PHYTOPHTHORA MANAGEMENT WITH BRASSICA BIOFUMIGATION

Gordon Johnson
Extension Fruit and Vegetable Specialist

UNIVERSITY OF DELAWARE
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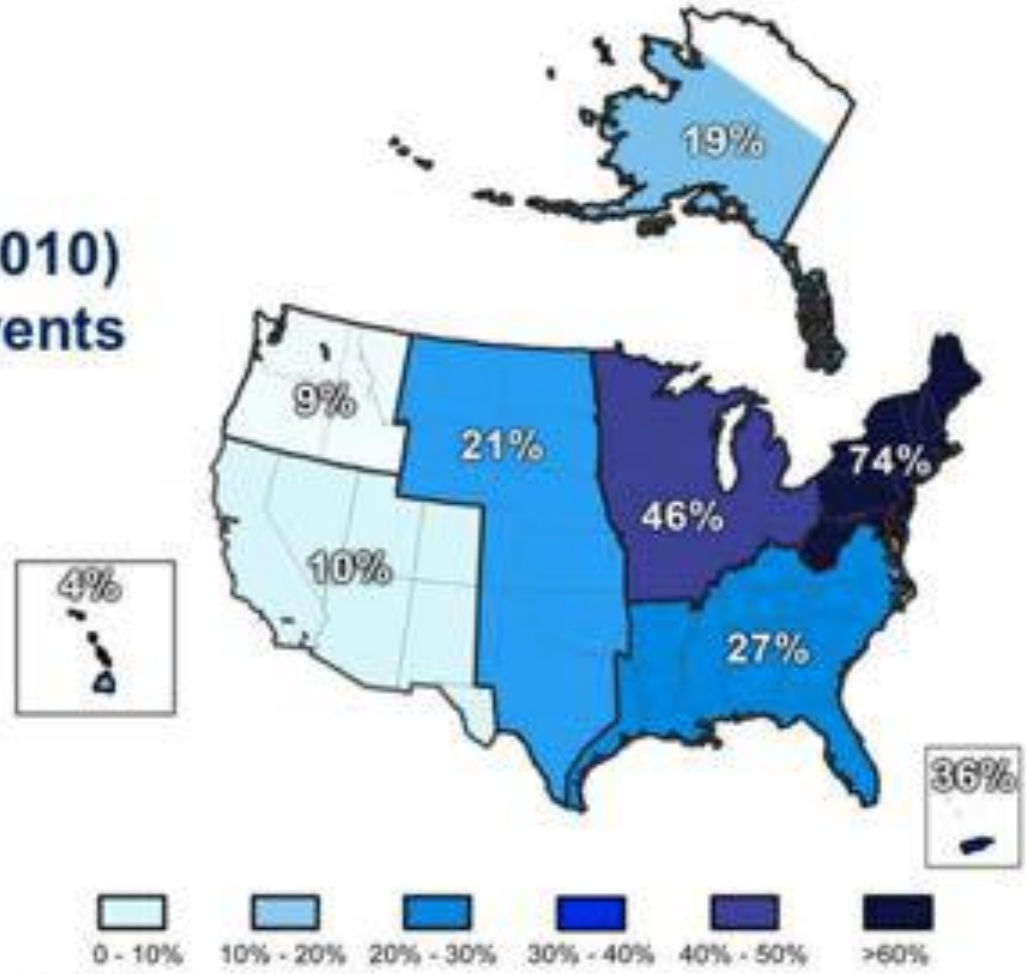
COOPERATIVE
EXTENSION

Problem

Regardless of Shifts in Total Annual Rain More of It Is Coming in Heavy Downpours

Percent Increase (1958-2010) in Heavy Precipitation Events (>2inch/48 hr)



