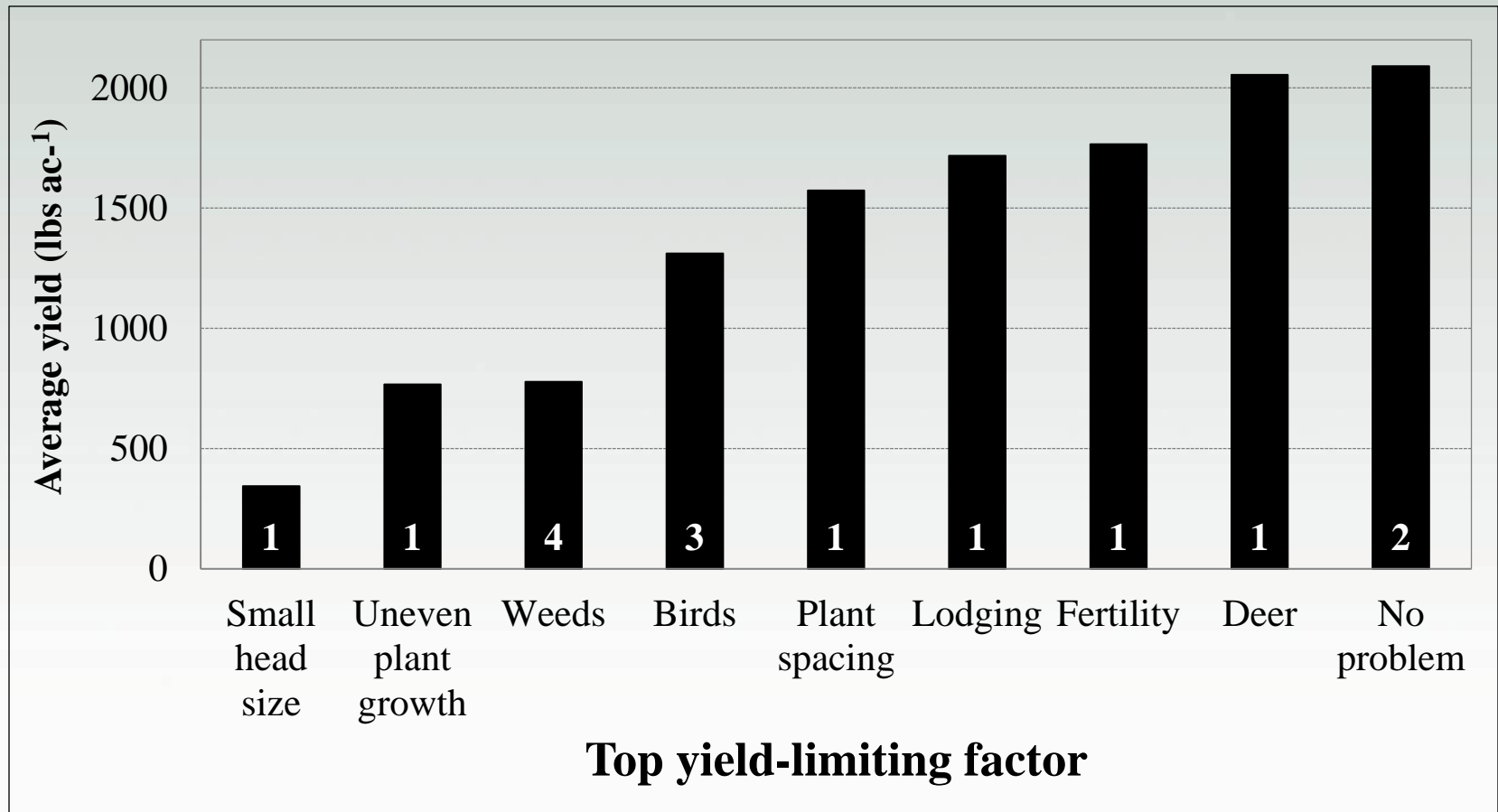
CHEMICAL

- herbicides
- insecticides
- fungicides

BIOLOGICAL

- introduction or conservation of predator species

Top Yield-Limiting Factors VT Sunflower 2012



Average 2012 seed yield: 1296 lbs/acre
(oil yield ~ 68 gal/acre)

Sunflower Pest Management: Insects



Banded sunflower moth
Cochylis hospes



BSM larvae
burrowing



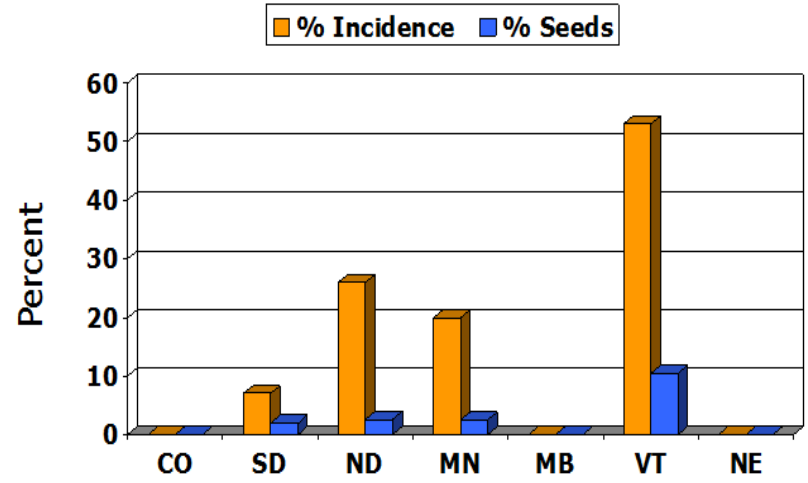
Sunflower midge damage



Sunflower maggot

- Scout regularly
(different life cycle stages)
- Alter planting and/or harvesting dates to avoid vulnerable stages
- Deep fall plowing
- Crop rotation

Banded Sunflower Moth (BSM)



