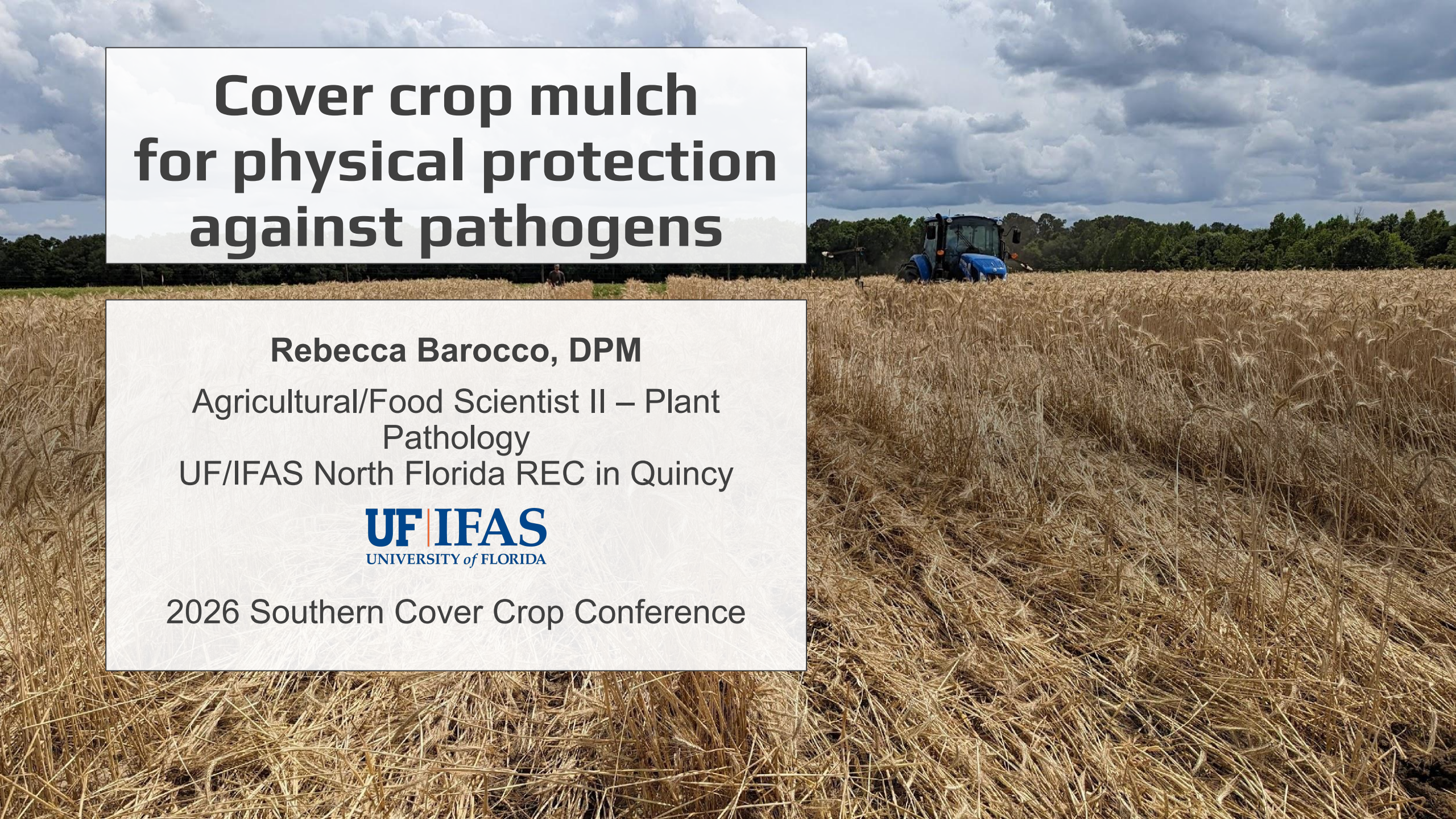
Cover crop mulch for physical protection against pathogens



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UF IFAS
UNIVERSITY of FLORIDA

2026 Southern Cover Crop Conference

Cover crops can affect pathogens in many ways

- Survival in the soil
  - Allelopathy
  - Promoting beneficial microbes
    - competition, antibiosis, predation, reduce plant stress
- Vector activity (e.g. viruses)
- Provide physical barrier to dispersal
  - Mulch
  - Intercropping