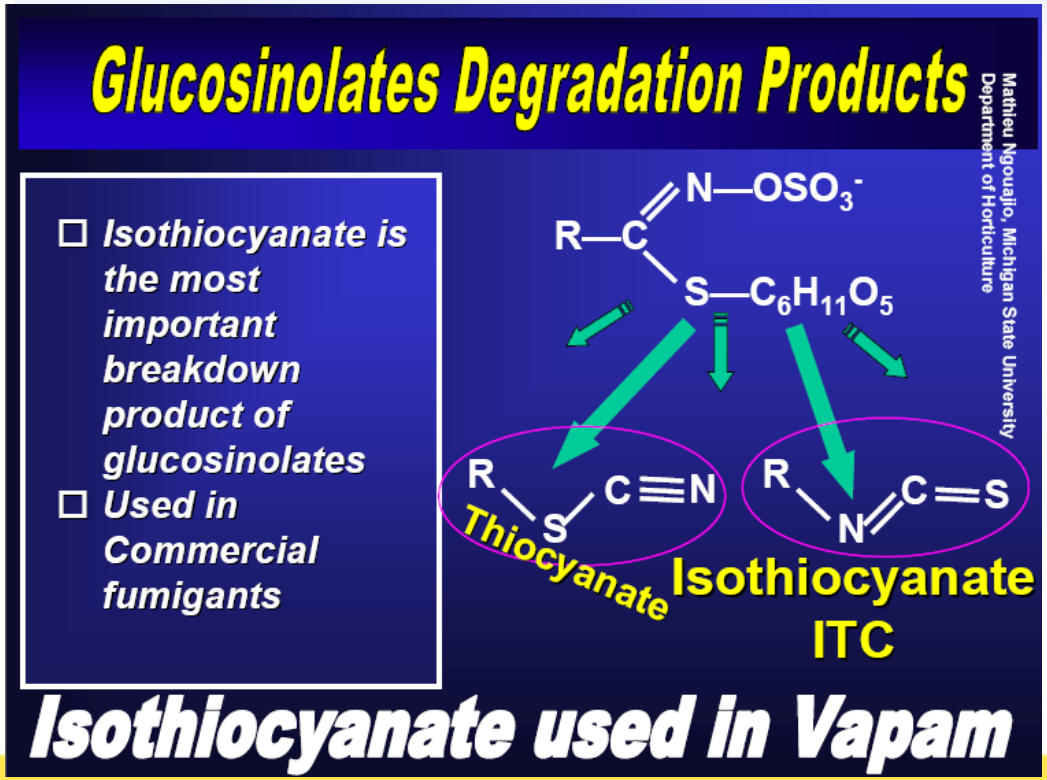
NOAA, provided by A. DeGaetano, NERCC, Cornell

Biofumigation with Brassica Species

Biofumigation With Brassica Species for Phytophthora Control

Table 1. Mustard classifications and common varieties.

Species names	Common	Varieties
Brassica napus	Canola Rapeseed	Dwarf Essex
Brassica juncea	Brown & Oriental mustards	**Brown:** Blaze, Common Brown **Oriental:** Pacific Gold, Cutlass, Forge, Lethbridge 22 Caliente blends
Brassica negra	Black mustard	
Brassica alba, Brassica hirta	White & yellow mustards	IdaGold, Martegena, Tinley



- What is Biofumigation?

  ″The suppression of various soil-borne pests and diseases by naturally occurring compounds″

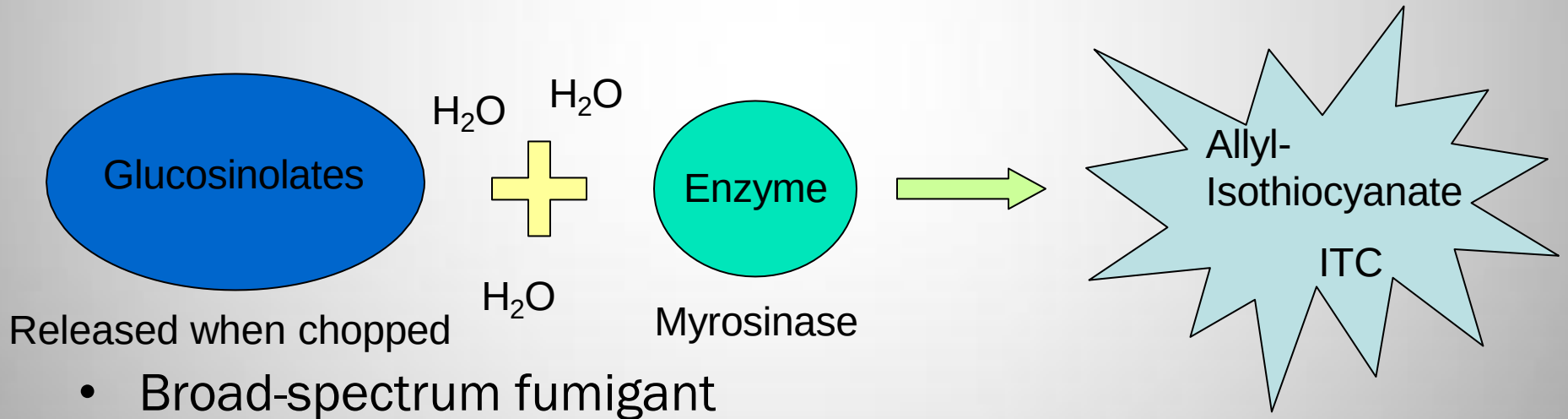
  Brassicas commonly used: **mustard**, **rapeseed,** canola and others

