Linking Root Studies with Biological Strategies to Control Nematodes on Potatoes

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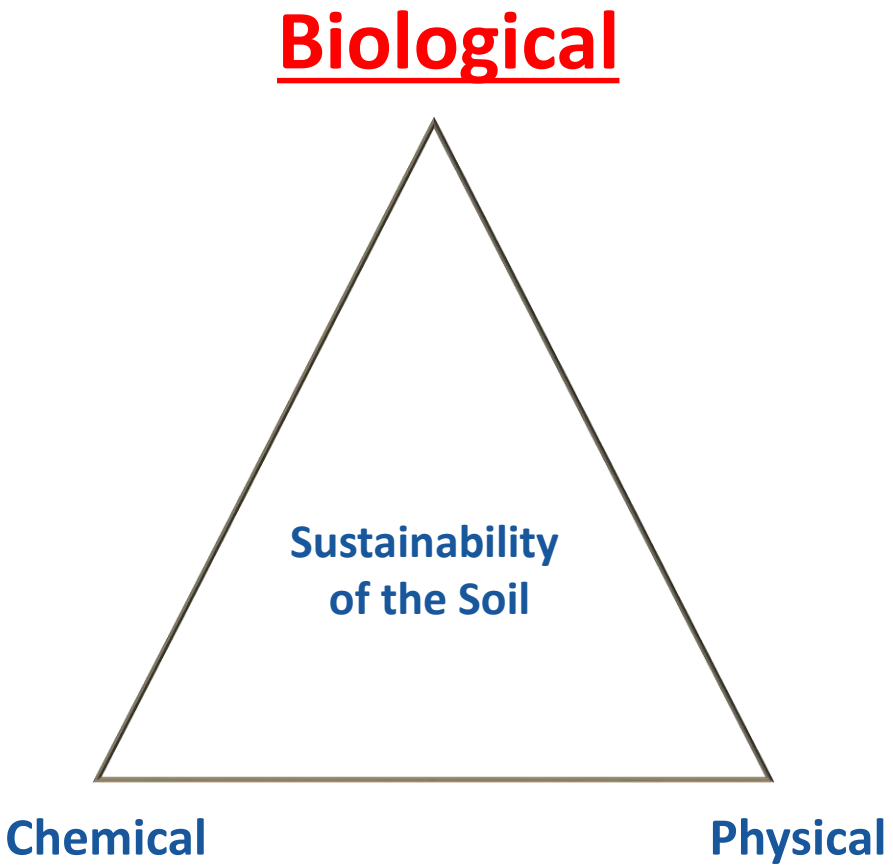
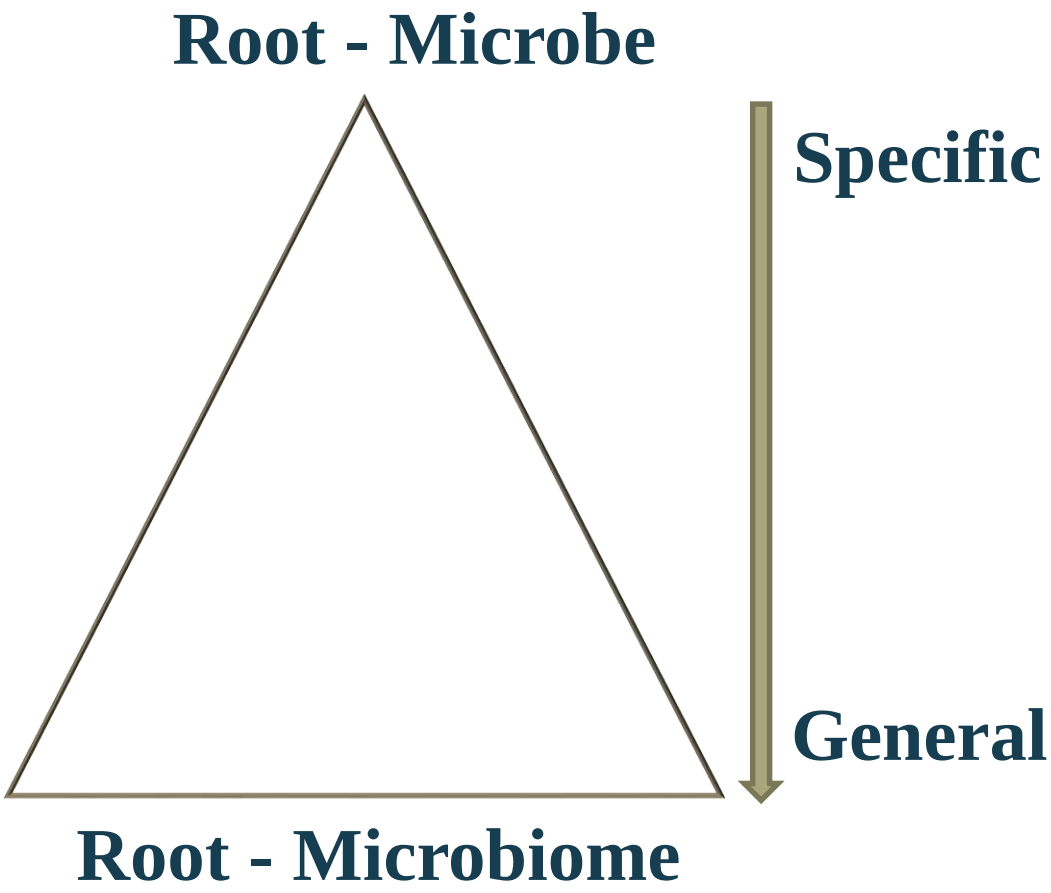
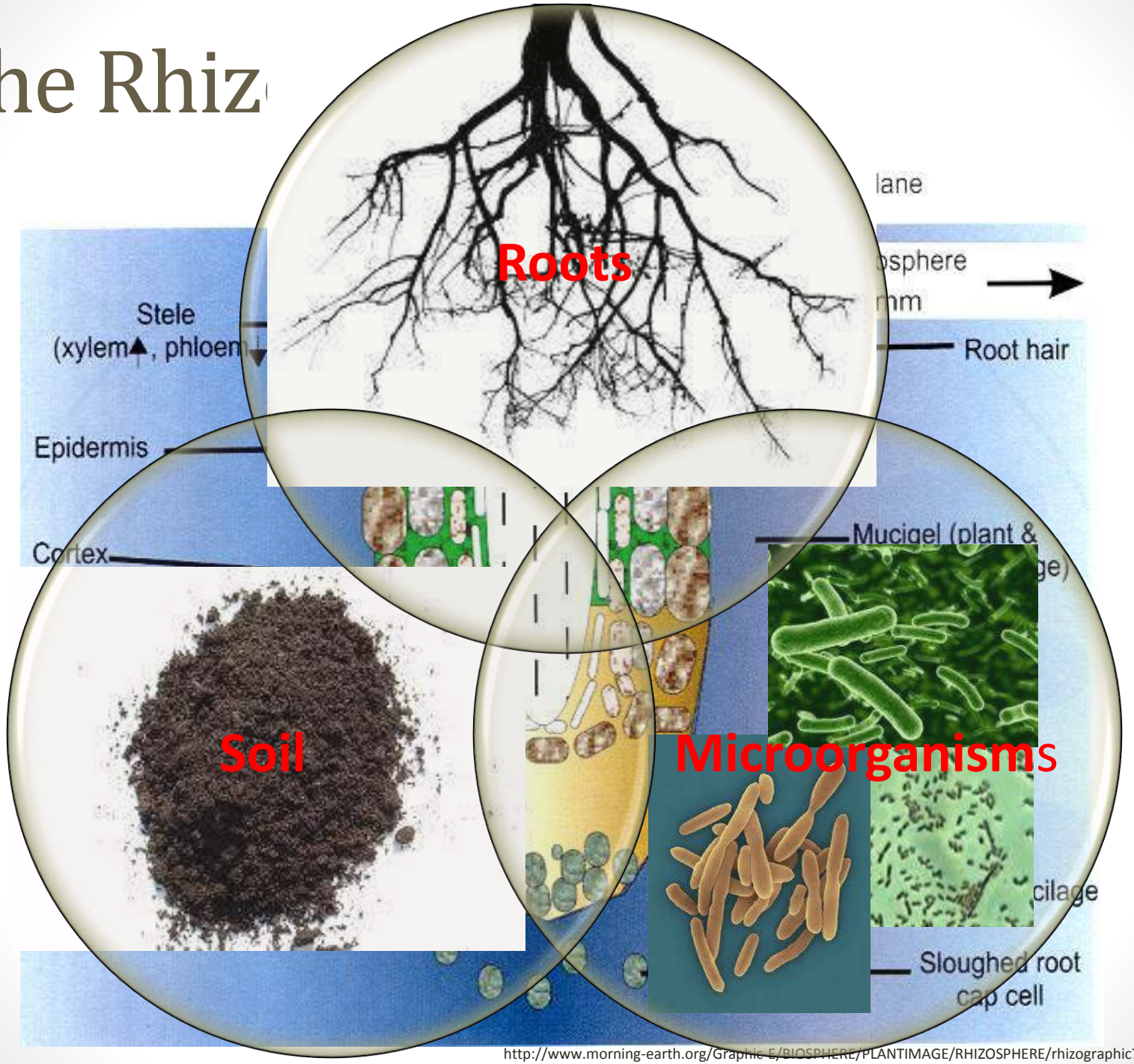
The Soil Environment

