

Crop Disease Research Update 2017 season

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CROPS

- Wheat: Scab
- Canola: Blackleg, White Mold, Club root
- Soybeans: White Mold
- Sunflowers: Head rot

Efficacy of commercially available fungicides in managing Canola black leg

| Treatment | Dosage | Application | Black Leg | | Yield | Test Weight |
|-------------|-----------|----------------|---------------|----------------|---------|-------------|
| | (Fl oz/A) | Timing | Incidence (%) | Mean Severity* | (lbs/A) | (lb/bu) |
| Non-treated | Check | Check | 36 | 0.48 | 2646 | 52 |
| Headline | 6 | 2-4 leaf+14DAA | 29 | 0.25 | 2385 | 52 |
| Priaxor | 6 | 2-4 leaf+14DAA | 21 | 0.34 | 2479 | 52 |
| Proline | 4 | 2-4 leaf+14DAA | 20 | 0.28 | 3121 | 52 |
| Mean | | | 27 | 0.34 | 2657 | 52 |
| CV (%) | | | 63 | 41 | 11 | 0.3 |
| LSD | | | 26 | 0.21 | 438 | 0.25 |
| p-Value | | | NS | NS | 0.01 | NS |

*Black Leg Mean Severity: was calculated by multiplying the category value (0-5)*actual severity (0.2,0.4,0.6,0.8,1.0), and summing, then dividing by the infected plant count.

NIS: Non-Ionic Surfactant was added at 0.25% V/V in all the fungicide treatments.

Fungicide Evaluation to Manage White Mold in Canola

| Treatments | Dosage | White Mold | Yield | Test Weight |
|--|-----------|------------|---------|-------------|
| | (F1 oz/A) | DSI* | (lbs/A) | (lbs/bu) |
| Approach + NIS | 9 | 0.03 | 3794 | 52 |
| Endura + NIS | 6 | 1.33 | 4086 | 52 |
| Proline + NIS | 4.3 | 0.28 | 4200 | 52 |
| Quash + NIS | 3 | 0.19 | 3968 | 52 |
| Topsin | 231(g/A) | 0.23 | 4372 | 52 |
| CHECK | Check | 1.46 | 3769 | 52 |
| Mean | | 0.59 | 4031 | 52 |
| CV (%) | | 59 | 14 | 0.76 |
| LSD | | 0.62 | 1014 | 0.7 |
| p-Value | | 0.0006 | NS | NS |
| NIS: Non-Ionic Surfactant 0.25% V/V | | | | |
| DSI*: White Mold Disease Severity Index | | | | |
| NS: Non-Significant | | | | |



Evaluation of various chemicals, cruciferous hosts and canola cultivars to manage clubroot on Canola in field condition

Clubroot



- Caused by a pathogen *Plasmodiophora brassicae* belong to lower group of living organisms called Protista
- Not a fungus/amoeba/slime mold but has some characters similar from each
- A serious yield robbing disease of brassica crops
 - E.g. Canola, cauliflower, cabbage, rutabaga, radish, turnip, brussel sprouts, kale etc.
 - Susceptible brassica weeds: wild mustard, shepard's purse, volunteer canola, stink weed
- Prefers acidic soils but found in the soils of pH up to 7.2
- Once in the soil can live as resting spores up to 20 years
- Pathogen infects roots; causes galls there by restricting the flow of water and nutrients to the plant
- If 100% of plants infected results in 50-80% reduction in yields (Europe and Sweden Research)

Clubroot - The challenge

- Clubroot has been a regular finding ever since identified in Cavalier County, ND in 2013
- Clubroot has appeared in 2016, in the field where it has been identified in 2014
- In 2017 started spreading to neighboring fields (found in new fields too)

Challenges:

- Lack of understanding of pathogen biology
 - Lack of knowledge of Genetic resistance
 - No effective chemical control and
 - Lack of knowledge on rotations to be followed.
- A Clubroot survey group has been formed with one pathologist, two extension specialists and seven county agents to create awareness of clubroot and its management in 2016.

Objectives



Plot lay out of three objectives

1. Chemical efficacy
2. Host susceptibility
3. Response of Commercial cultivars



Evaluation of chemicals, fungicides and soil ameliorating products

| Treatment | Tradename | Dosage |
|----------------------|---------------|---|
| Cyazofamid | Ranman | 7.5 l/ha |
| Fluazinam | Allegro | 2000 g/ha |
| PCNB | Terrachlor | 67.5kg/ha |
| Wood ash | Lime | 7.5t/ha |
| Calcium Carbonate | Lime stone | 7.5t/ha |
| Beet lime | Versa Lime | 15 t/ha |
| Gypsum | Gypsum | 7.5 t/ha |
| Nano Particle | Zn | 500mg/L of Zn |
| Non-Ionic surfactant | Aqua-Gro 2000 | 10g/m just before planting Incorporated into rows |
| Non-treated | CHK | |

Planted on: 6/8/2017
Plot size:5ft Length
3ft. Width
Replicated 4 times
Rated on:7/31/2017

Methodology



Evaluation of chemicals, fungicides and soil ameliorating products

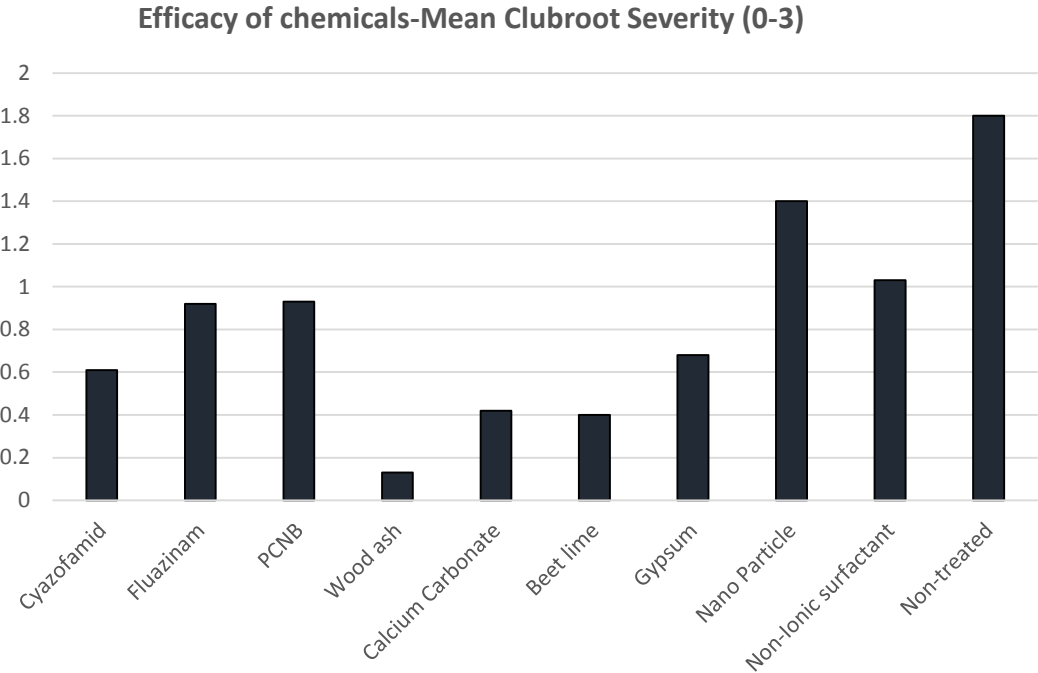
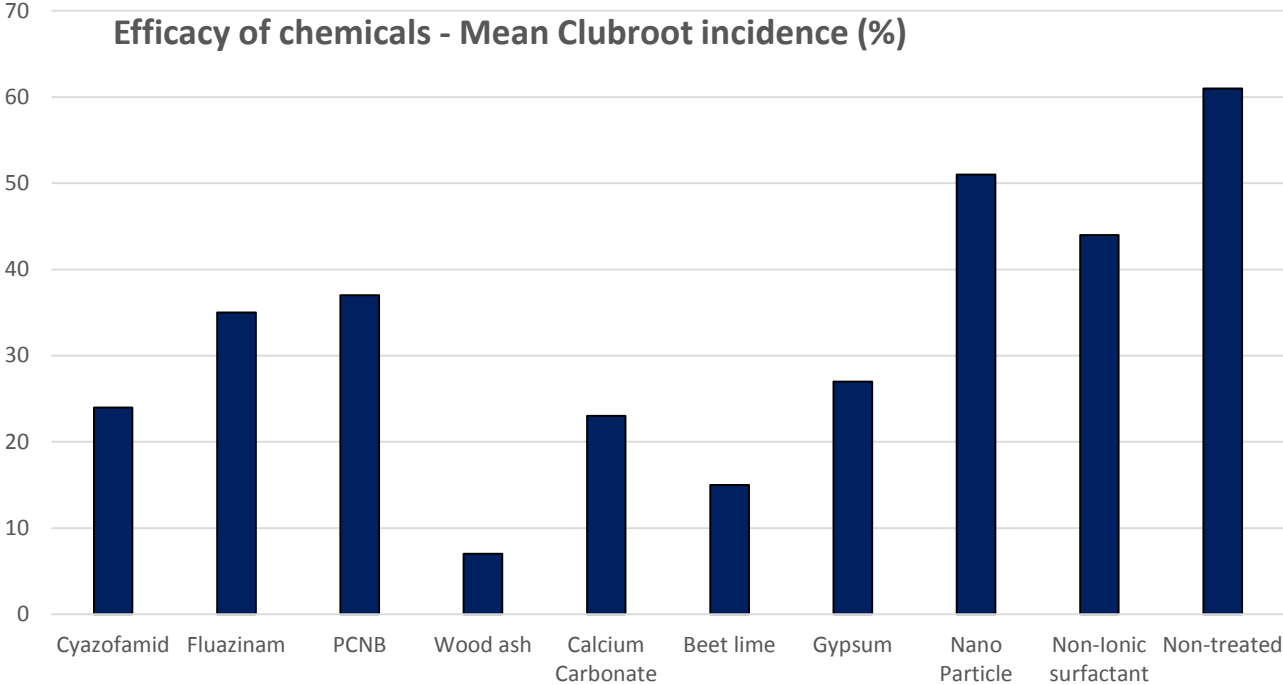