Rapeseed

‘Caliente’ Mustards

How does it work?

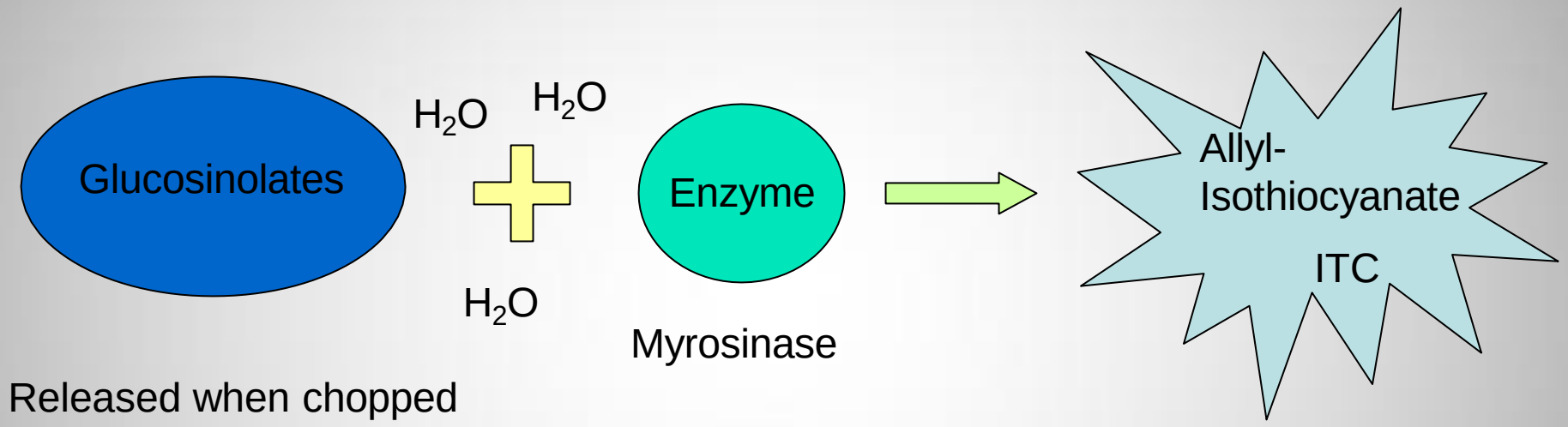
- Brassicas naturally produce *glucosinolates*
  - Sulfur compound that makes certain brassicas “hot/spicy”
  - Essential component in biofumigation



Similar to active ingredient in *Vapam* (methyl-isothiocyanate)

- Broad-spectrum fumigant
- Need 10-60 x typical biomass to equal Vapam concentration

Facilitate Biofumigation reaction in the field



- In sequence:
  - Chop >incorporate > seal > (irrigate?)
- ITC is volatile (gas): Activity time is limited!


M. McGrath


D. Gies


D. Gies

Big hopes for Biofumigation

- Soil-borne disease suppression
  - Fusarium, Verticillium, Rhizoctonia, Pythium, Sclerotinia, Botrytis, Phytophthora
- Nematode suppression
  - Root knot and root lesion nematode
- Weed seed germination suppression