How the different soil components influence sustainability



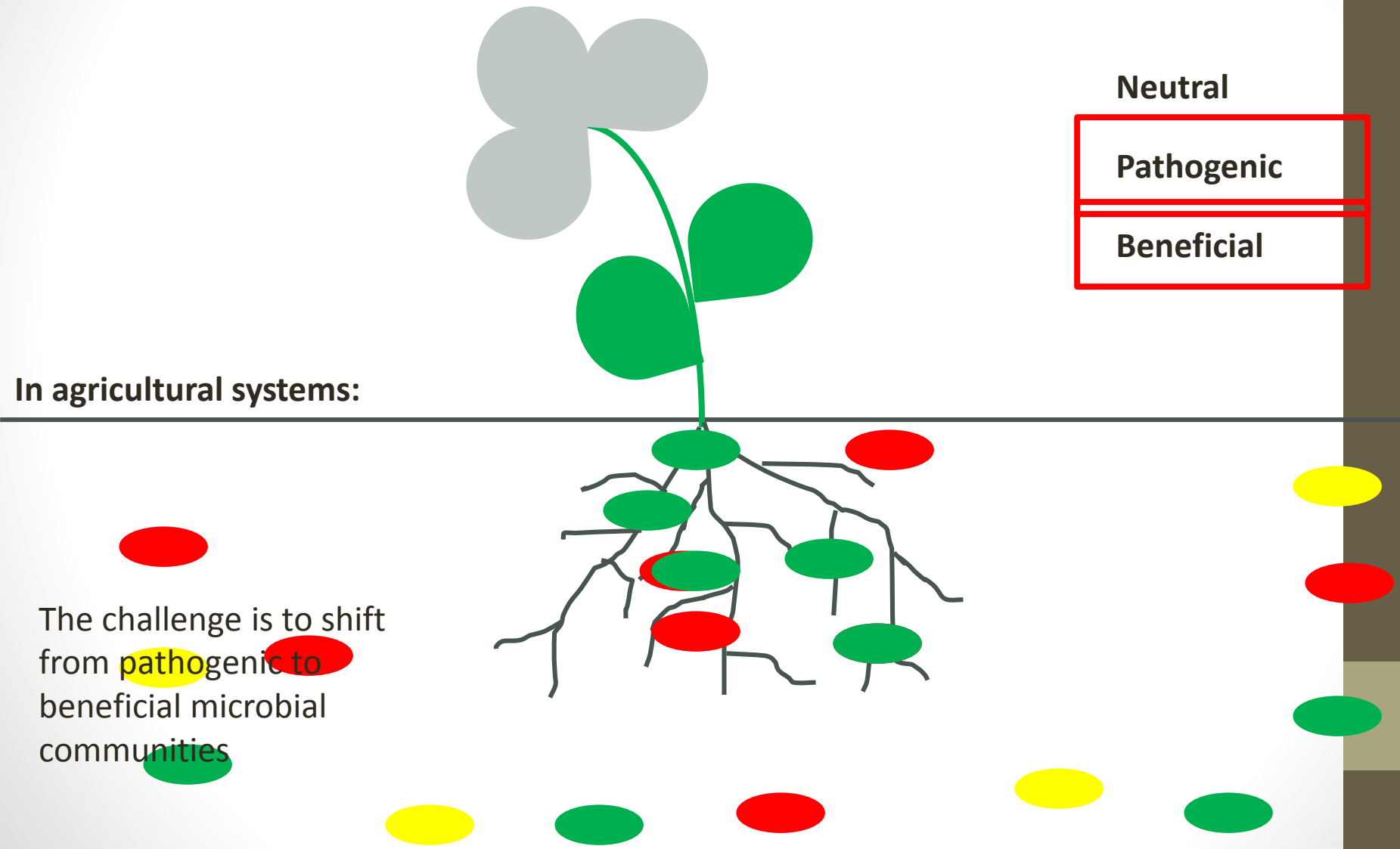

Root - Microbe
Specific
General
Root - Microbiome

The Rhiz



http://www.morning-earth.org/Graphic_E/BIOSPHERE/PLANTIMAGE/RHIZOSPHERE/rhizographic7.jpg

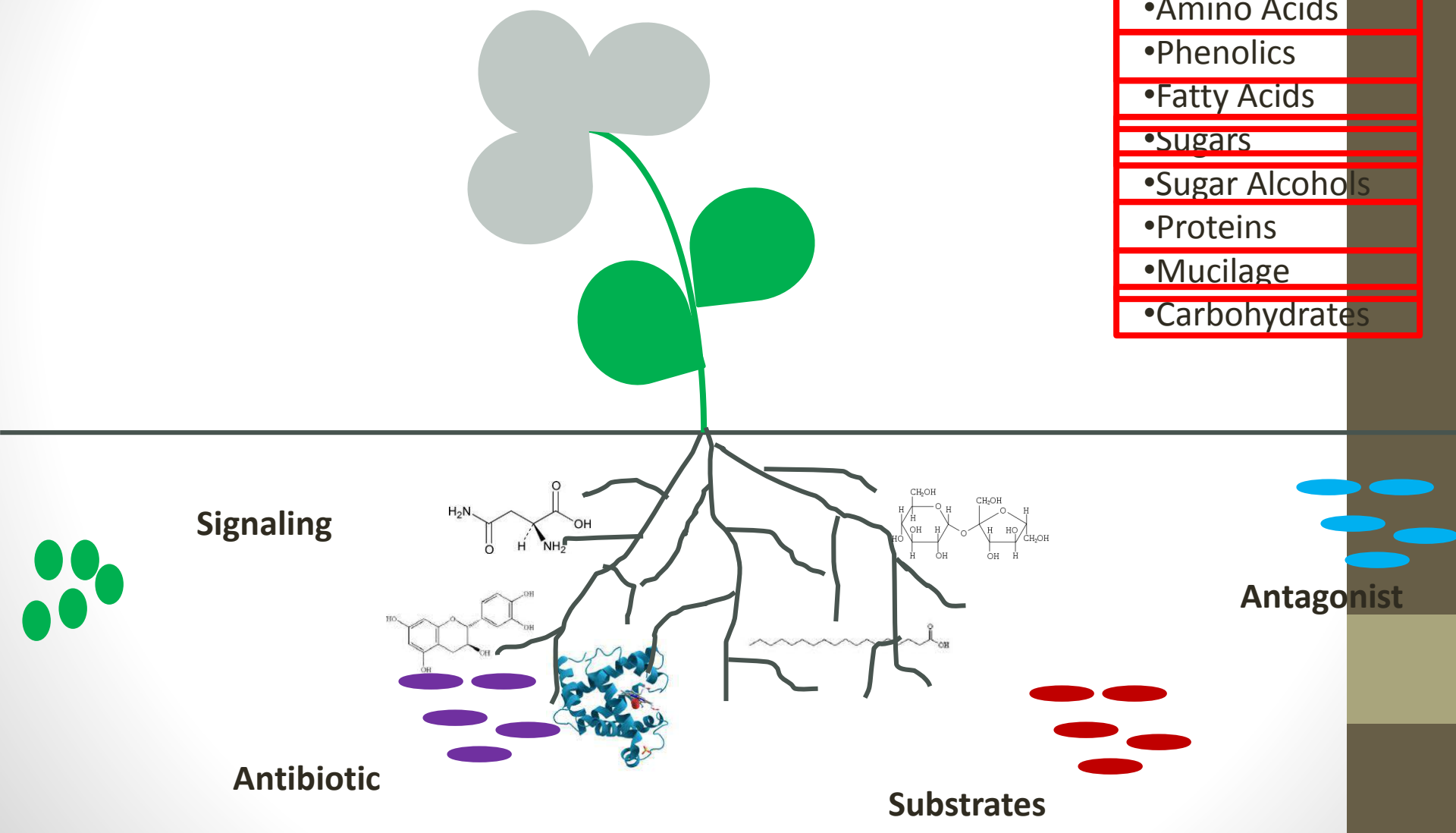
Plants associate with an array of microbes