2012 BSM damage, compared to other regions.

2012 BSM traps



20-Aug

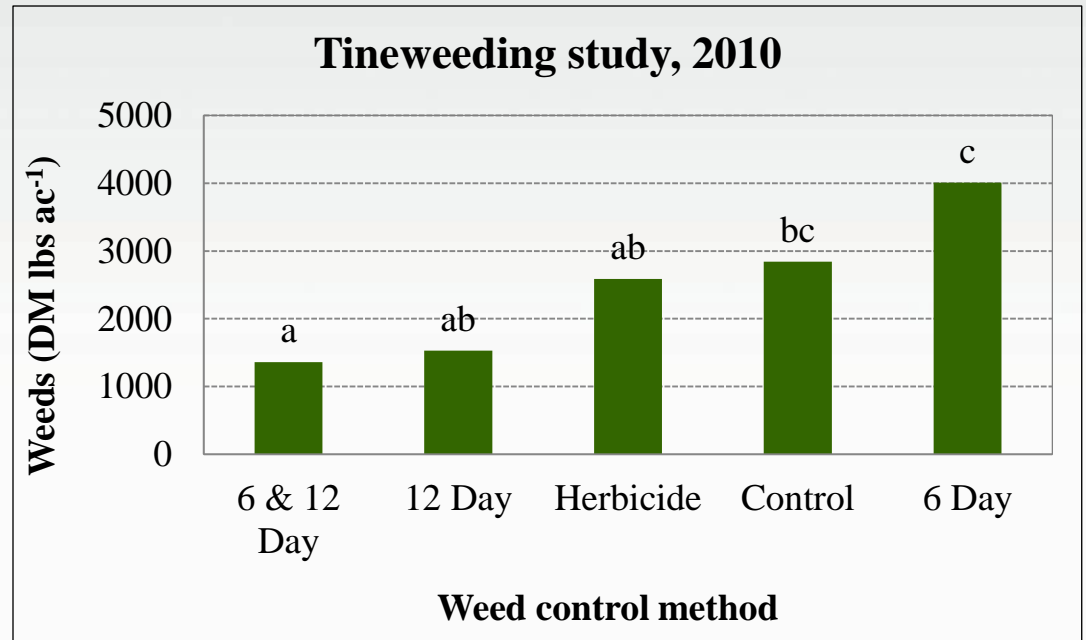


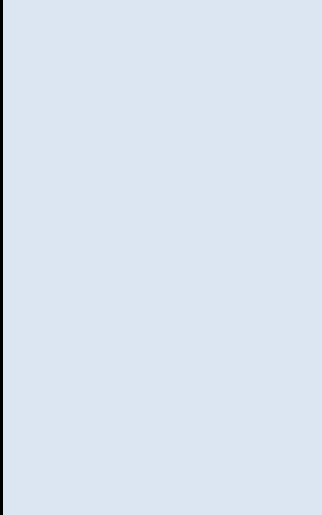
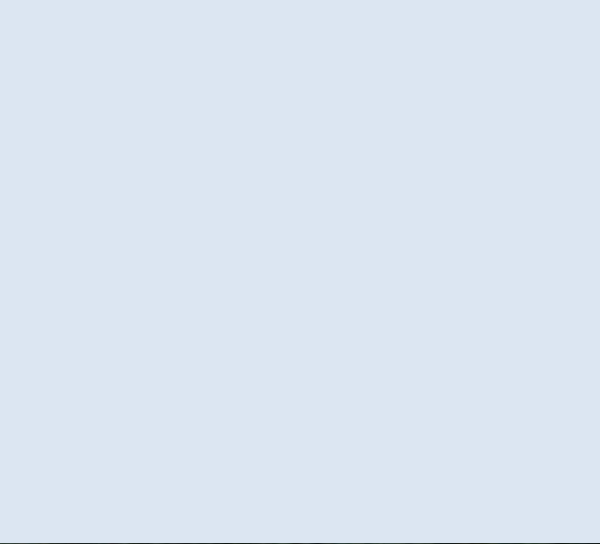
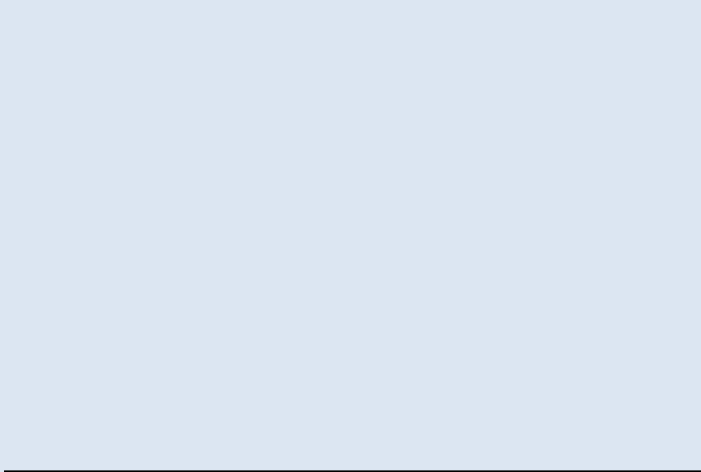
Setting up a wing trap with pheromone lure, Newbury, VT.

Sunflower Pest Management: Weeds

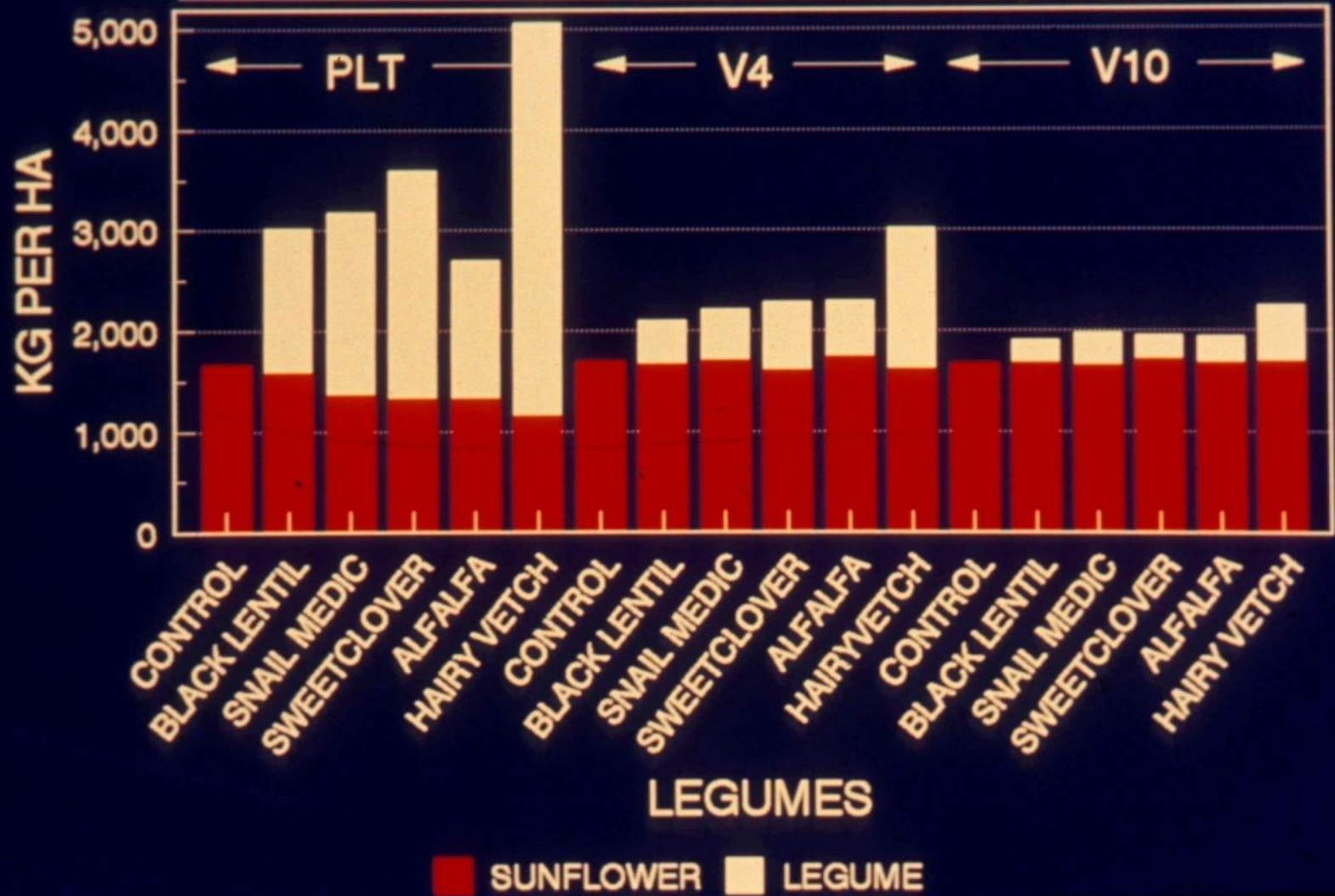


- Mechanical cultivation: tinweeding, row cultivator
- Herbicide (pre-plant or post-emergent)