Clubroot rating scale

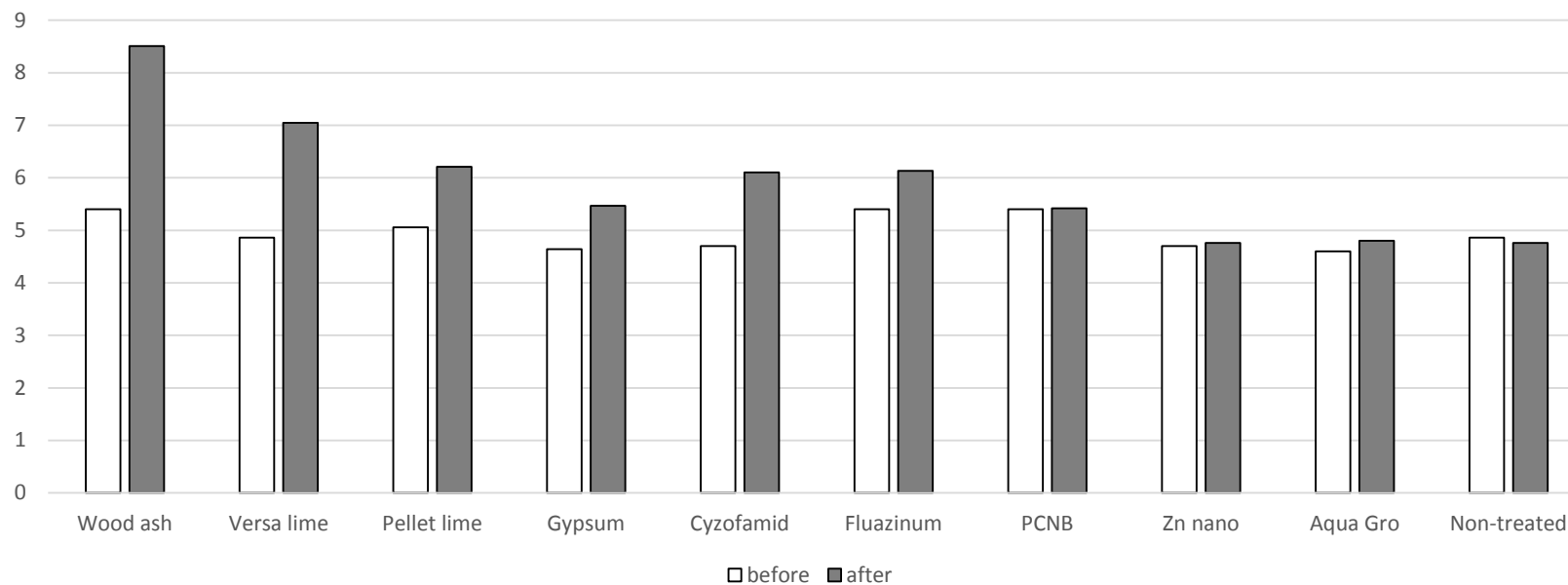


Fig. 1. Clubroot rating scale: 0 = no galling; 1 = a few small galls (small galls on less than 1/3 of roots), 2 = moderate galling (small to medium-sized galls on 1/3 to 2/3 of roots), 3 = severe galling (medium to large-sized galls on more than 2/3 of roots) (S.E. Strelkov)

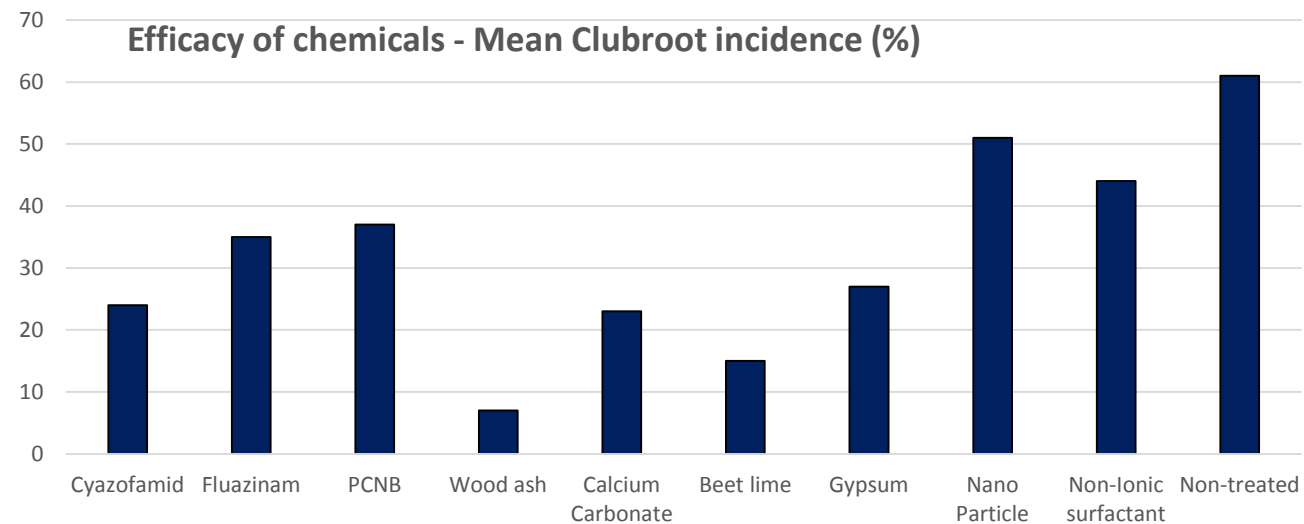
Objective 1: Evaluating the effects of adding fungicides and pH- altering soil amendments on clubroot of canola incidence and severity in field condition



Soil pH before and after application of soil amendments to manage clubroot on canola



Efficacy of chemicals - Mean Clubroot incidence (%)



Objective 2: Evaluating the symptoms caused by clubroot pathogen on various hosts of brassica family in field condition

Planted on: 6/8/2017
Plot size: 5ft Length
3ft. Width
Replicated 4 times
Rated on: 7/31/2017



Cabbage, Cauliflower, Brussel sprouts, Kale and Chinese cabbage (buck choy) were planted as seedlings
Shepard's purse, Wild mustard, Radish round, turnip and Arugula were direct seeded with hand.