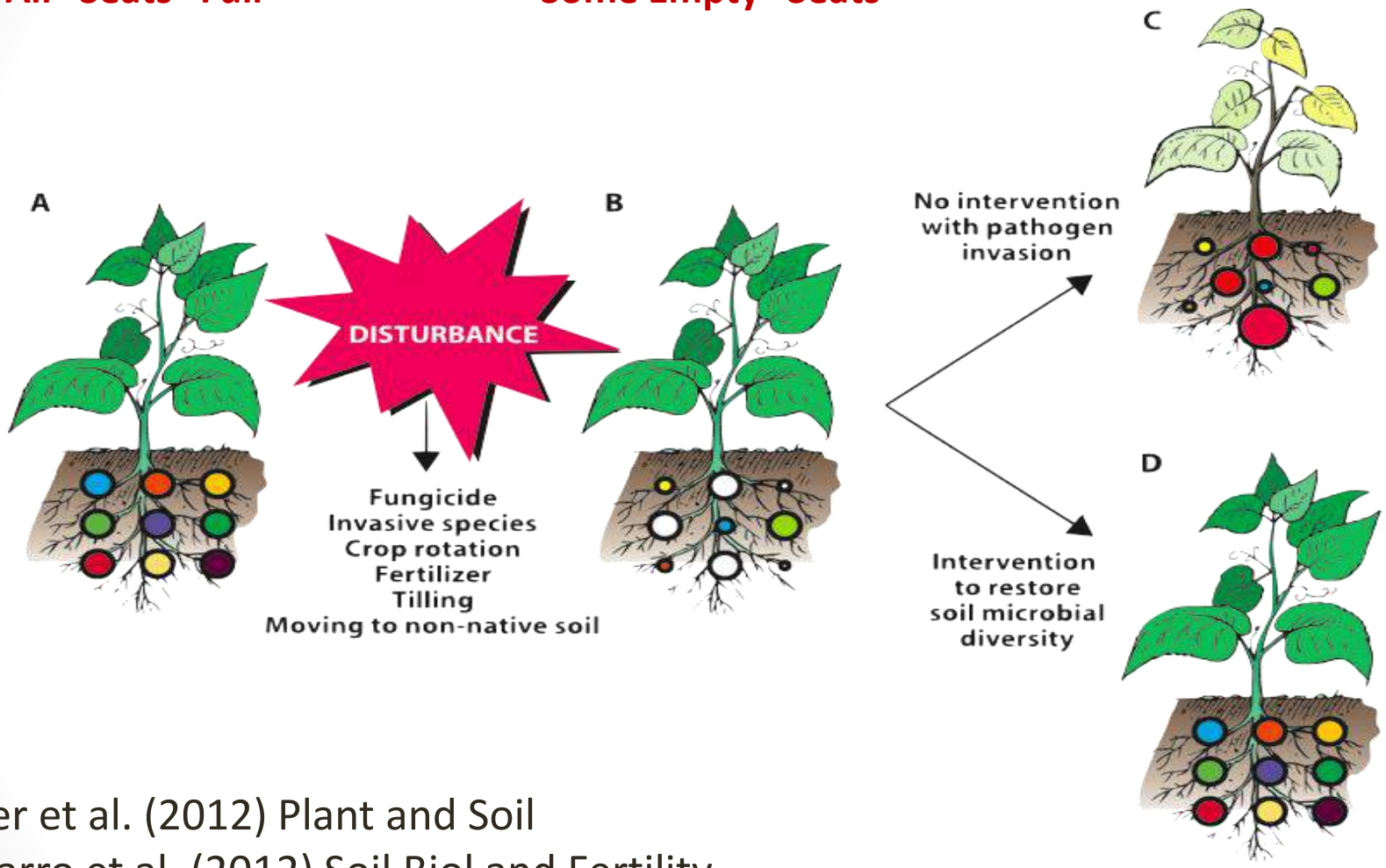
Root Exudates

Composed of:

- Amino Acids
- Phenolics
- Fatty Acids
- Sugars
- Sugar Alcohols
- Proteins
- Mucilage
- Carbohydrates



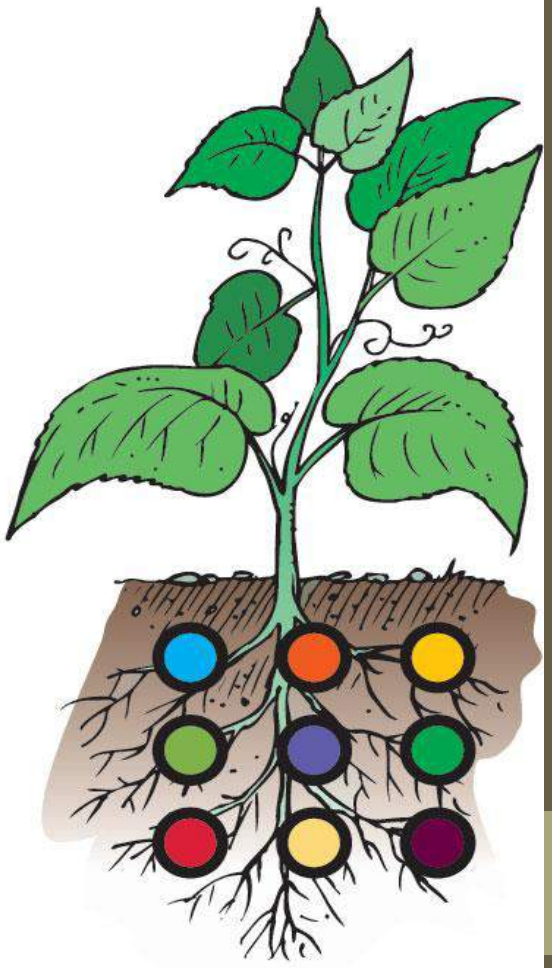
All "Seats" Full **Some Empty "Seats"**



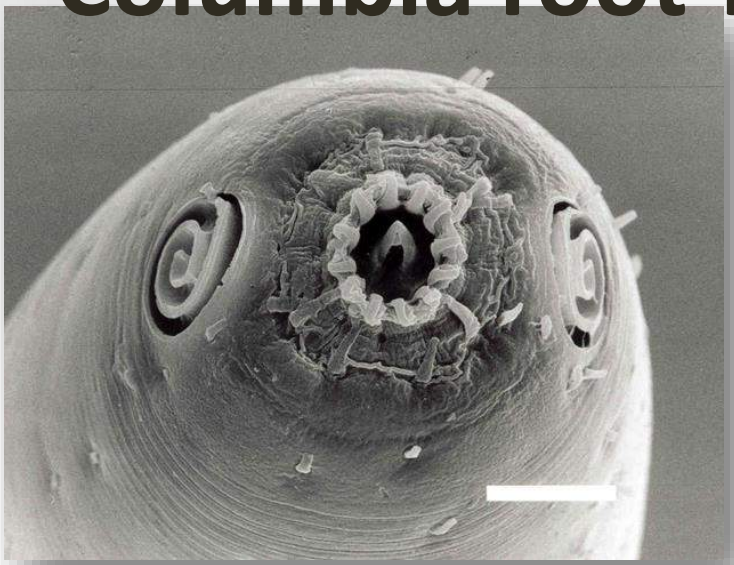
Bakker et al. (2012) Plant and Soil
Chaparro et al. (2012) Soil Biol and Fertility
Qiu et al. (2014) Biol Fertil Soils

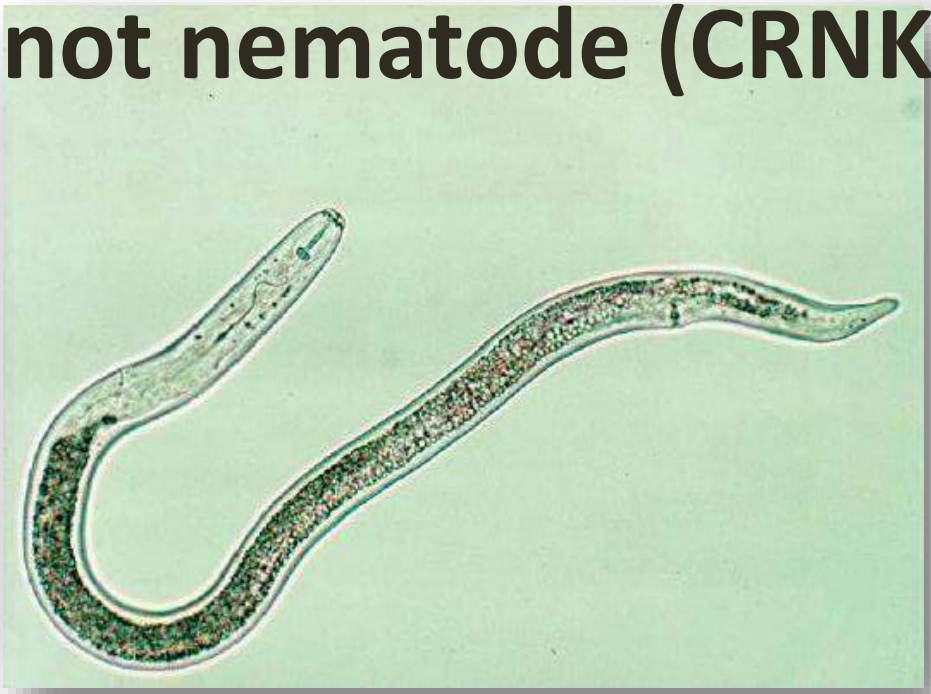
Soil Health

- **“Seats” may be kept full by:**
  - less disruption
  - applied composts/biologicals
  - more vigorous community re-fills seats as they empty
- **No empty “seats” = no new “comers”.**