SUNFLOWER YIELD AND LEGUME BIOMASS IN KG PER HA PROSPER AND CARRINGTON 1992 AND 1993



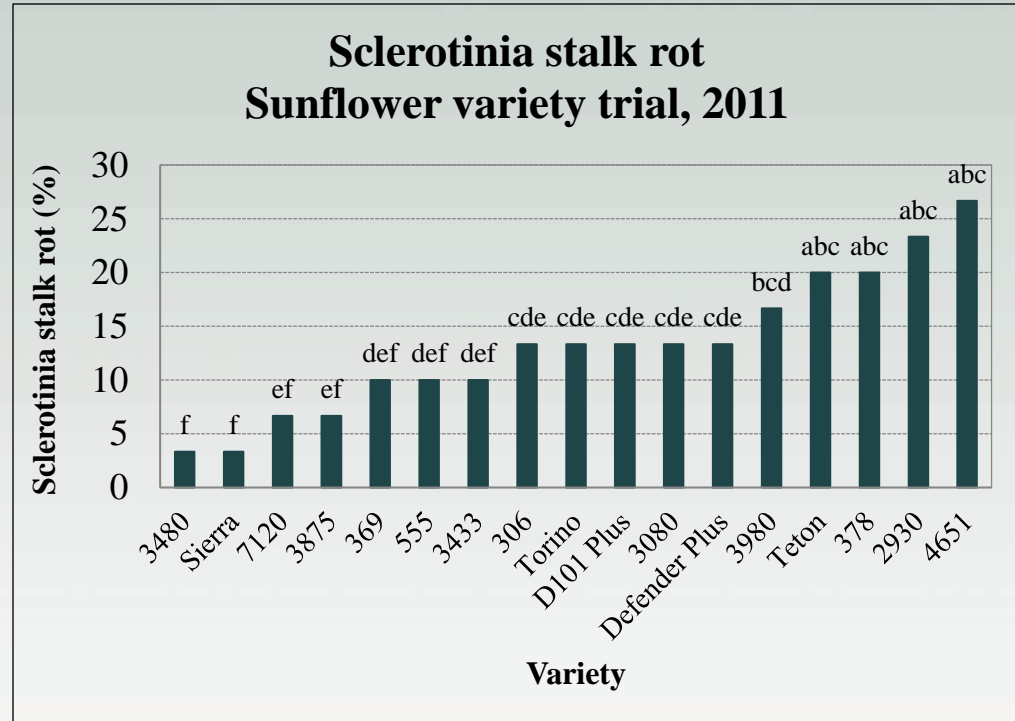
Sunflower Pest Management: Disease



Sclerotinia
head rot



Sclerotinia
stalk rot



- Varietal selection
- Scout regularly

- Fungicides, seed treatments
- Deep fall plowing
- Crop rotation

White Mold

Sclerotinia sclerotiorum

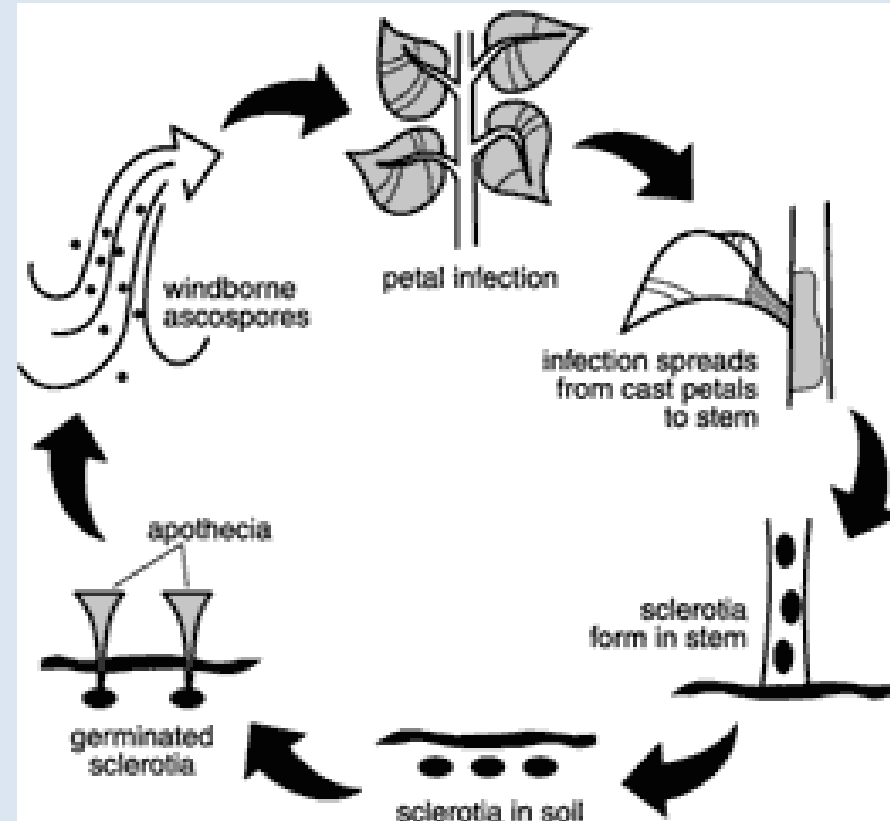
400+ broadleaf hosts

Causes 3 diseases in sunflower
sclerotinia wilt
middle stalk rot
sclerotinia head rot