Growing cover crops for mulch

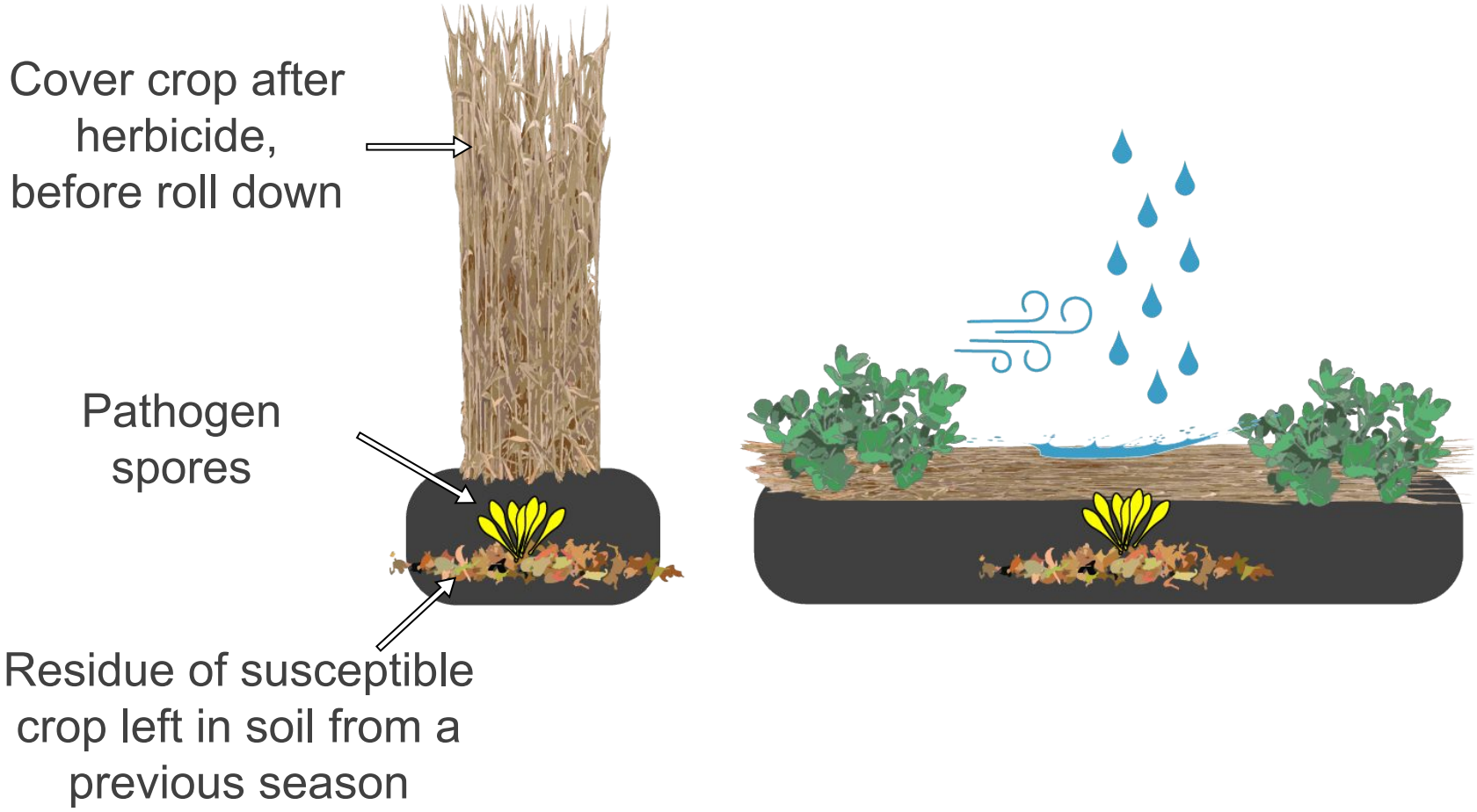
- Grown over the winter between seasons
- Terminate in spring with herbicide and/or mechanical method (mowing, roll down) prior to planting
- Strip-till or no till in the spring (may have fall tillage)
- For disease management, primarily concerns foliar or fruit pathogens that overwinter in the soil

Triticale cover crop as mulch for a peanut field trial at the UF/IFAS NFREC in Quincy.