Columbia root-knot nematode (CRNK)





Treatments

1. Zero Control – No CRKN; No biological products

2. Control – With CRKN; No biological products

3. NemaRoot – With CRKN
   - *Paecilomyces lilacinus 5% (2x*10^9 UFC/g)
   - Exu-Root 20% (Carboxy Acids) – root exudate inductor
   - Inert Ingredients 75% (diluent, conservative, binder and thickener)

4. BioFit N – With CRKN
   - Azotobacter *chroccum* (1x 10^5 CFU/g)
   - *Bacillud subtillis* (1x 10^8 UFC/g)
   - *Bacillus megaterium* (1x 10^6 CFU/g)
   - *Bacillus mycoides* (1x 10^5 CFU/g)
   - *Trichoderma harzianum* (1x 10^6 CFU/g)
   - Exu-Root 20% (Carboxy Acids) – root exudate inductor
   - Inert Ingredients 60% (diluent, conservative, binder and thickener)

Greenhouse Studies

Replications

Silverton (Nematode Susceptible): 15 reps x 4 treatments = 60 plants total

Application Rate of Biological Inoculants

2g of product per liter of water

Timing

First Application

Immersion of rooted potato plantlets in products and irrigate product into pot to saturate substrate

Additional Applications: At 2 weeks, 4 weeks and 6 weeks

substrate drench with enough solution to allow for full saturation of the substrate

Growing Conditions

6" pots with 2/3 sterilized sand and 1/3 sterilized vermiculite irrigated as needed with liquid fertilizer. Track substrate temperature with temperature probes and data logger

Experiment Duration

9 weeks = 1031 CRKN degree days (from substrate temperature data logger)

- First CRKN generation time when roots are present: 600°C degree-days
- Subsequent CRKN generation time: 500 - 600°C degree-days

Experiment Overview Cont.

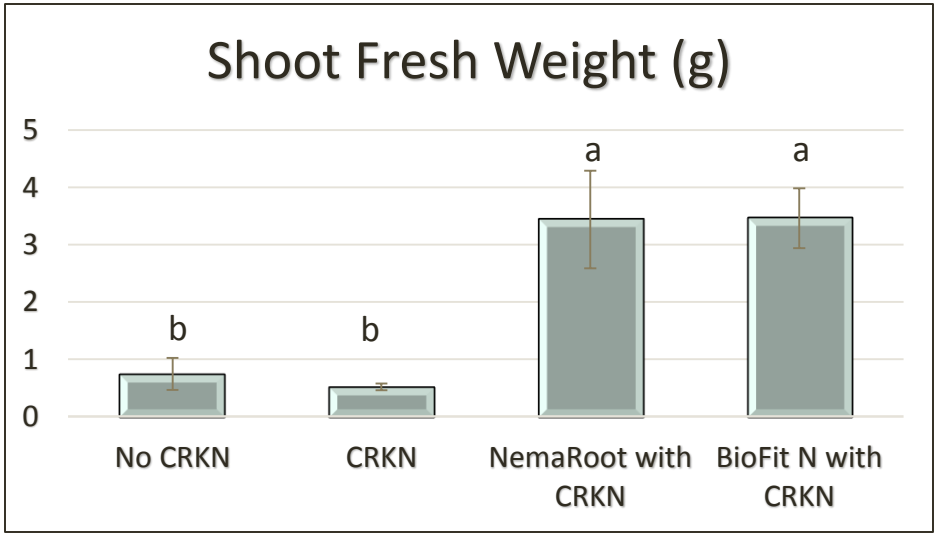
CRKN Egg Inoculum Rate

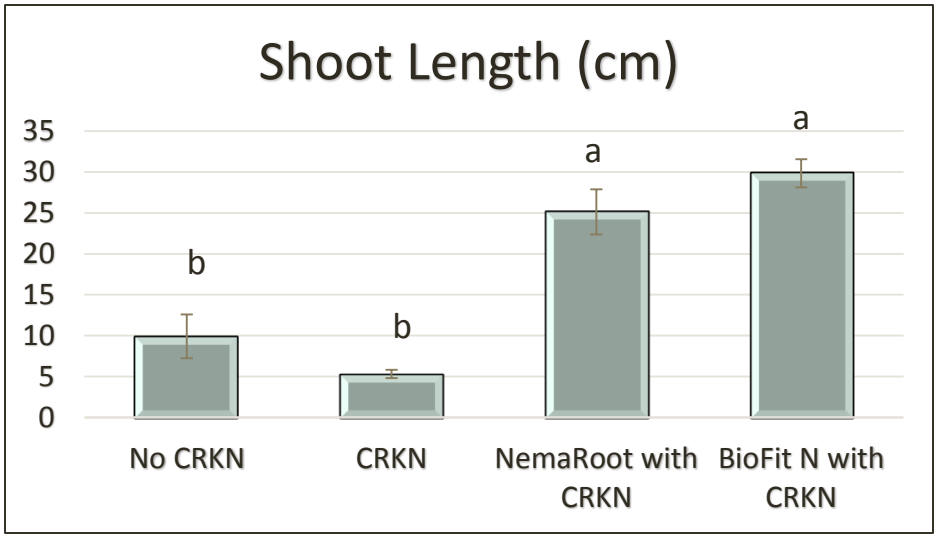
- 1,000 CRKN eggs in an aqueous solution per pot.
- Thoroughly mix CRKN eggs with substrate for each pot pre-planting to ensure even dispersal of inoculum though out the substrate