Cabbage

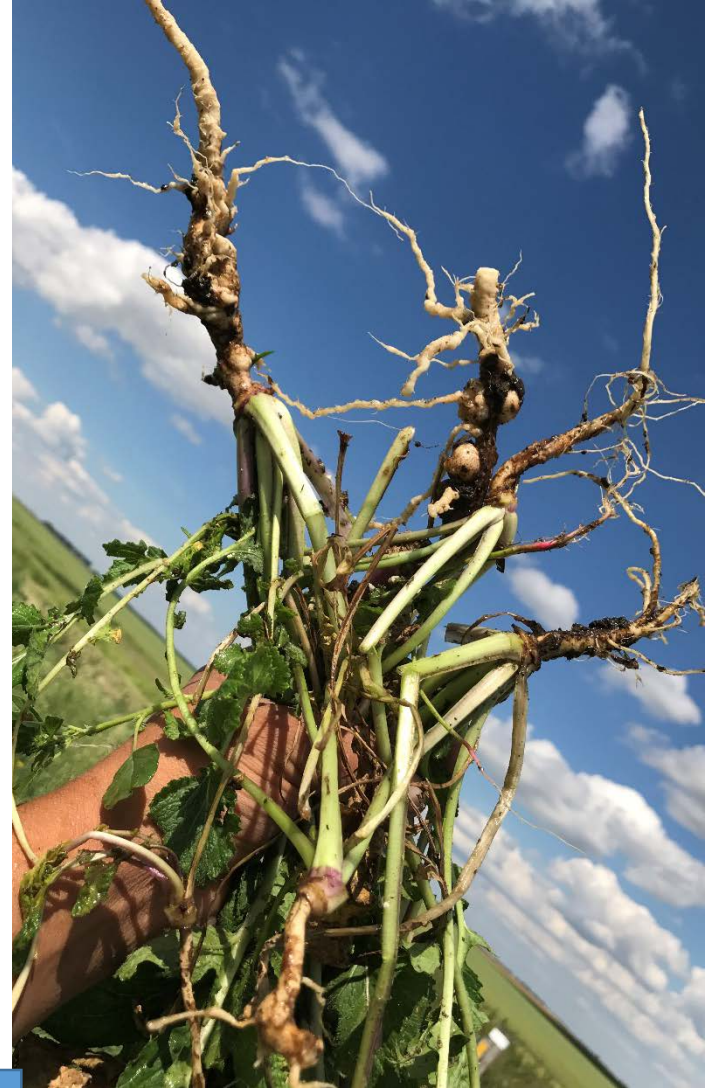


Cauliflower





Broccoli



Turnip

Radish Round



Arugula





Wild Mustard

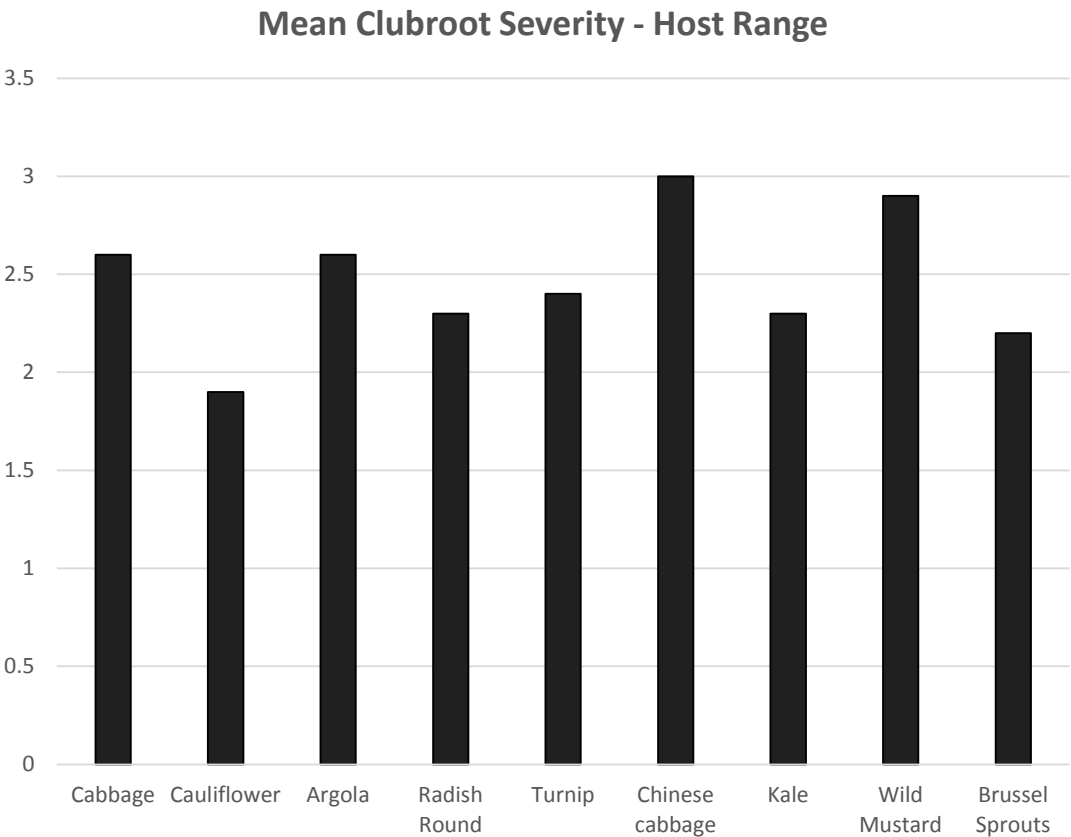
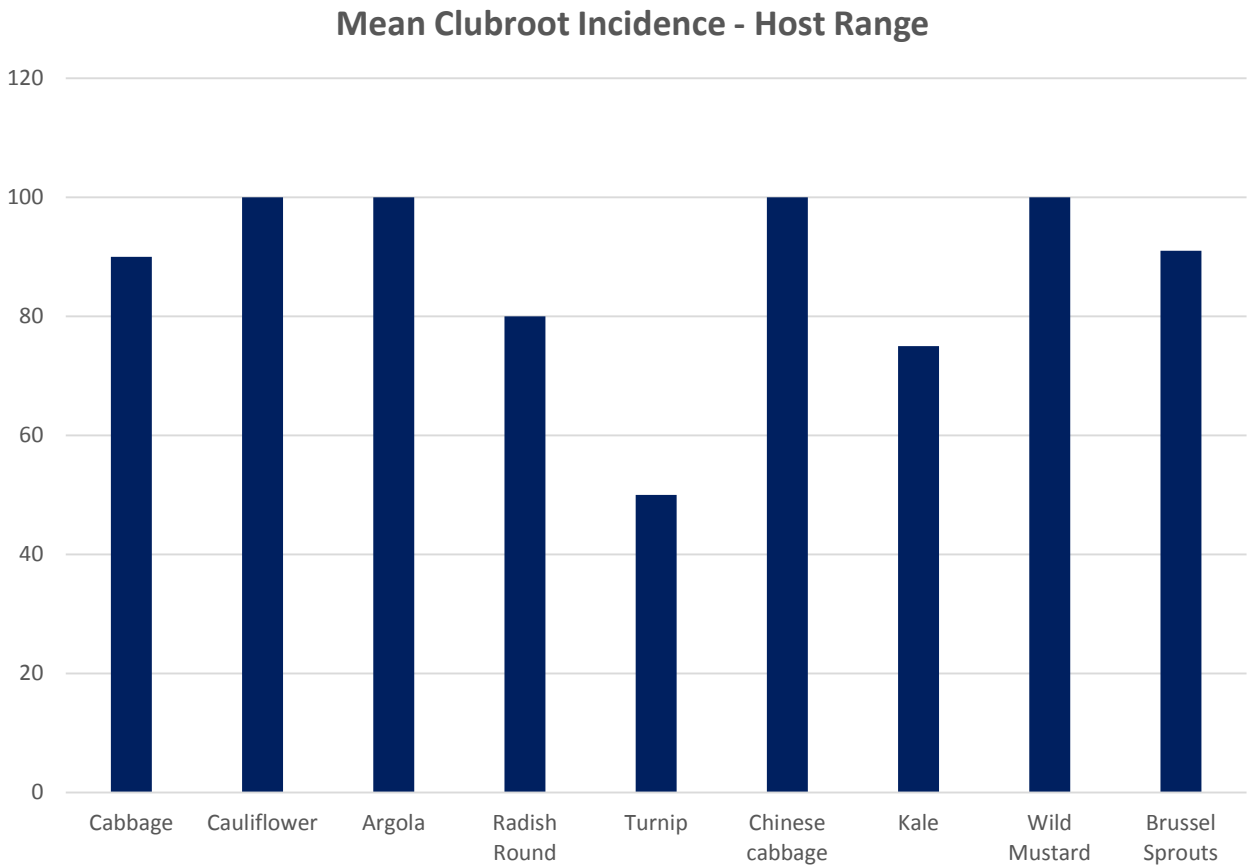


Kale

Chinese Cabbage



Objective 2: Evaluating the symptoms caused by clubroot pathogen on various hosts of brassica family in field condition



Objective 3: Evaluation of commercial Canola cultivars against clubroot pathogen in field condition