Bare soil with no mulch

- Many foliar and fruit pathogens survive in soil on crop residue
- Pathogens disperse from soil by rain splash, wind, and/or wind-driven rain droplets
- Bare soil exposes the surface

Cover crop mulch covers the soil



- Absorbs raindrop energy and reduce splash
- Blocks pathogen dispersal from soil (primary dispersal)
- Can reduce re-splash of spores originating from another plant (secondary dispersal)
- May reduce foliar wetness favorable for disease

Straw mulch and rain splash studies

- First studies that showed effect - greenhouse rain simulation with strawberry
  - Leather rot by *Phytophthora cactorum* (Madden and Ellis 1990)
  - Anthracnose by *Colletotrichum acutatum* (Yang et al. 1990)
- Straw mulch reduced dispersal
  - Compared to both bare soil and plastic mulch
- Fruit as inoculum source above mulch (secondary dispersal)

Strawberry anthracnose

Photo credit: Gerald Holmes, Strawberry Center, Cal Poly San Luis Obispo, Bugwood.org

Cover crop mulch and disease studies

- Disease field studies with annual fruit and vegetables
- Higher disease control with cover crop mulch
  - Compared to bare ground and plastic mulch
- Marketable yield
  - Higher than (typically) or the same as bare ground
  - Lower than (typically) or higher than plastic mulch

Cover crop mulch and disease studies

- Hairy vetch mulch:
  - Watermelon anthracnose (*Colletotrichum orbiculare*) and gummy stem blight (*Stagonosporopsis* spp.) (Zhou and Everts 2012)
  - Tomato early blight (*Alternaria solani*) and Septoria leaf spot (*Septoria lycopersici*) (Mills et al. 2002a, 2002b)

Associated with lower soil splash and lower sensor leaf wetness

Hairy vetch (*Vicia villosa*)
Photo credit: John D. Byrd, Mississippi State University, Bugwood.org

Watermelon gummy stem blight
Photo credit: Gerald Holmes, Strawberry Center, Cal Poly San Luis Obispo, Bugwood.org

Tomato early blight
Photo credit: Gerald Holmes, Strawberry Center, Cal Poly San Luis Obispo, Bugwood.org

Cover crop mulch and disease studies

- Hairy vetch and hairy vetch/rye mulch:
  - Pumpkin Plectosporium blight (*Plectosporium tabacinum*), black rot (*Stagonosporopsis* spp.), and powdery mildew (*Podosphaera xanthii*) (Everts 2008)
- Winter wheat mulch:
  - Pepper Phytophthora blight (*Phytophthora capsici*) (Ristaino et al. 1997)

Wheat (*Triticum* spp.)
Photo credit: Howard F. Schwartz, Colorado State University, Bugwood.org

Pepper Phytophthora blight
Photo credit: Howard F. Schwartz, Colorado State University, Bugwood.org

Is it reduced tillage or cover crop mulch?

- Strip-tillage delayed the onset and reduced disease compared to deep tillage in the spring (Cantonwine et al. 2007a, 2007b)
  - Peanut early leaf spot (*Passalora arachidicola*)
  - Both tillage systems with winter wheat cover crop

Peanut early leaf spot

Wheat (*Triticum* spp.)
Photo credit: Howard F. Schwartz, Colorado State University, Bugwood.org

Triticale mulch in peanut planted with strip-tillage

Is it reduced tillage or cover crop mulch?

- Adding straw mulch reduced early leaf spot in conventional (deep) tilled system (Cantonwine et al. 2007b)
  - Effect primarily due to mulch cover
  - However, adding wheat straw to deep tilled plots still higher disease than strip-tilled plots
- Appear to be additional benefits beyond mulch effect

Peanut early leaf spot

Wheat (*Triticum* spp.)
Photo credit: Howard F. Schwartz, Colorado State University, Bugwood.org