Record

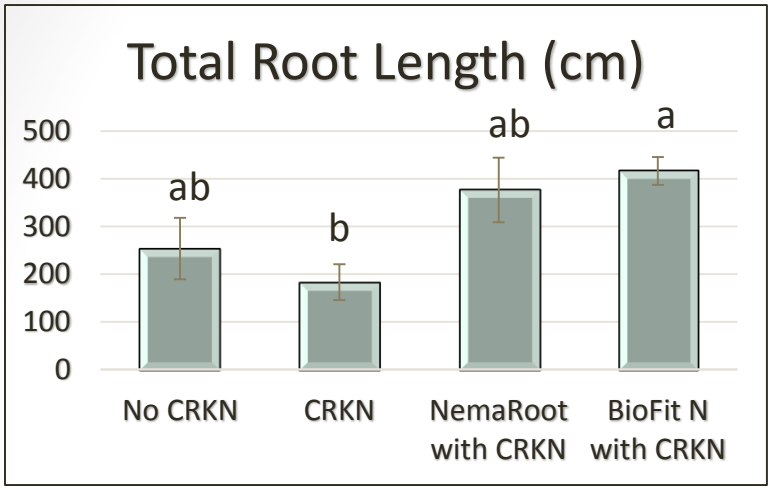
1. Fresh weight of shoots and roots
2. Measure shoot and root length
3. Scan roots with WinRhizo software
   a. Total root length
   b. Root surface area
4. Extract CRKN eggs from whole root and count eggs.
5. Extract CRKN J2 from 250cc subsample of substrate for quantification

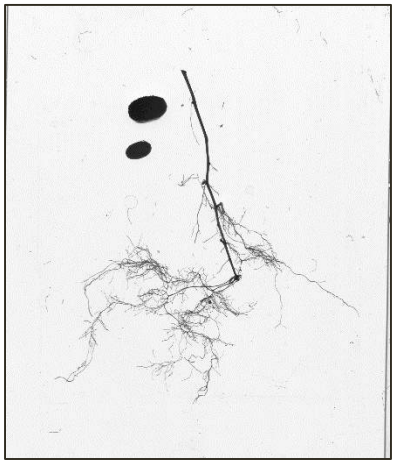
Results


Shoot Fresh Weight (g)
5
4
3
2
1
0
b
b
a
a
No CRKN
CRKN
NemaRoot with CRKN
BioFit N with CRKN


Shoot Length (cm)
35
30
25
20
15
10
5
0
b
b
a
a
No CRKN
CRKN
NemaRoot with CRKN
BioFit N with CRKN