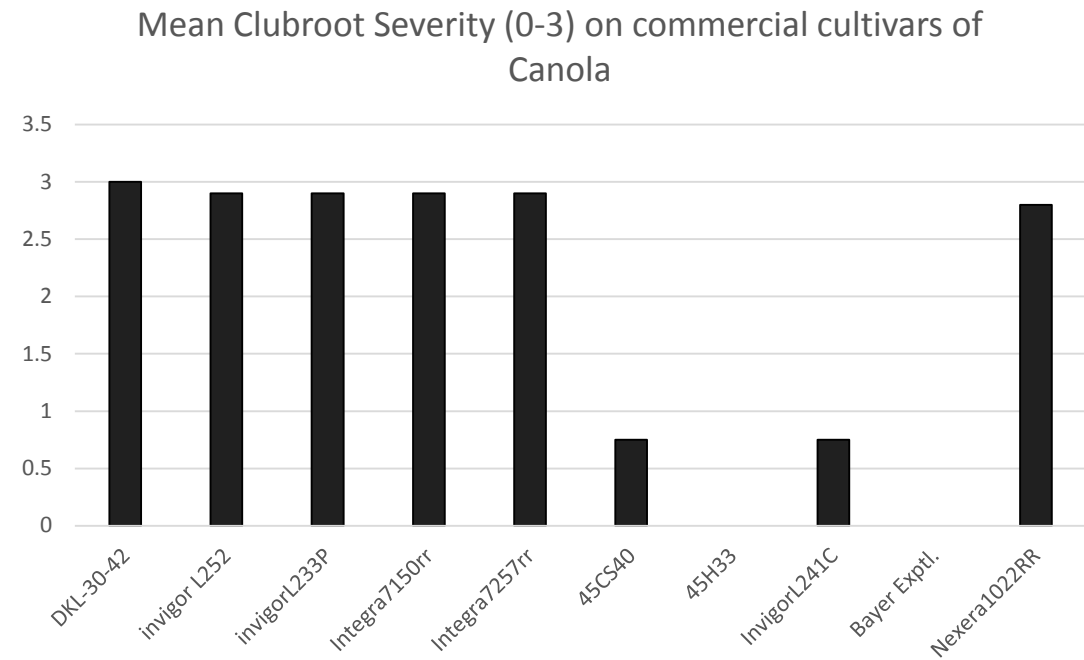
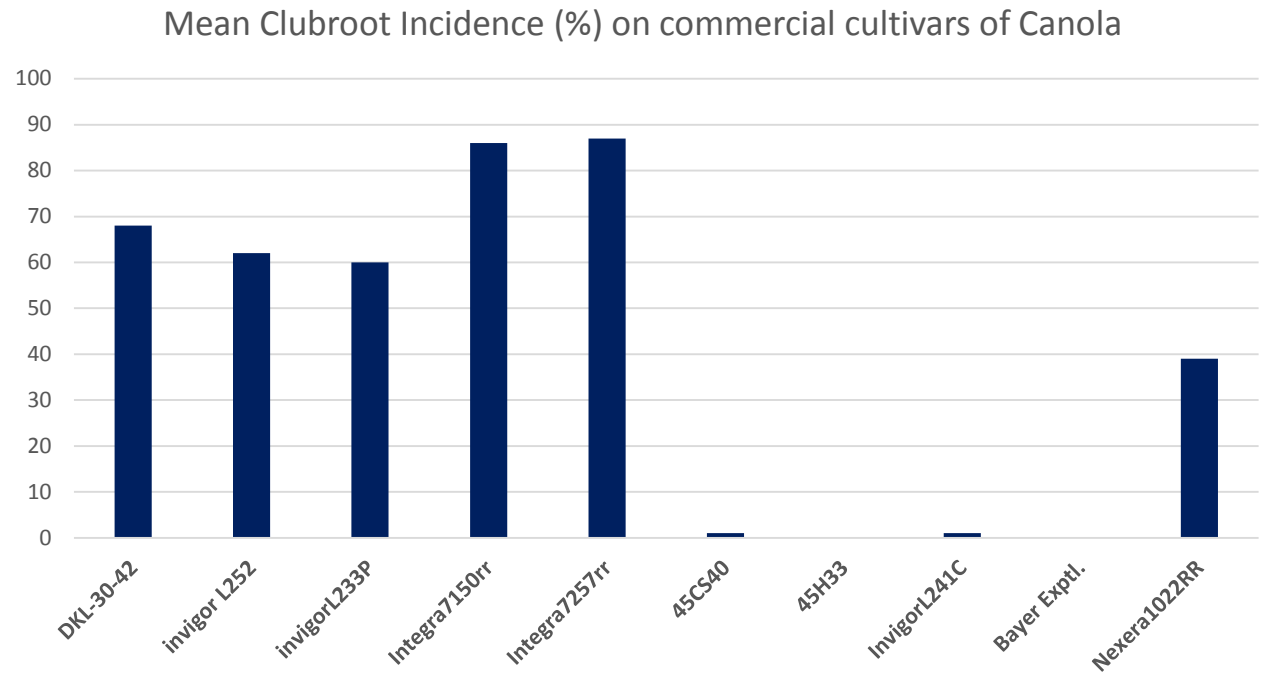


| S.No | Cultivar | Response | Source | Contact Person |
|------|-----------------------|-------------|---------------|--|
| 1 | DKL-30-42 | Susceptible | Purchased | Greg Engel Nowatzki Jon Vanderberg Jon Vanderberg Gary |
| 2 | Invigor- L252 | Susceptible | Grower | |
| 3 | Invigor- L233P | Susceptible | Grower | |
| 4 | Integra7150rr | Susceptible | Willbur Ellis | |
| 5 | Integra7257rr | Susceptible | Willbur Ellis | |
| 6 | 45CS40 | CR | Pioneer | |
| 7 | 45H33 | CR | Pioneer | |
| 8 | InvigorL241C | CR | Bayer | |
| 9 | Bayer Exptl. | CR | Bayer | |
| 10 | Nexera1022RR | ? | Simplot | |

Planted on: 6/1/2017
Plot size:5ft Length
3ft. Width
Replicated 4 times
Rated on:7/27/2017



Objective 3: Evaluation of commercial Canola cultivars against clubroot pathogen in field condition



Planted on: 6/1/2017
Plot size:5ft Length
3ft. Width
Replicated 4 times
Rated on:7/28/2017



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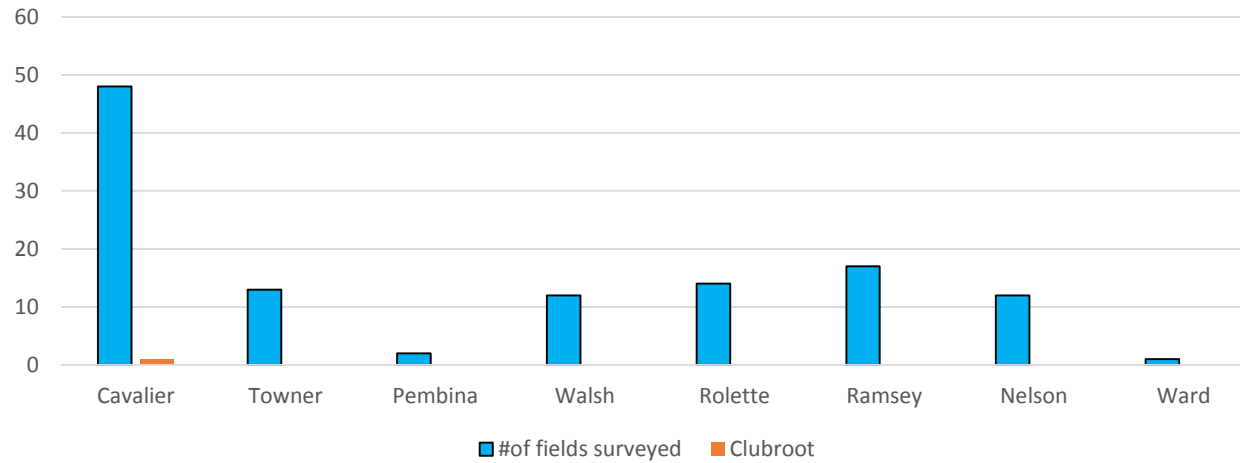
Clubroot Survey

- Collected stubbles and soil samples and were sent for molecular confirmation
 - Six out of 57 fields suspected of having clubroot from Cavalier county
 - Spreading to new fields as expected
-
- Thanks to all the county Extension agents of seven counties and The Extension Area specialists (Lesley and Naeem)