Crop Rotation – best control
3 – 6 years low levels
8 + years for high levels

Non host crops

Contans = biocontrol agent



NDSU

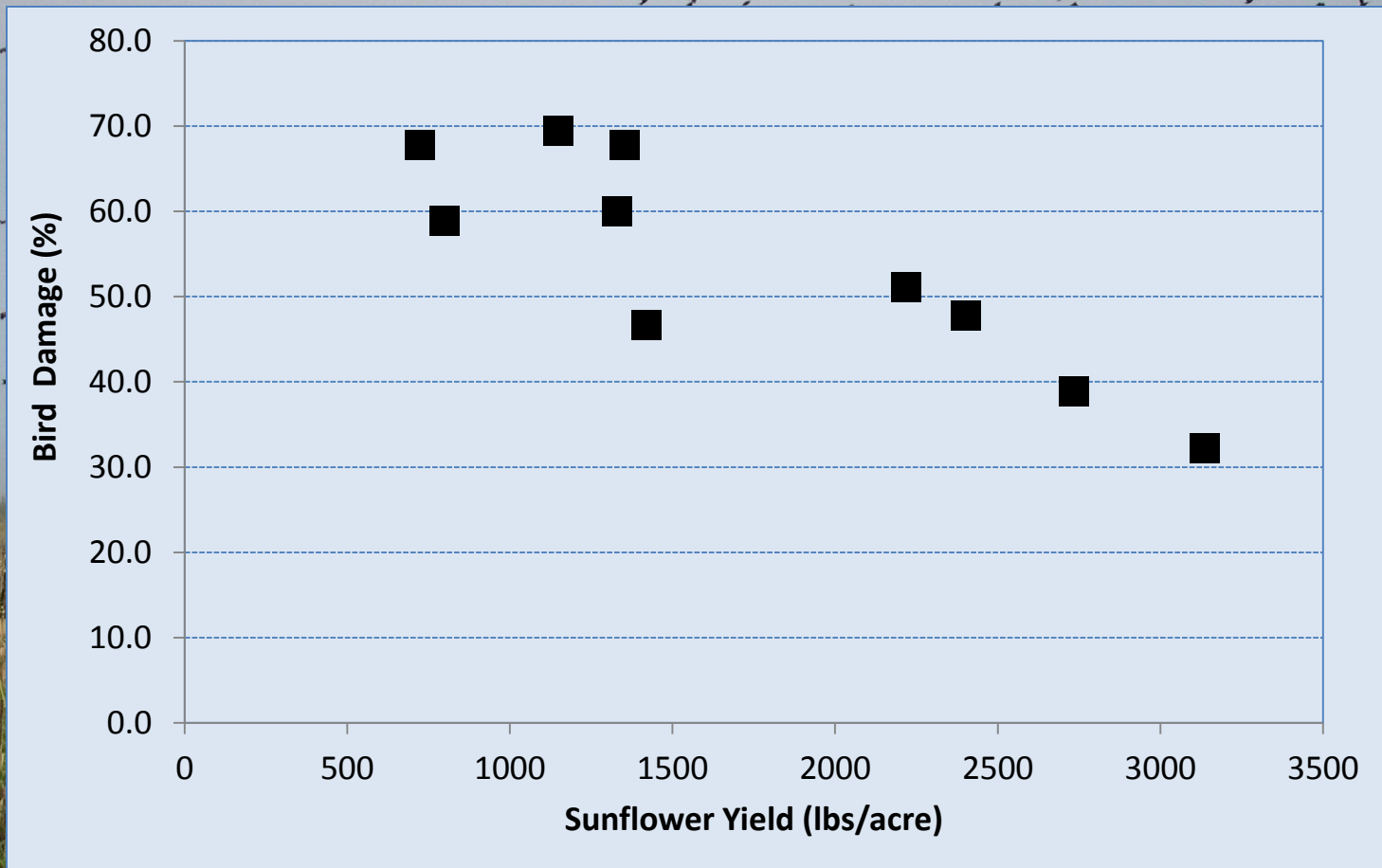
Sclerotinia Wilt

- Sunflower roots come in contact with sclerotia, the sclerotia germinate and infect the roots.
- The fungus grows upward in the infected root
- The plant wilts and dies
- Adjacent plants in the row may be infected through root-to-root contact.
- 1.0 sclerotium per 1,000 cm³ of soil results in about 65 percent wilted plants.





Impact of Bird Damage on Yields, Borderview Farm

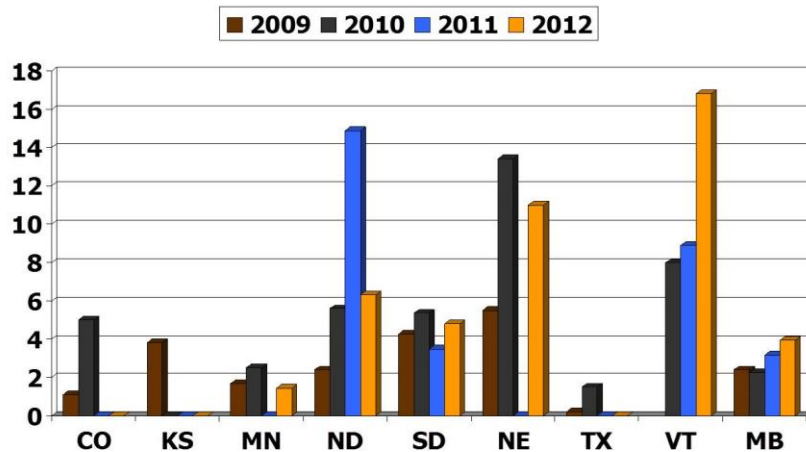


Sunflower Pest Management: Birds

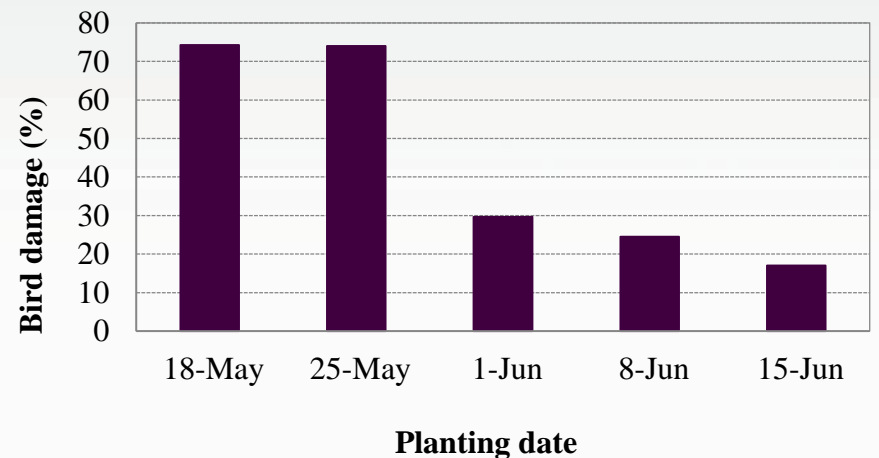


- Scare tactics
- Crop rotation
- Sacrificial planting
- Alter planting and/or harvesting dates

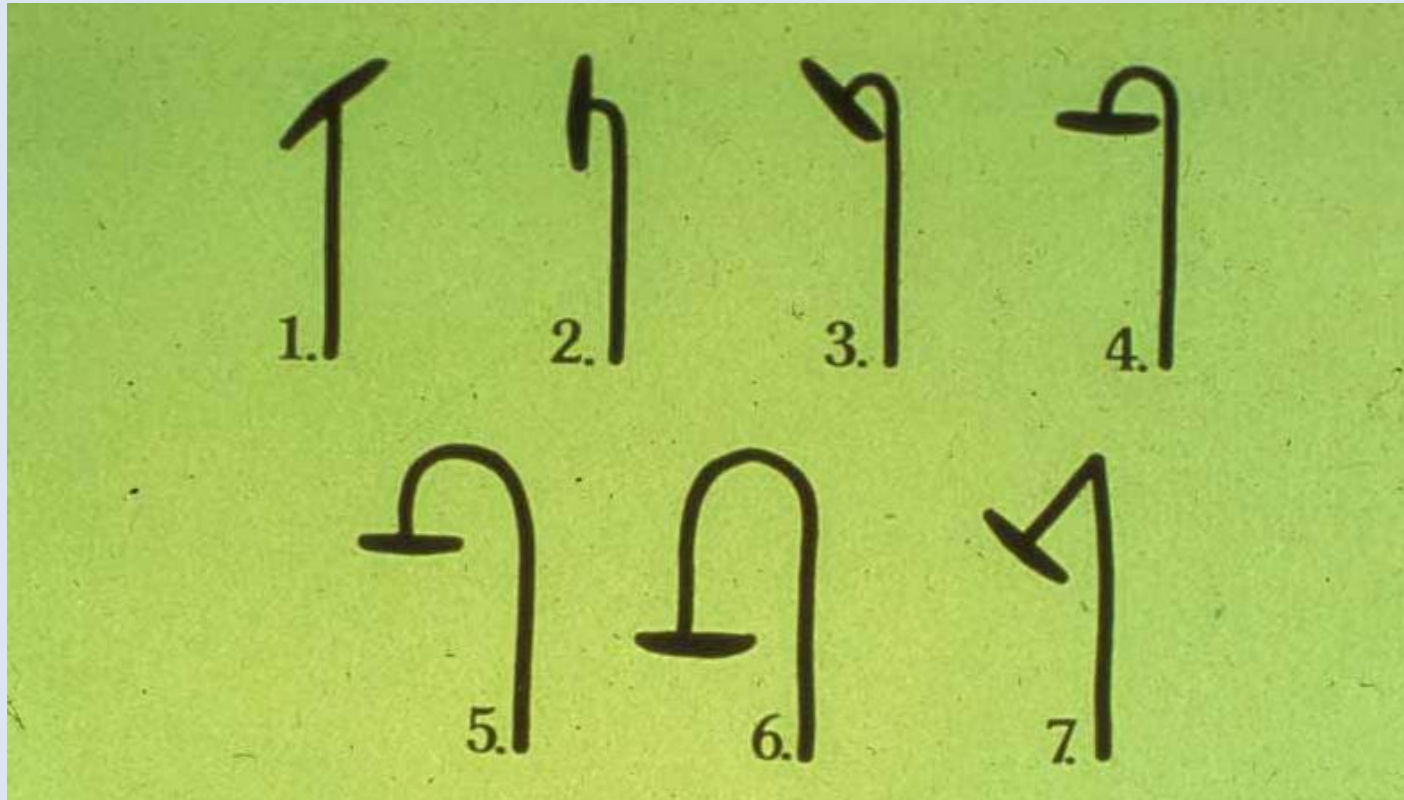
**% Bird Damage in Fields
Sunflower 2009-2012**