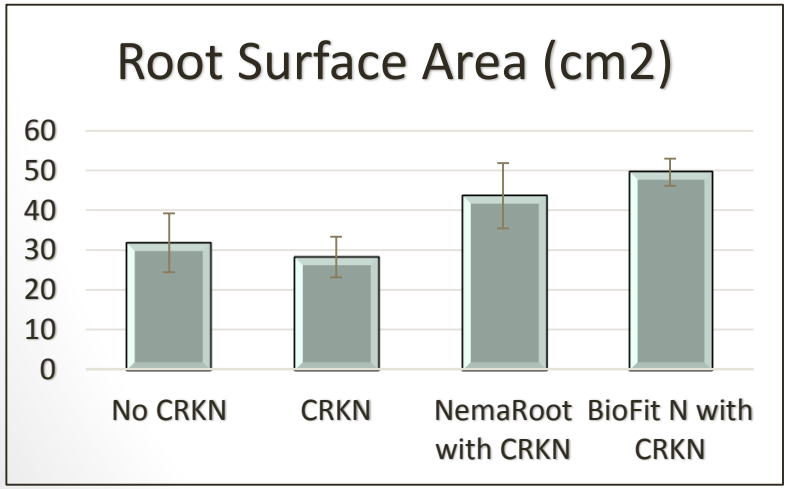
Results

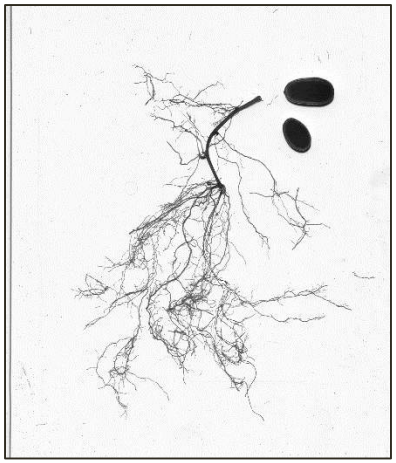




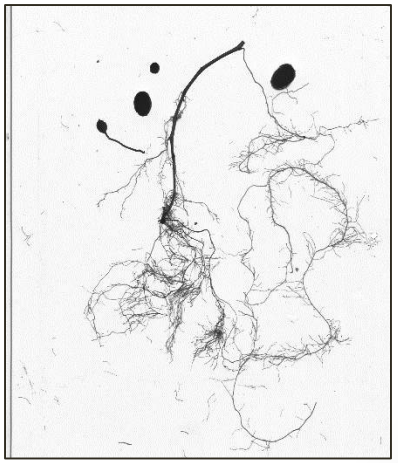
No CRKN

CRKN



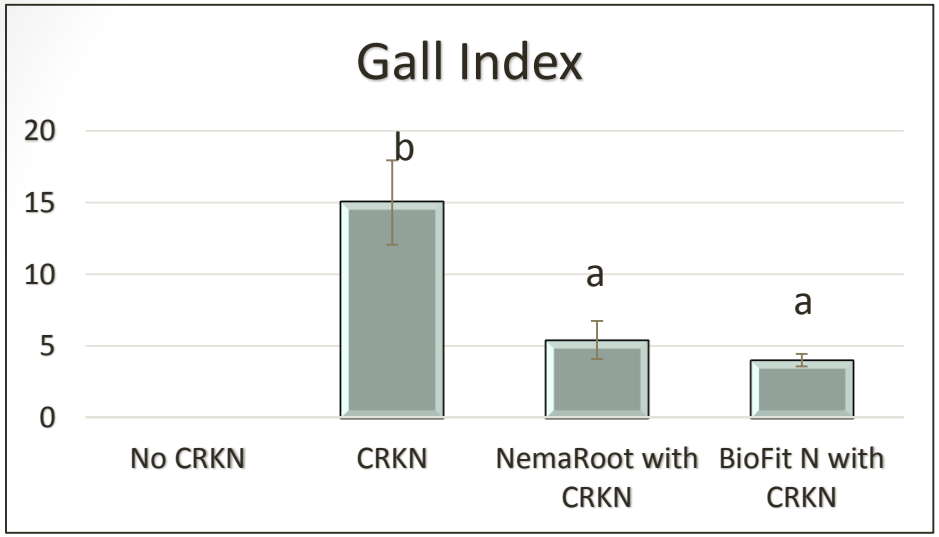


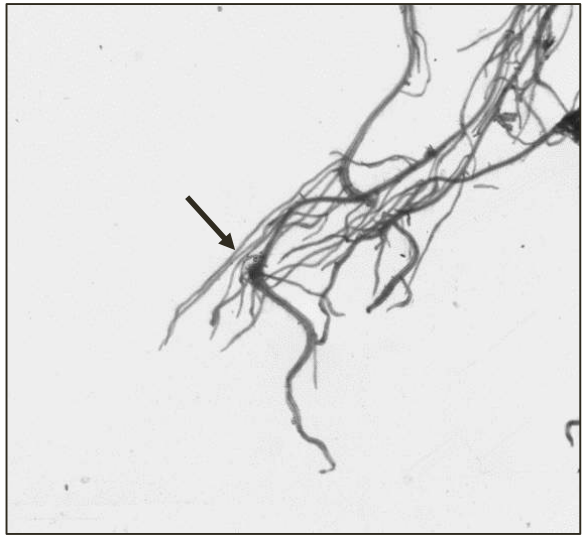
NemaRoot with CRKN

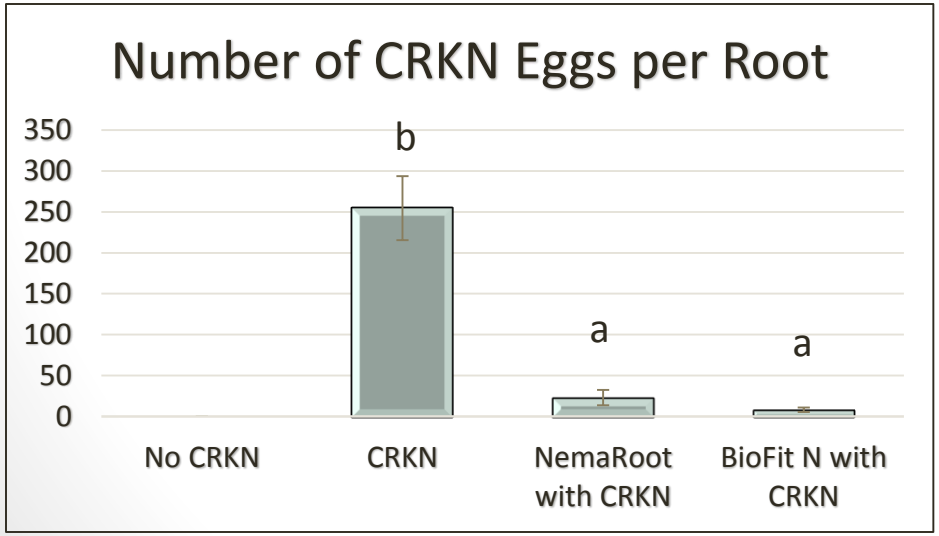


BioFit N with CRKN

Results


Gall Index
20
15
10
5
0
b
a
a
No CRKN
CRKN
NemaRoot with CRKN
BioFit N with CRKN




Number of CRKN Eggs per Root
350
300
250
200
150
100
50
0
b
a
a
No CRKN
CRKN
NemaRoot with CRKN
BioFit N with CRKN

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Innovak Global

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References

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