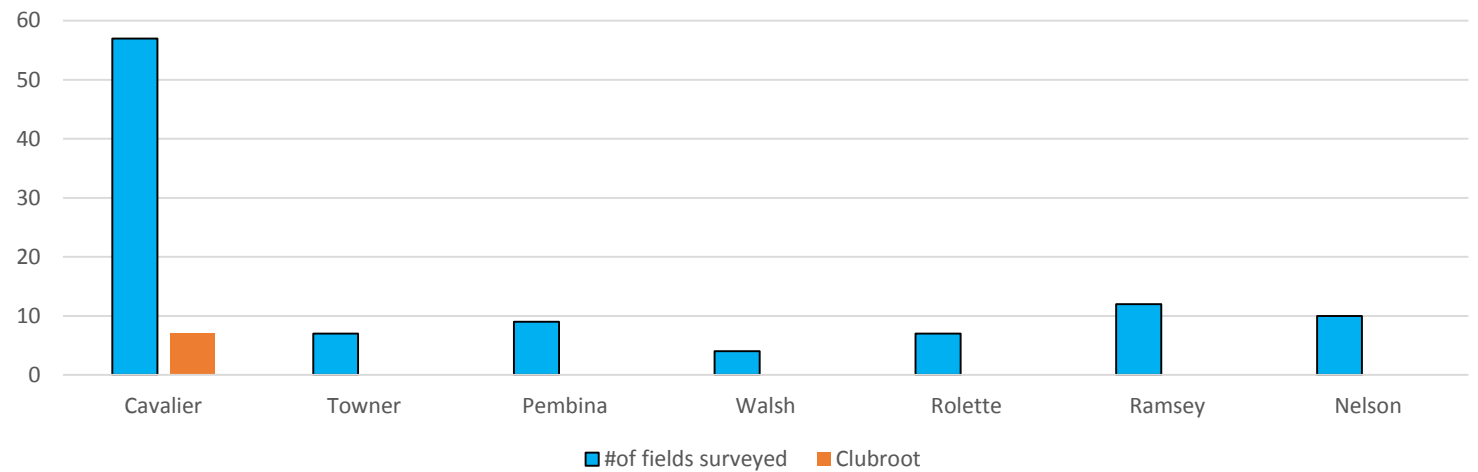


Clubroot Survey

Clubroot Survey 2016



Club root Survey-2017



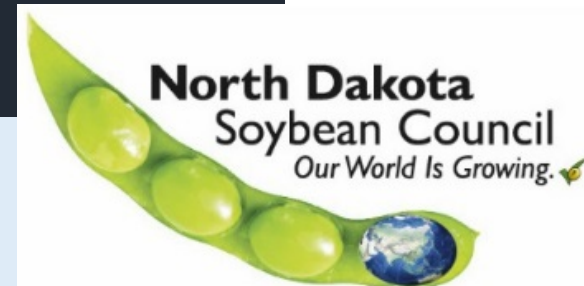
Soybean Disease Management Update

SCLEROTINIA MANAGEMENT IN SOYBEANS

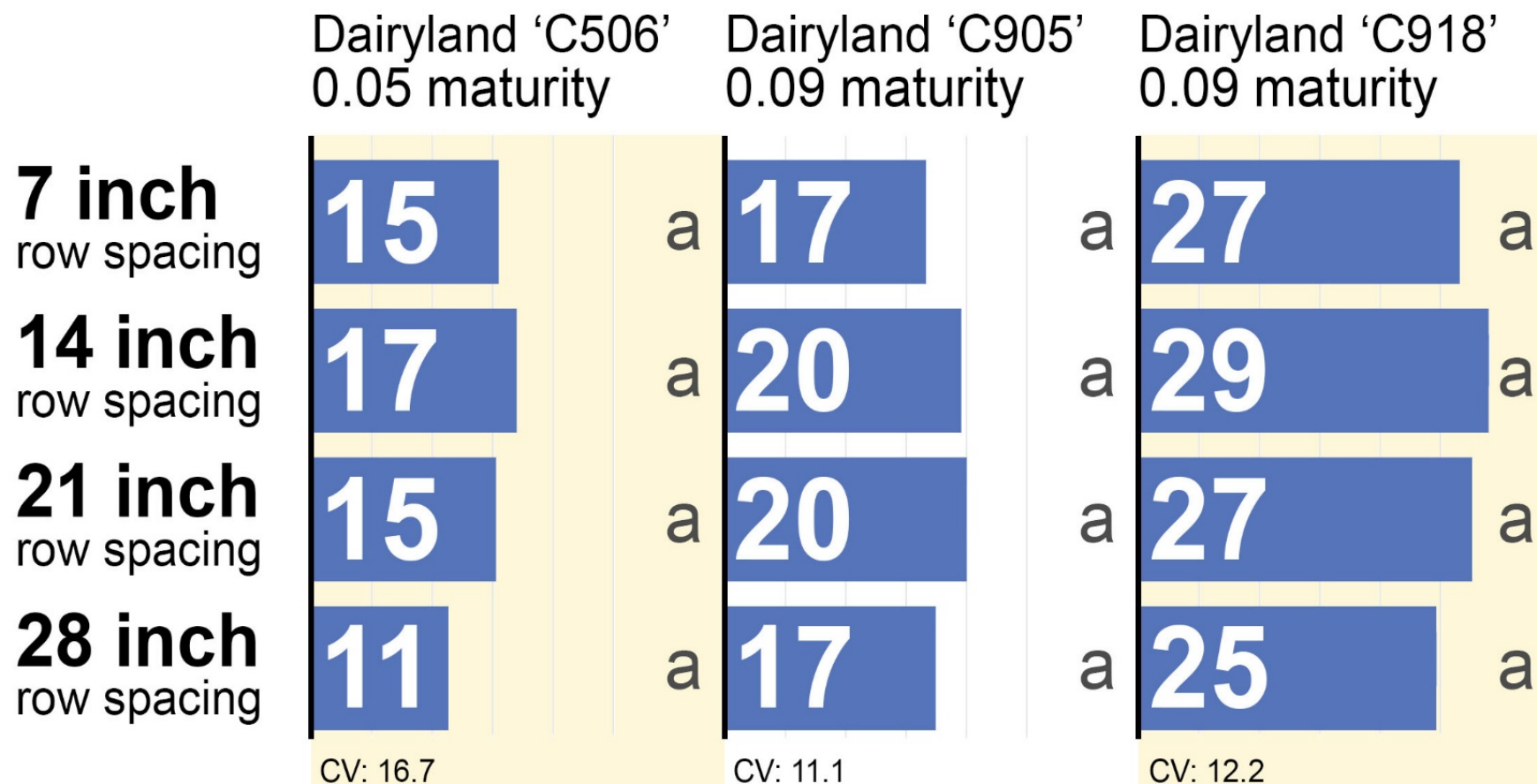
Row spacing

Langdon, ND 2015-2017: 00-maturity soybeans

Combined analysis across three years (2015, 2016, 2017)
and three seeding rates (132,000; 165,000; 198,000 viable seeds/ac)



White mold incidence (% of plants diseased)