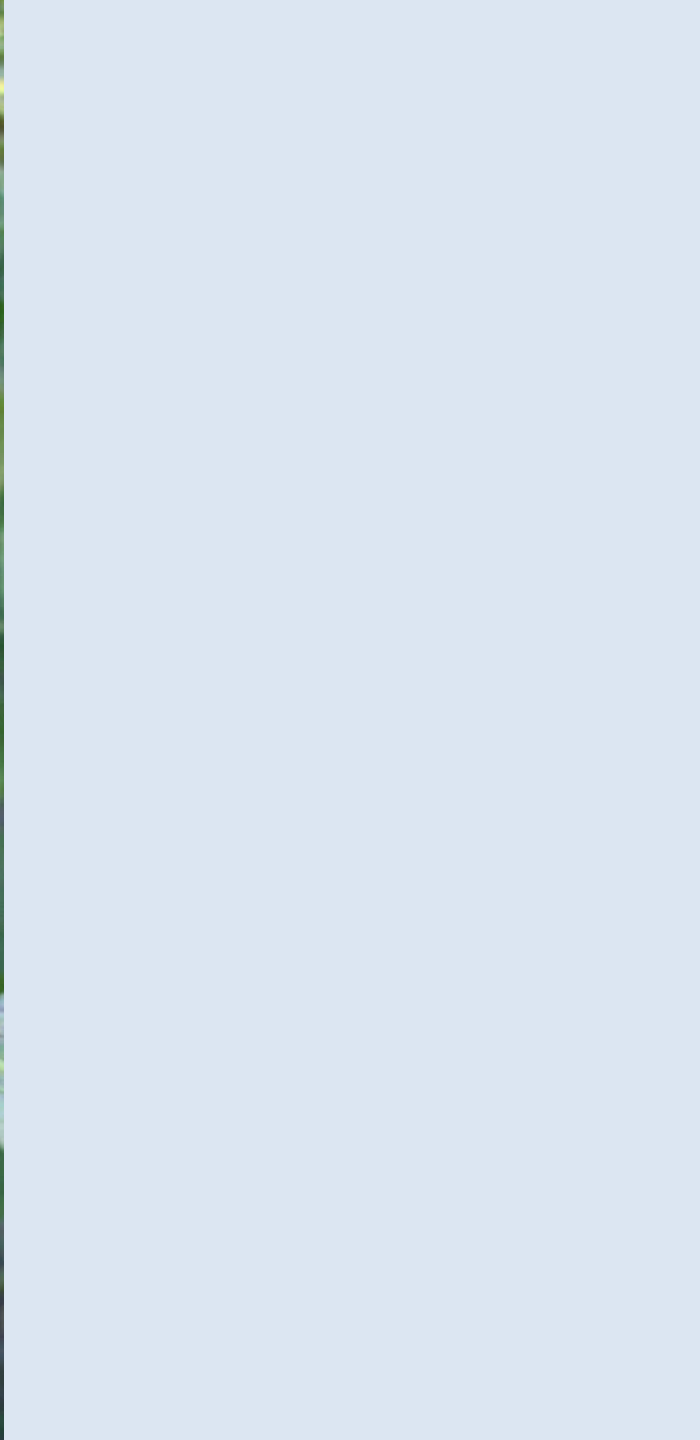


Bird damage by planting date, 2012



Stem Curvature Classes in Sunflower





Canola Pest Management: Insects



Flea beetle
Phyllotreta cruciferae



- Scout regularly
- Crop rotation
- Foliar insecticides
- Varietal selection

Canola Pest Management: Disease



Blackleg, caused by fungal pathogen

- Crop rotation
- Fungicides
- Seed treatments
- Varietal selection



Deformation on stem caused by sclerotinia

Canola Pest Management: Birds



- Scare tactics
- Crop rotation
- Sacrificial planting
- Alter planting and/or harvesting dates



Oil Yields in Vermont?

National
Average

Vermont
Average

Canola:

74 gallons/acre

74 gallons/acre

(40-100 gallons/acre)

Sunflower:

74 gallons/acre

74 gallons/acre

(45-140 gallons/acre)