- Meg McGrath

  Cornell Plant Pathology & Plant Microbe Biology

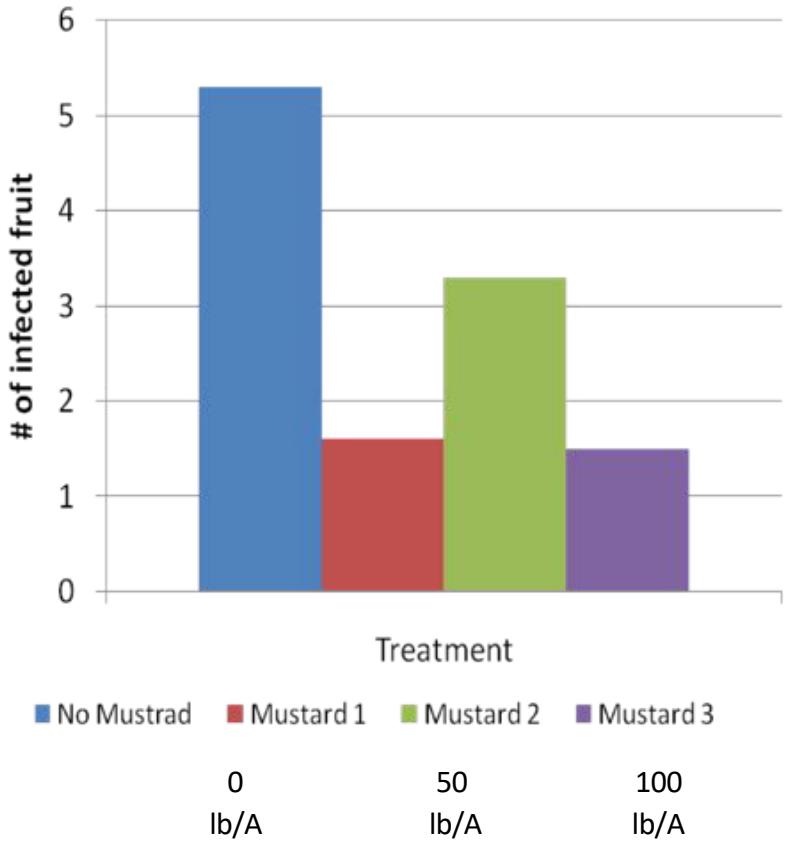
- Sandy Menasha- Extension Veg. Specialist, Suffolk Co.

  Cornell's Long Island Horticulture Research and Extension Center (LIHREC)

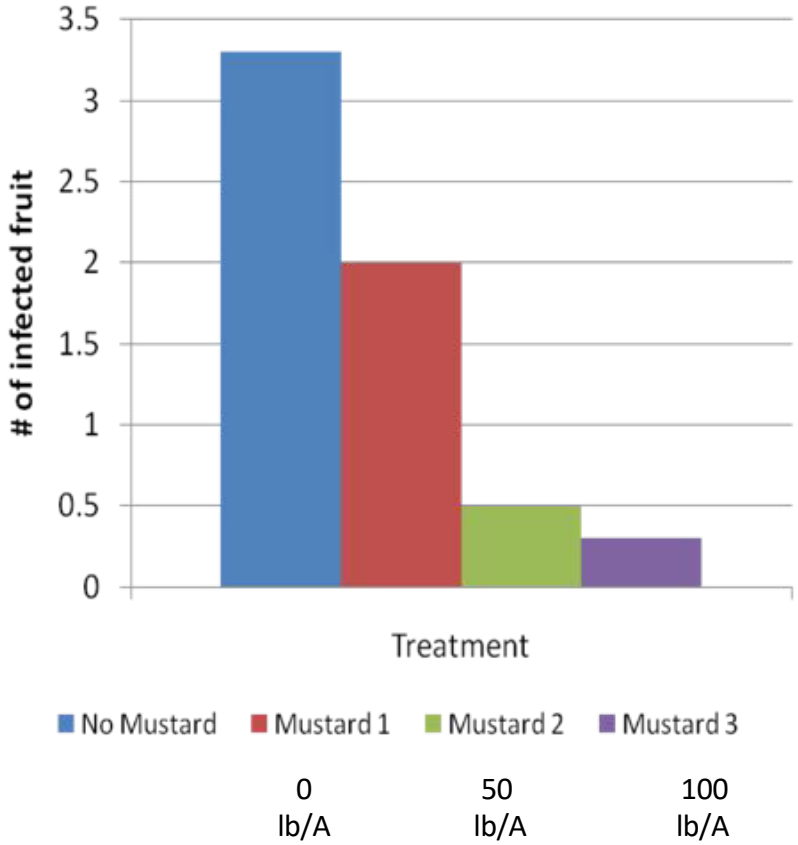
  - Preliminary studies with P-cap
  - Some good grower feedback