Source: Dr. Wunsch

SCLEROTINIA MANAGEMENT IN SOYBEANS

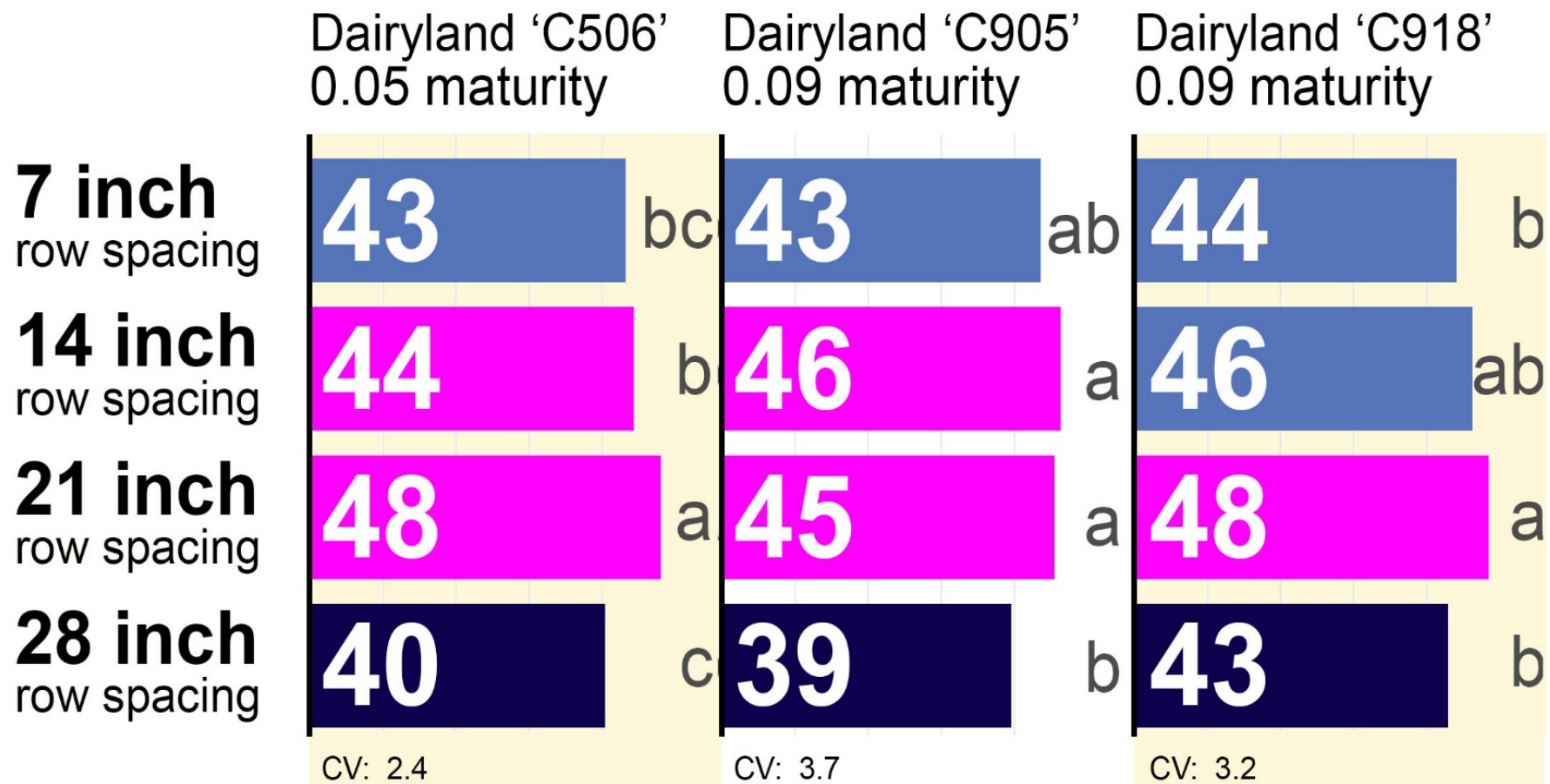
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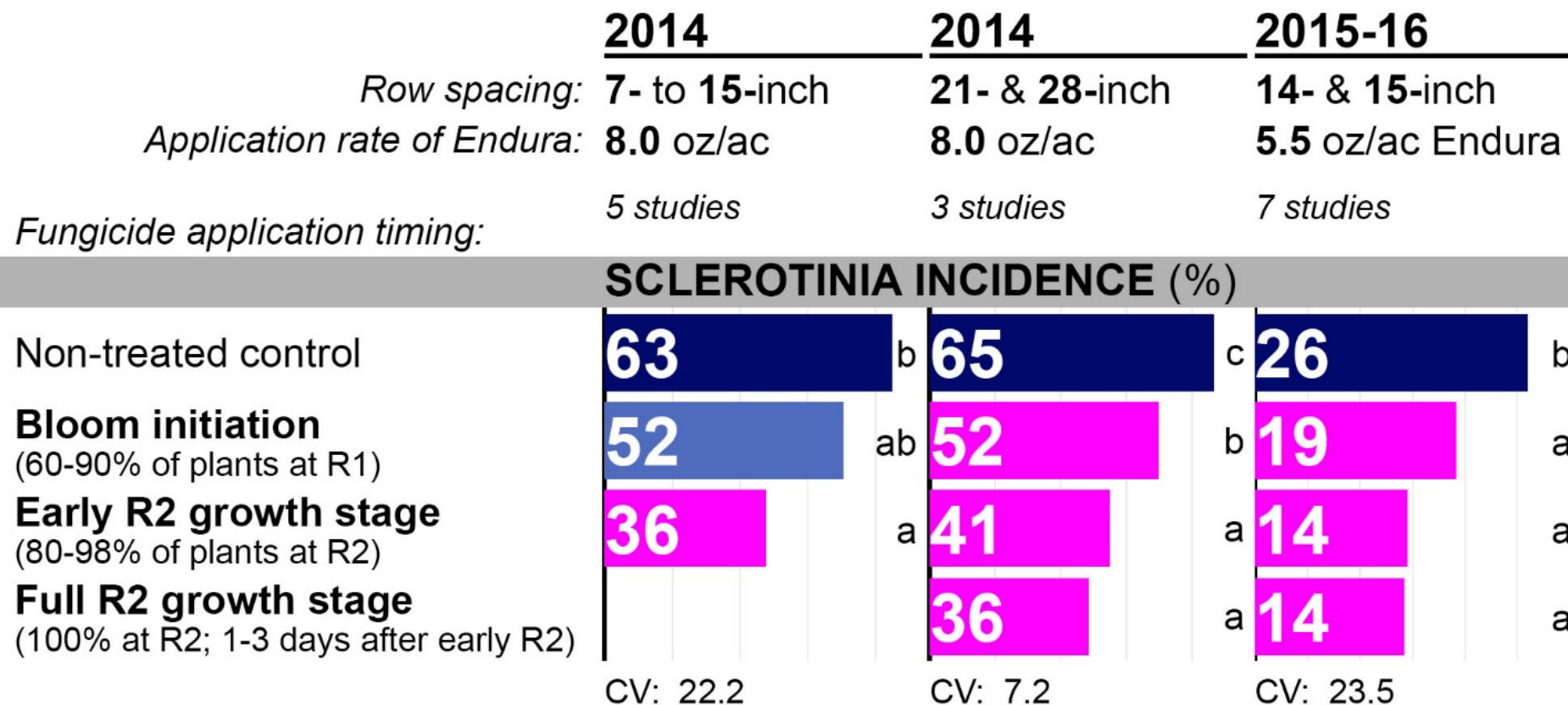
Yield (bushels/acre)



Source: Dr. Wunsch

SCLEROTINIA MANAGEMENT - Soybeans

Fungicide application timing



NDSU NORTH DAKOTA AGRICULTURAL
EXPERIMENT STATION

Endura 5.5 or 8.0 oz/ac, applied once

Active ingredient:

Boscalid 109 g or 159 g ai/ac

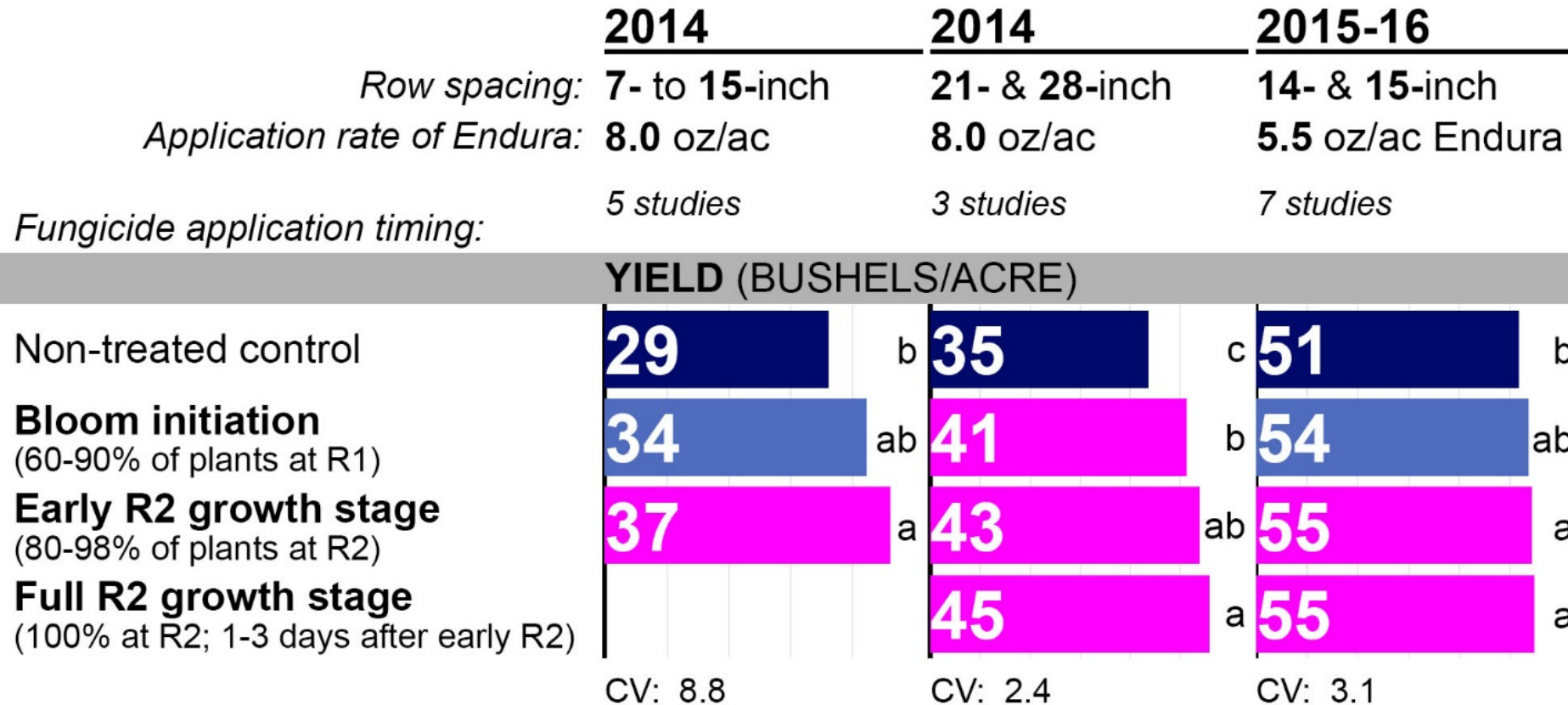
Fungicide application methods: 15 to 19 gal/ac, 35 or 40 psi, flat-fan nozzles with fine droplets

Study locations: Carrington, Hofflund, Langdon and Oakes, ND

Source: Dr. Wunsch

SCLEROTINIA MANAGEMENT - Soybeans

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Source: Dr. Wunsch

Management of Head Rot in Sunflowers Using Bee Vectoring Technology



Venkat Chapara and Amanda Arens
Langdon Research Extension Center

Pic Source: Agweek



Bee Vectoring Technology(BVT)