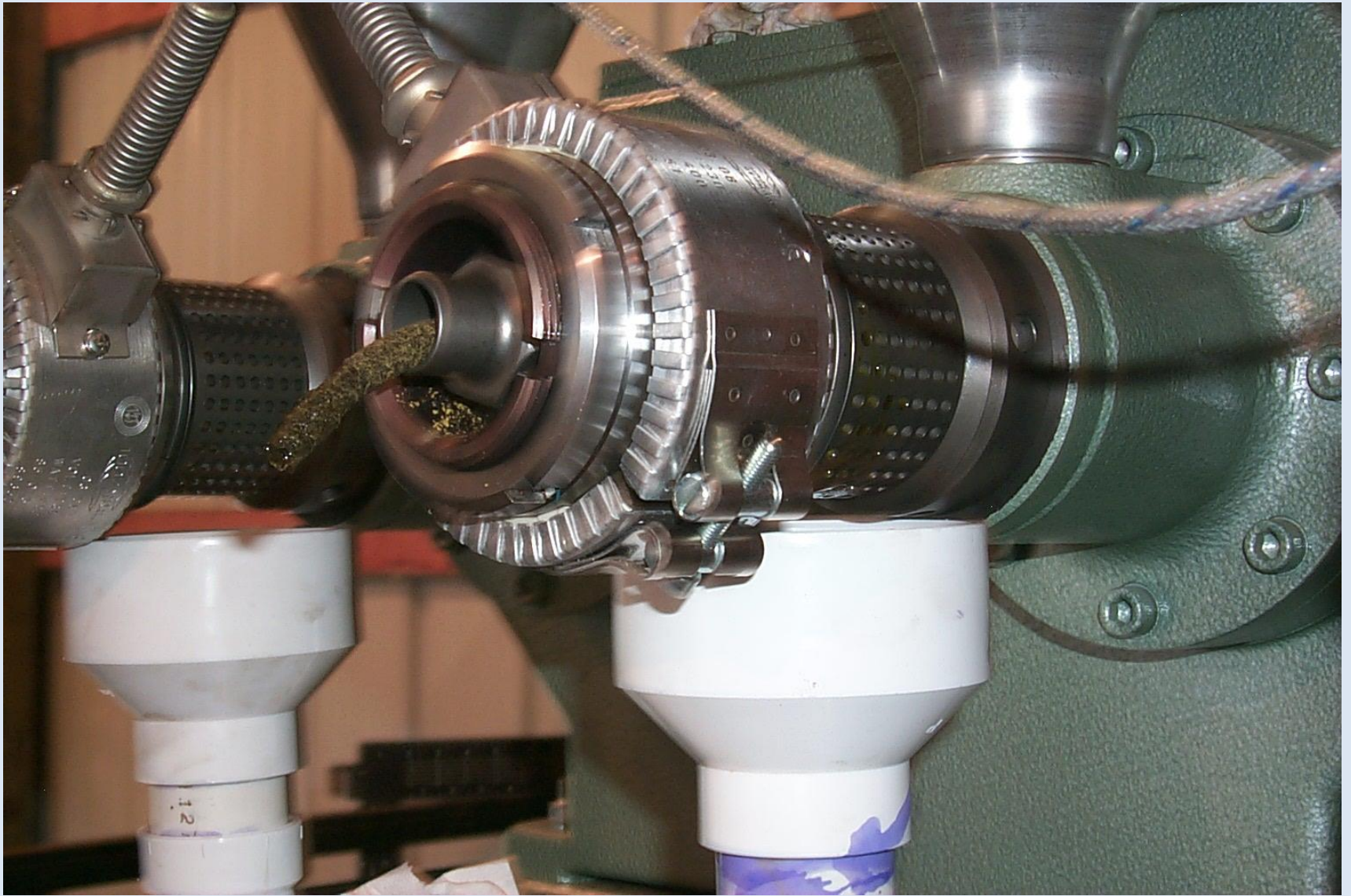
Oil press comparisons

Chinese Press

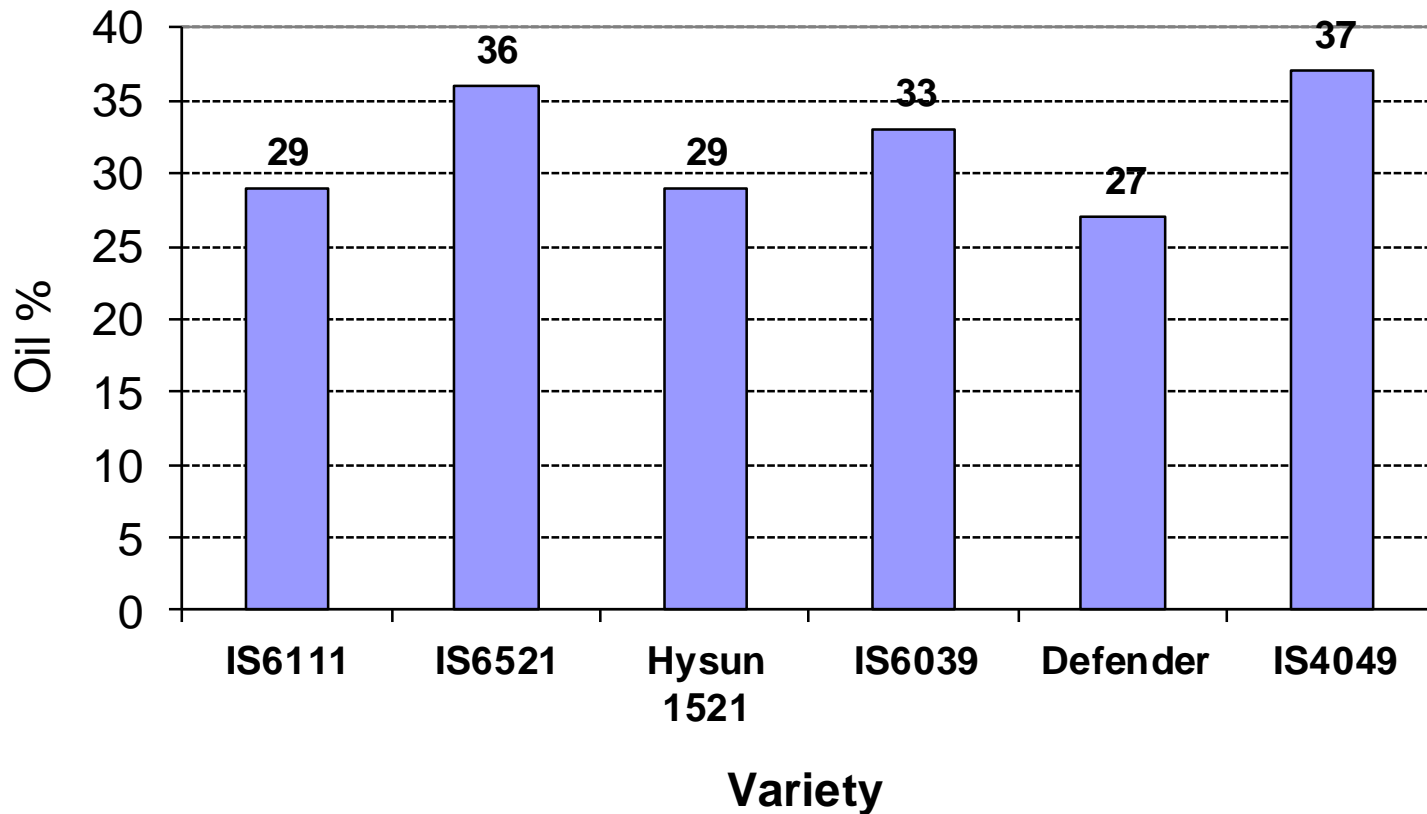


German Kern Kraft 40





Oil Yields From Varieties



Oil Yields & Moisture

Variety	Moisture (%)	Oil (%)
HySun 1521	12	24
HySun 1521	7	29

Oil Yields & Press Number

Press (#)	Oil (%)
1	24
2	10
3	8

Seed Meals



Crude Protein:

Canola 30 %

Sunflower 34 %

Fat:

Canola 14%

Sunflower 15%

Dairy Feeding Trial

Canola meal source	Crude protein	Crude fat	Net energy lactation
	% DM		Mcal/lb
Farm grown	33.1	13.4	1.15
Purchased	36.3	2.94	0.79

Dairy Feeding Trial

Feed	Milk Yield (lbs)	Fat (%)	Protein (%)
Farm grown	40.4	3.11	2.80
Purchased	39.1	3.25	2.80

Meal Nutrient Content

Nutrient content	Sunflower	Canola	Mustard
% N	5.60	4.60	6.00
%P	1.26	0.74	1.02
%K	1.49	0.68	1.02

Other Meal Benefits

Biocidal properties

- Some oilseed crops have high glucosinolate values
- These glucosinolates hydrolyze into isothiocyanates
- Various mustards have high glucosinolates
- Suppress diseases and nematodes



Weed Control with Oilseed Meals

Table 3. Weed counts in oilseed amended plots in 2008 and 2009.

Amendment	2009
	Weed count
Sunflower meal	33b
Canola meal	38b
Mustard meal	15a
Control (synthetic N)	52c

**Within each column, numbers followed by the same letter are not significantly different ($P < 0.05$).

Organic Nitrogen Source

Impact of oilseed meal amendments on soil nitrate levels at 4, and 8 weeks after planting.