Phytophthora Fruit Rot Incidence

2009



2010



cf. Sandy Menasha

Beyond biofumigation

- Adds organic matter
  - Improve soil fertility
  - Catch cropping & nutrient cycling
  - Improve infiltration and water holding capacity
  - Improve soil aeration
  - Healthy soils > soil borne disease suppression
- Attracts beneficials
- Weed suppression
- Applicable in organic and IPM stystems both

Biofumigation Equipment

Mower (flail is rec'd)

- Ruptures brassica cells, releases glucosinolates

Tillage implement (rototiller rec'd)

- Increases biofumigant contact with soil borne pathogens

Packing implement (cultipacker rec'd)

- Seals in ITC biofumigant gas

Irrigation lines if droughty

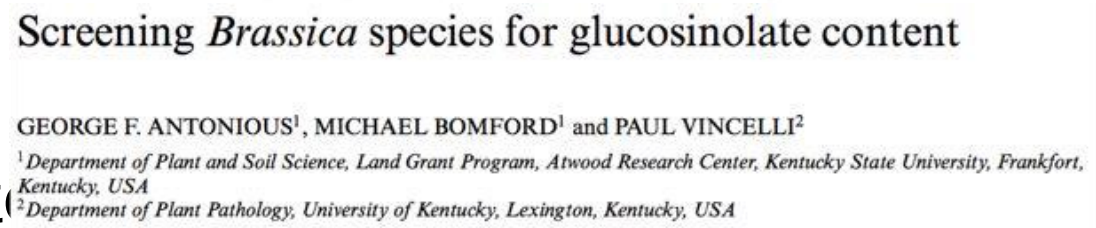
- Assures conversion of glucosinolates to ITCs
- Assures start of 7-14 day biofumigation period
- Helps seal soil surface to retain ITC gas

Growing for biofumigation

- Considerations

  Species/variety with high *glucosinolate* cont

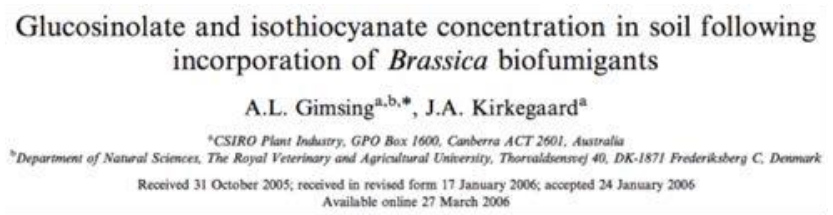
  - 'Caliente' varieties (*B. juncea*)
  - Mighty mustards
  - 'Pacific Gold' (*B. juncea*)
  - 'Ida Gold' (*B. campestris*)
  - *White mustard (Sinapsis alba)*
  - *Rapeseed, Canola (B. napus)*
  - *Arugula (Eruca vesicaria)*



Screening *Brassica* species for glucosinolate content

GEORGE F. ANTONIOUS[1], MICHAEL BOMFORD[1] and PAUL VINCELLI[2]

[1]*Department of Plant and Soil Science, Land Grant Program, Atwood Research Center, Kentucky State University, Frankfort, Kentucky, USA*
[2]*Department of Plant Pathology, University of Kentucky, Lexington, Kentucky, USA*



Glucosinolate and isothiocyanate concentration in soil following incorporation of *Brassica* biofumigants

A.L. Gimsing[a,b,*], J.A. Kirkegaard[a]

[a]*CSIRO Plant Industry, GPO Box 1600, Canberra ACT 2601, Australia*
[b]*Department of Natural Sciences, The Royal Veterinary and Agricultural University, Thorvaldsensvej 40, DK-1871 Frederiksberg C, Denmark*

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MUSTARD AND ARUGULA BLENDS

CALIENTE 199 MUSTARD BLEND:

Produces excellent biomass with high "bio-fumigation" potential. Contains ISCI 99, which until recently had the highest glucosinolate level of any commercial variety available. It has been the research standard for over 10 years. Responds to good fertility and management. Seeding Rate: 9-11 lbs/ac.

CALIENTE 119 MUSTARD BLEND:

Our original mustard blend using ISCI 20. Quick growth and good biomass under a wide range of conditions. Best planted early spring or late summer in most areas. Seeding Rate: 10-12 lbs/ac.