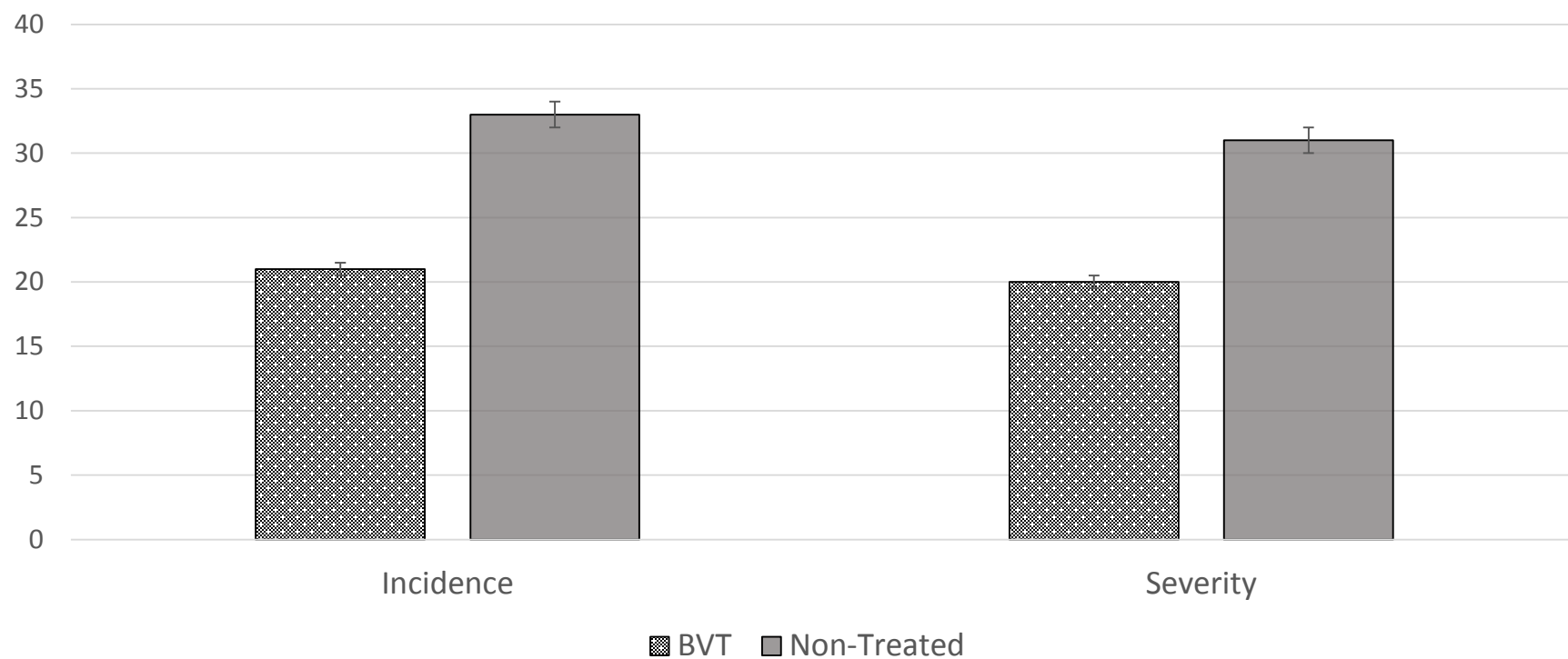
- Using Bees (Honey and Bumble bees) to deliver bio-controls to flowering crops
- Bio-agent *Clonostachys rosea* strain CR-7 ($1-4 \times 10^8$ spores/g) is the active ingredient
- CR-7 added to the vectorite (Talk like powder)
- Packed in a tray called vector pack
- Vector pack is placed in a beehive
- Bees deliver the treatment as they forage
- CR-7 is an endophyte



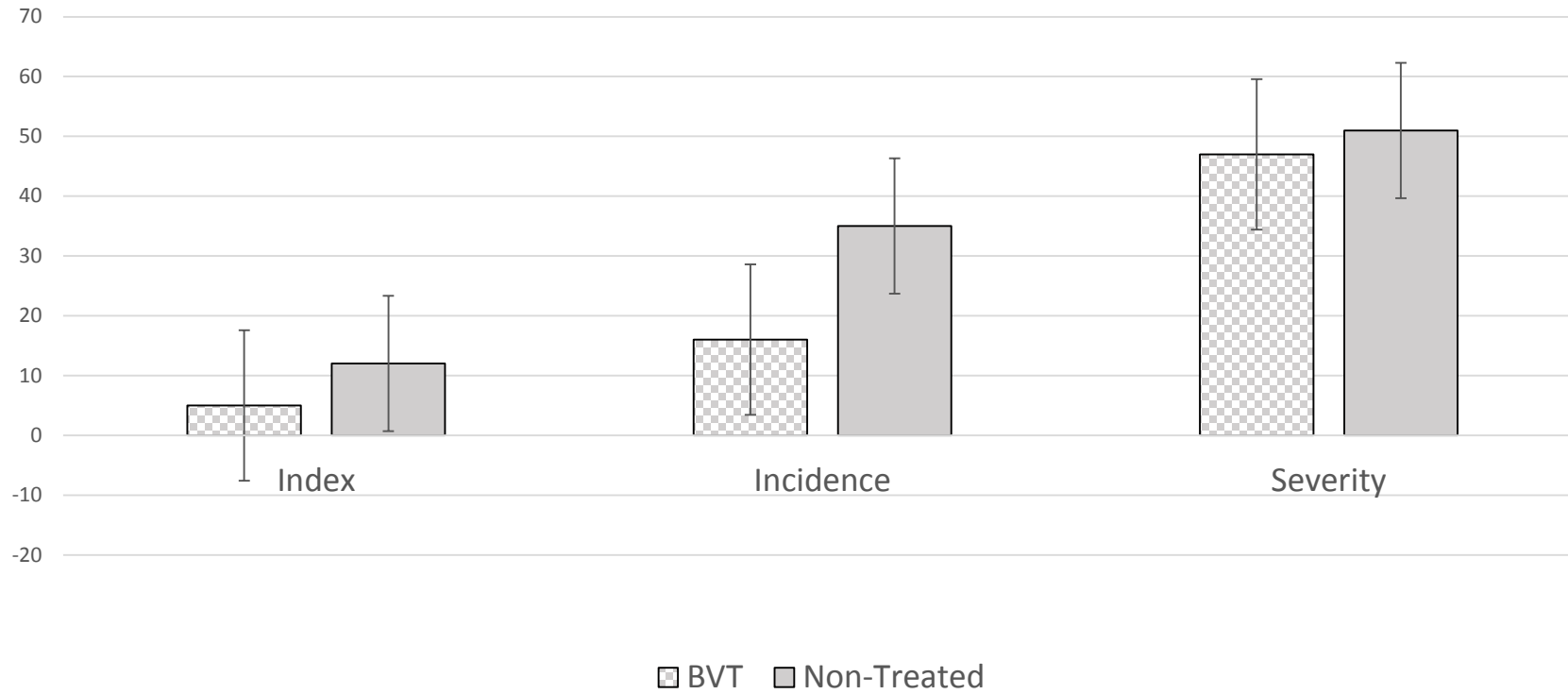
Bee hive set up in the field



Results-2016



Results-2017



Results From LREC

| | Sunflower Head Rot 9/8/2016 | | Sunflower Head Rot 9/14/2016 | | Sunflower Head Rot 9/22/2016 | | Yield | Test Weight | Oil |
|------------------------------------|--------------------------------|--------------|---------------------------------|--------------|---------------------------------|--------------|--------|-------------|-------|
| | Incidence (%) | Severity (%) | Incidence (%) | Severity (%) | Incidence (%) | Severity (%) | lbs/A | lbs/bu | G/A |
| Non-Treated | 15 | 7.7 | 32.5 | 19.1 | 38.8 | 30.57 | 1880 | 29.3 | 44.9 |
| BVT-CR7 | 8.8 | 7.4 | 21.25 | 14.1 | 26 | 19.91 | 2053 | 30.15 | 41.2 |
| Mean | 11.9 | 7.54 | 26.9 | 16.6 | 32.5 | 25.24 | 1966.6 | 29.7 | 43 |
| CV % | 61 | 55.8 | 18.2 | 52 | 17 | 11.1 | 7.6 | 4.7 | 4.74 |
| p ($\alpha=.05$) | ns | ns | 0.0175* | ns | 0.0195* | 0.0017* | ns | ns | 0.038 |

| | Sunflower Head Rot 9/6/2017 | | | Sunflower Head Rot 9/14/2017 | | | Sunflower Head Rot 9/26/2017 | | |
|------------------------------------|--------------------------------|--------------|-------|---------------------------------|--------------|-------|---------------------------------|--------------|-------|
| | Incidence (%) | Severity (%) | INDEX | Incidence (%) | Severity (%) | INDEX | Incidence (%) | Severity (%) | INDEX |
| Non-Treated | 6 | 43 | 1.2 | 17 | 48 | 7 | 35 | 51 | 12 |
| BVT-CR7 | 3 | 19 | 0.9 | 11 | 41 | 3 | 16 | 47 | 5 |
| Mean | 4.3 | 31 | 1.01 | 14 | 44 | 4.8 | 25 | 49 | 8.6 |
| CV % | 96 | 120 | 90 | 59 | 69 | 70 | 22 | 31 | 27 |
| LSD | 5.4 | 48 | 1.6 | 11 | 40 | 6 | 7 | 20 | 4 |
| p ($\alpha=.05$) | NS | NS | NS | NS | NS | NS | 0.0001 | NS | 0.005 |