Amendment	4 week NO ₃ (ppm)	8 week NO ₃ (ppm)
Sunflower meal	41.2a	28.6b
Canola meal	49.7a	37.5a
Mustard meal	53.1a	38.5a
Control (synthetic N)	17.8b	9.38c

**Within each column, numbers followed by the same letter are not significantly different (P<0.05).

Fuel Testing at NW Manufacturing

Test furnace



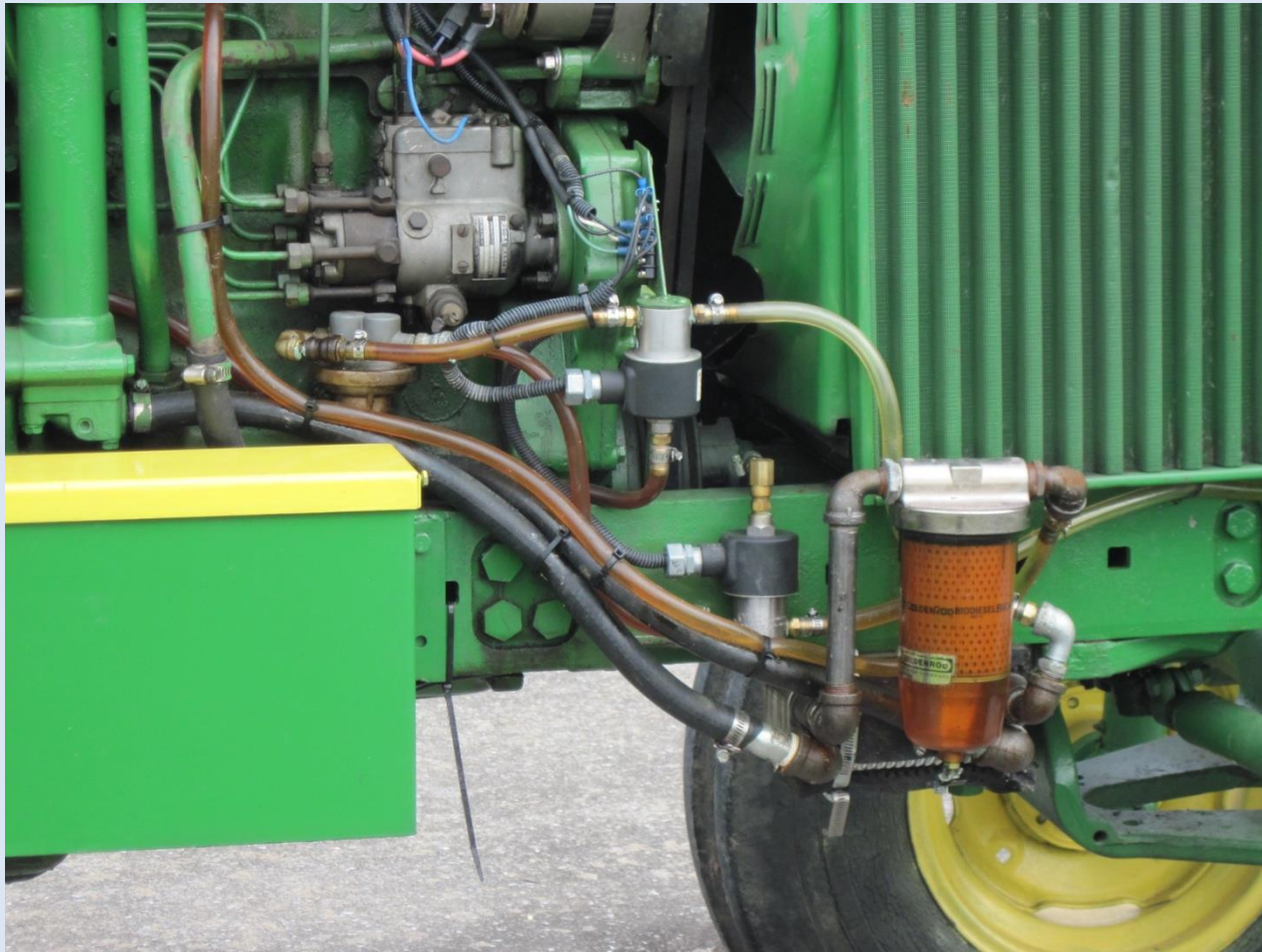
Clean emmissions



Going Green



CONVERSION FOR USING STRAIGHT VEGGIE OIL





2004 10 15

Making Biodiesel

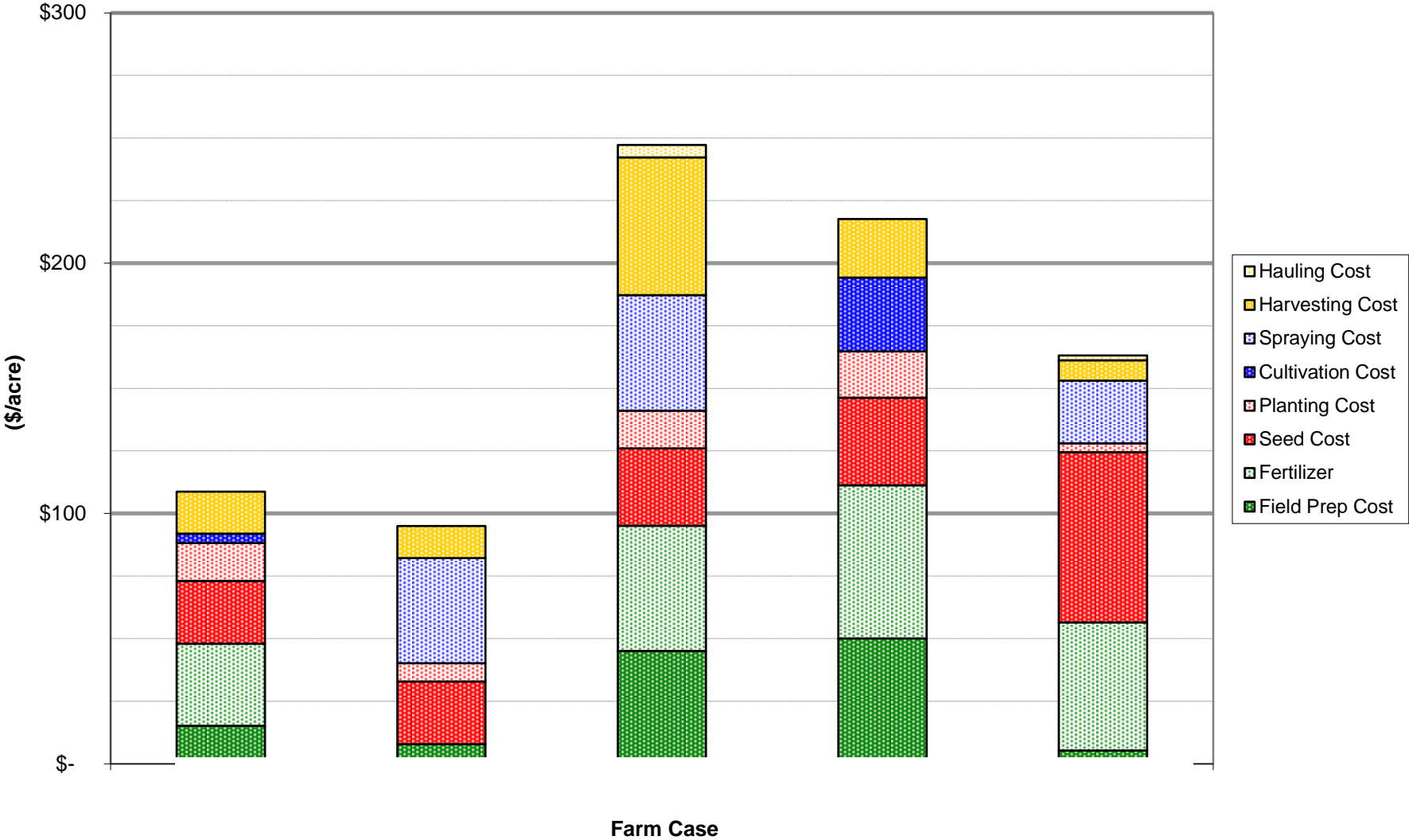


Spontaneous combustion, a very real hazard!