CALIENTE 61 MUSTARD BLEND:

Rugged, high biomass blend containing ISCI 61. Does better under hot, dry conditions than other varieties. Good variety for summer production in non-irrigated areas with limited/intermittent rainfall. Seeding Rate: 5-7 lbs/ac.

NEMAT ARUGULA BLEND:

High glucosinolate producing arugula that is an excellent trap crop for root knot and sugar beet cyst nematode. Shows good disease and weed suppression also. Plant in spring, summer, or fall. Very cold and drought tolerant. Over-winters in many Northern climates in the rosette stage. Mowing at bloom maintains cover for longer periods, improving nematode trapping potential. Can be utilized in vineyards and orchards. Seeding Rate: 5-7 lbs/ac.

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NEMAT/CALIENTE ROJO ARUGULA-MUSTARD BLEND:

Arugula/mustard blend designed to enhance nematode and wireworm suppression in organic production or conventional IPM programs, while providing excellent green manure biomass for improved soil tilth and disease and weed suppression. Seeding Rate: 6-9 lbs/ac.

NEMAT/CALIENTE 199 ARUGULA-MUSTARD BLEND:

Arugula/mustard blend designed for high biomass production and improved nematode suppressioin, especially in IPM programs combine with chemical nematicides. Excellent disease and weed suppression also. Seeding Rate: 6-9 lbs/ac.

NEMAT/ CALIENTE 61 ARUGULA-MUSTARD BLEND:

Arugula-mustard blend designed for summer and/or non irrigated conditions. Good drought and heat tolerance. Excellent biomass with adequate moisture and fertility. Seeding Rate: 5-7 lbs/ac.

MIGHTY MUSTARD®

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Trifecta Power Blend™

The three most powerful biofumigant mustards in one convenient blend.

Primary actions:

- **Sinalbin Glucosinolates (a.k.a. 4-Hydroxybenzyl)** suppress broadleaf weeds.
- **Sinigrin Glucosinolates (a.k.a. Allyl or 2-Propenyl)** reduce pathogens and harmful nematodes.

Secondary actions:

- Produces greatest volumes/tons of organic matter
- Captures & recycles soil nutrients
- Improves soil aeration & water penetration
- Reduces wind & water erosion
- Blossoms attract beneficial pollinators
- Trap crop for crucifer flea beetles and cabbage aphids

Growing for biofumigation

- Considerations

  <u>TREAT IT LIKE A CASH CROP!</u>

  Crop rotation
  - Sequence before soilborne disease-sensitive cash crops
  - Distance from brassica cash crops in time and space
  - Past herbicide?

  Season timing (~50-60d growth)
  - Spring (April - June)
  - Winter (Sept - winterkill or May)
  - Late summer (Aug – Oct)*

Growing for biofumigation

- Seedbed preparation

  Conditioning for small seeded crop

  Weed-free

  Pre-plant fertility

  - Soil test recommended P, K, micros for mustards
  - Starter N (~20 lbs mimimum, esp. in spring!!)
  - S (~20 lbs or ~6:1 N:S ratio; gypsum will not lower pH)
  - *Your biofumigation can only be as good as your fertility*

Growing for biofumigation: Seeding

- Use drill (rec'd) or broadcast
- Seed depth: ¼ to ½"
- Mustards: 10-12 lbs/ac
- Rapeseed/Arugula: 6-8 lbs/ac
  - Late seedings, shortened season > can increase rate

Growing for biofumigation - Management

- Topdress N (usually needed)
  - 50-100 lbs/ac total applied N is optimal
  - Depends on crop history, inherent fertility
- Weed control?
- Irrigate if droughty

Growing for biofumigation

- What to Expect:
  - Begins flowering after ≥30 d usually ~2½-3’
    - Let it flower away!
  - Viable seed 6 weeks from flower
  - Doubles in height after flowering
  - Grows up to ~5 ft
  - Incorporate 2-4 weeks after flower
  - Biofumigation potential drops after maturity
    - Mustard weed seed after maturity

Biofumigation – wait to plant next crop

- ~10 day biofumigation recommended
- Should inhibit weed seed germination by default
- SO- do not plant crops in biofumigating soils also- poor germ risk!
- Light tillage after biofumigation period will help assure release of any remaining gases

RKN Nematode biofumigation research UD Not reliable method