Honeybee as a Vector

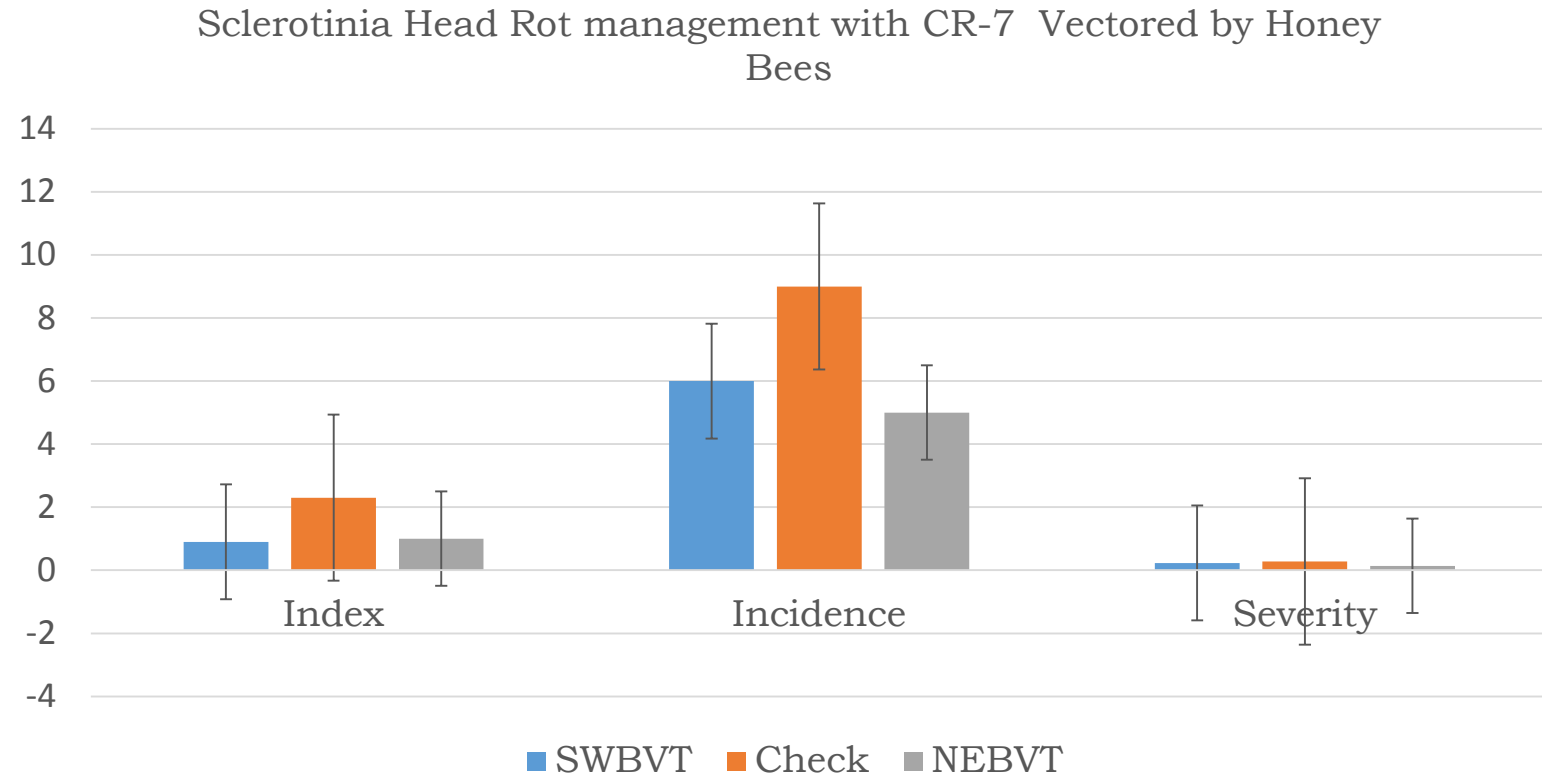


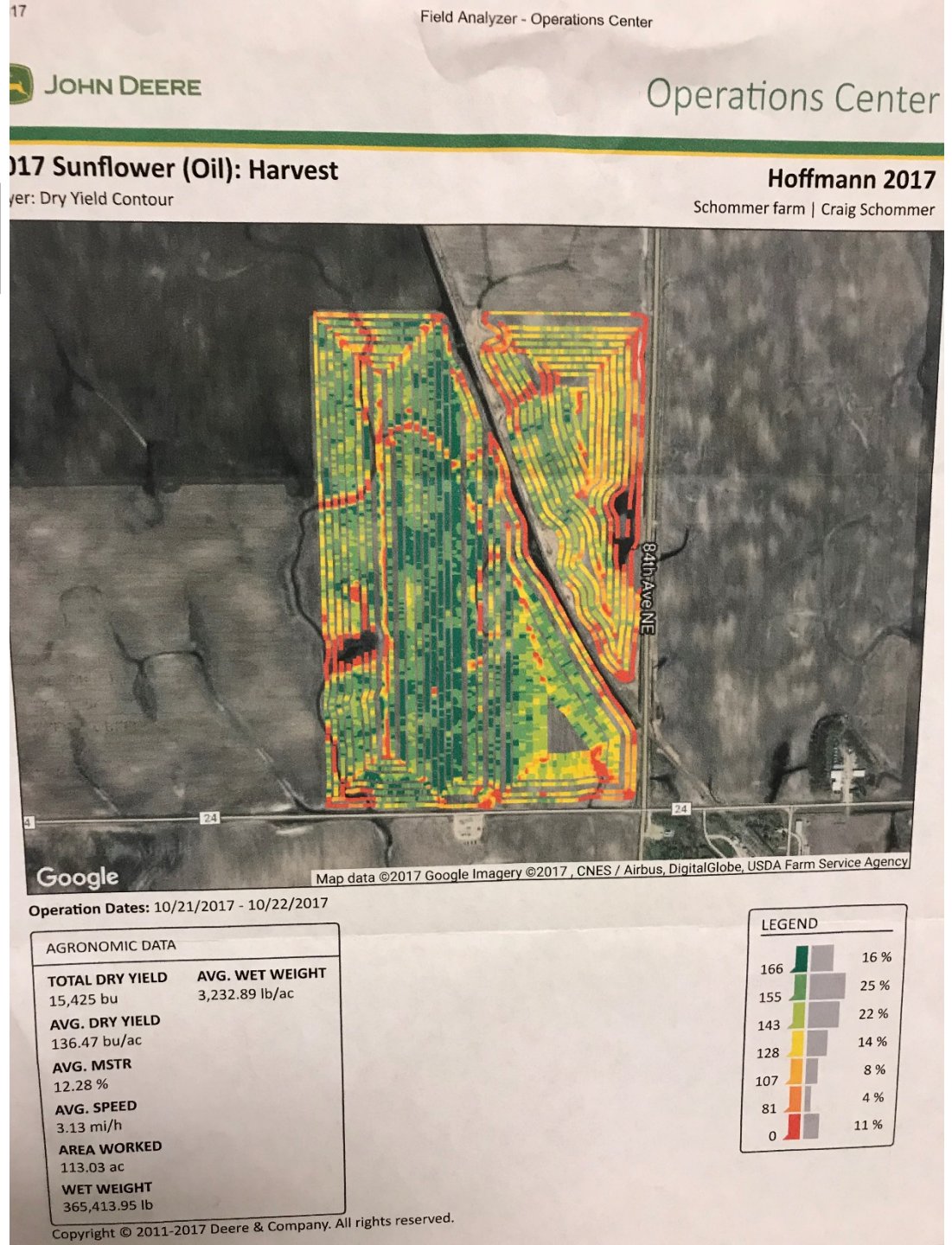
Set up of Honey Bee hive



BVT (CR7) Trial in Munich-North Dakota

Variety: SunOpta 4414
Trial Initiation
Date: 7/27/2017
Vectorite changed every
3 days
Two hives (2 with
vectorite and 0 in
check)
Had problems with 1
Hive Of SE
Rated Thrice





Yield Map of Grower's trial

Summary of BVT

- Based on disease data BVT-CR7 has efficacy on Head rot
- 2016 BVT had yield improvement over non-treated check
- 2017 yields are not taken into account (due to heavy winds bags blown away at harvest)
- Growers perception on BVT:
 - BVT has effect on head rot
 - Will be more effective on confectionaries than on oil seed

Thank you
Questions