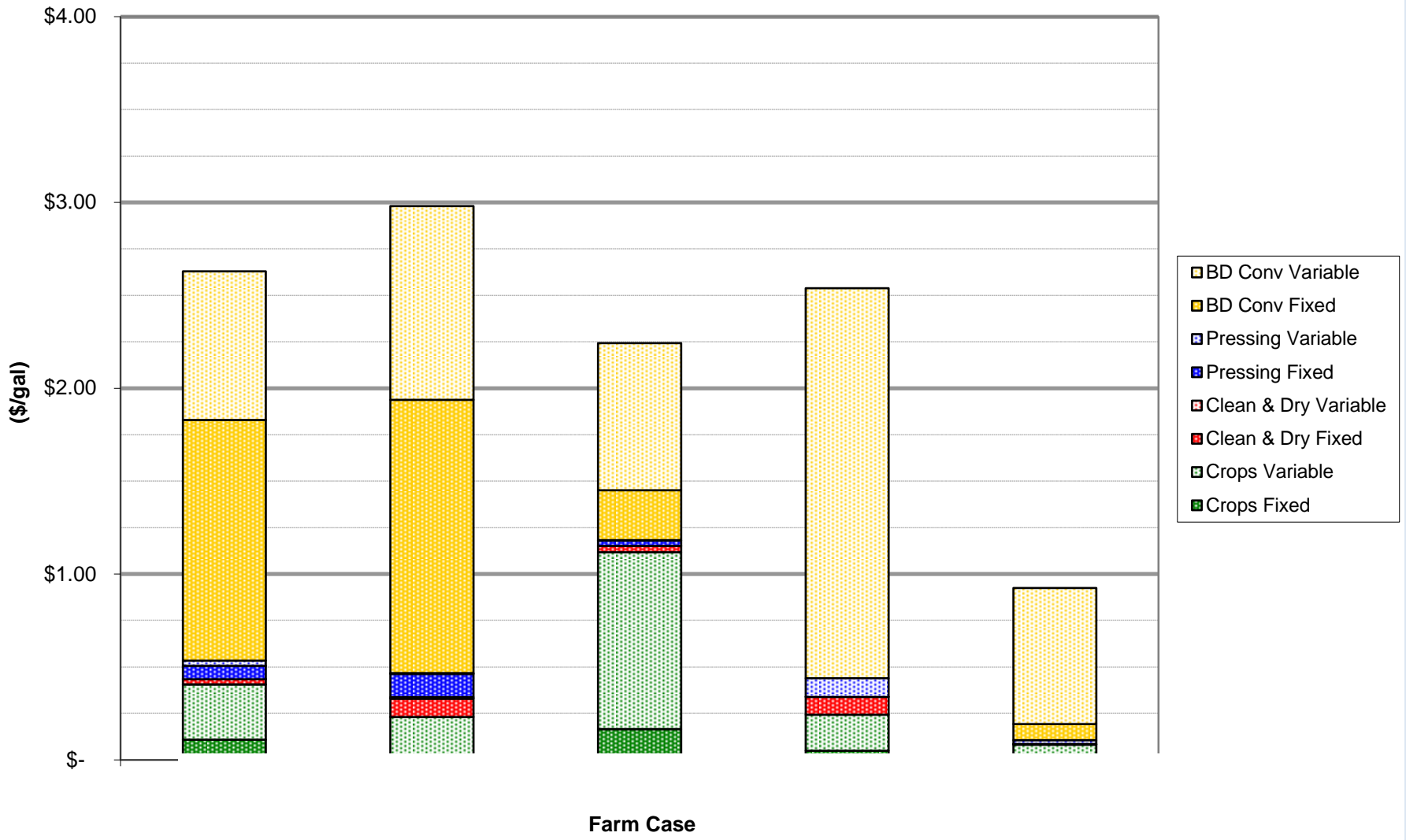
- Oily sawdust, paper towels or rags must not pile up!
- Warm days, moving air
- Wash out rags and hang to dry
- Store in bucket of water
- Use a fire can or tight metal trash can
- Disperse in dumpster



Cost Breakdown of Oilseed Crop Production



Cost Breakdown of Biodiesel



www.uvm.edu/extension/cropsoil/

The screenshot shows the website for the Northwest Crops & Soils Program at the University of Vermont. The header includes the UVM logo and navigation links such as 'ABOUT UVM', 'ADMISSIONS', 'ACADEMICS', 'STUDENT LIFE', 'RESEARCH', 'ATHLETICS', 'OFFICES', and 'OUTREACH'. A sidebar on the left lists various topics like 'Forages', 'Grains', and 'Soil Health and Nutrient Management'. The main content area features a 'Welcome' message and a large banner with the text 'NW CROPS & SOILS PROGRAM' and a collage of images showing agricultural activities. Below the banner, there is a 'Follow us:' section with social media icons for YouTube and Facebook. The text below the banner states: 'The mission of the UVM Extension Northwest Crops and Soils Team is to provide the best and relevant cropping information, both research-based and experiential, delivered in the most practical and understandable ways to Vermont farmers.'

OUT CROPPINGS: Important crop news from the field!

Northern Corn Leaf Blight Once again, We have seen increased Northern Corn Leaf area. Northern leaf blight is a fungal disease found in humid climates wherever corn is grown. Click [here](#) to download a Cereal Grain Test Submission Form.

Cereal Grain Testing comes to the Green Mountains! UVM Extension Northwest Crops and Soils Laboratory is up and running! Our lab is currently accepting samples and will continue to accept samples through the end of the year. Click [here](#) to download a Cereal Grain Test Submission Form.

Northeast Hop Alliance Presents Hops 101 and 201 Courses, Saturday-Sunday, October 10-11, 2014, Fenimore Art Museum Cooperstown, NY 13326. Click [here](#) to download a pdf flyer of the course.

The screenshot shows a YouTube channel page for 'UVM Ext Crops & Soils Team'. The channel name is 'cropsoilteam' and it has 136 subscribers. The main video is titled 'Evaluating the Potential to Graze Fall Seeded Grains' and features Dr. Heather Darby, UVM Extension Agronomist. The video description reads: 'From cropsoilteam | June 11, 2014 | 136 views Heather Darby, UVM Extension Agronomist describes an on-farm research trial looking at the potential to graze fall seeded grains.' The right sidebar shows a list of other videos, including 'Fallcorn Wheat Harvest', 'Sowing Wheat: Certified Seed vs. Uncertified Seed', 'Soil Myers Tests: Aggregate Stability', 'Early Season Tillage and Grazing', 'Planting and Grazing in a Corn Field', 'Home-grown vs. Mill Flour', and 'Adjusting a Corn Planter'. The bottom of the page shows a 'Recent Activity' section with a video titled 'Cropsoilteam' and a 'Post Bulletin' button.