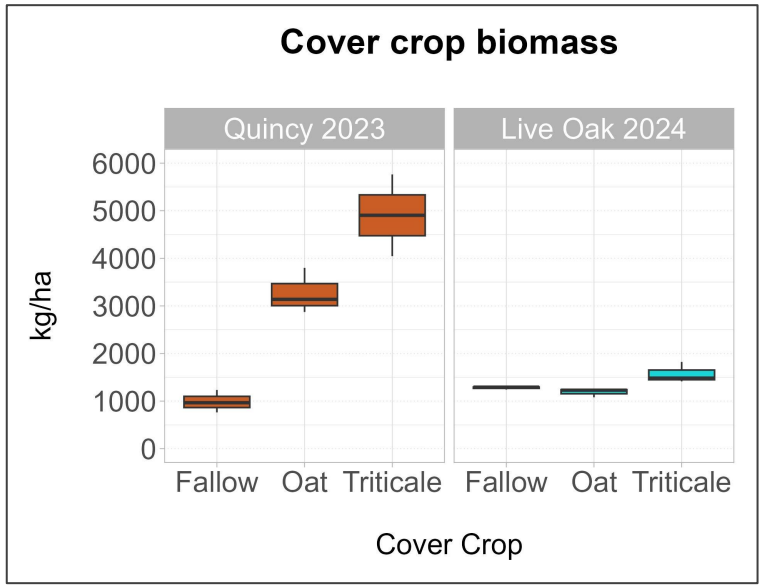
Triticale mulch in peanut planted with strip-tillage

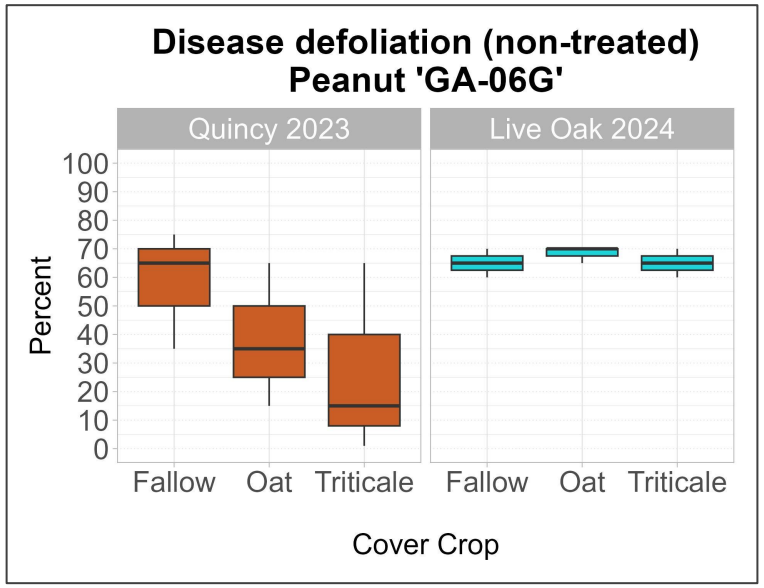
Cover crop biomass can vary greatly

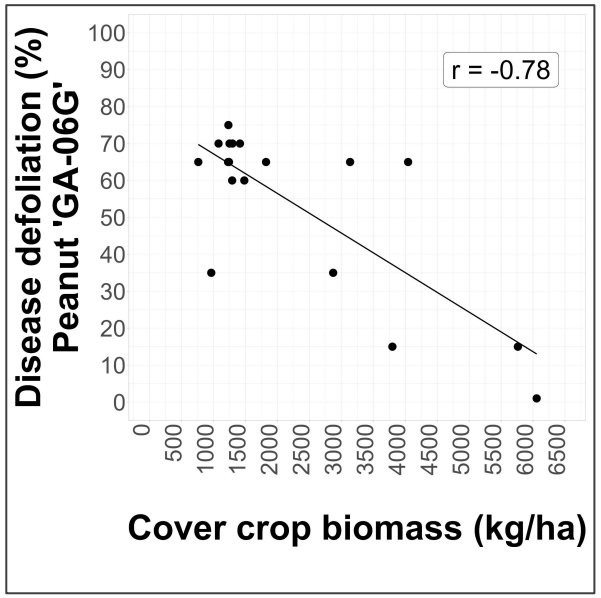
- Amount of biomass may correlate with level of disease control

- Species and cultivar
- Planting date
- Fertility practices
- Termination timing
- Site-specific field and weather conditions

Cover crop biomass can vary greatly





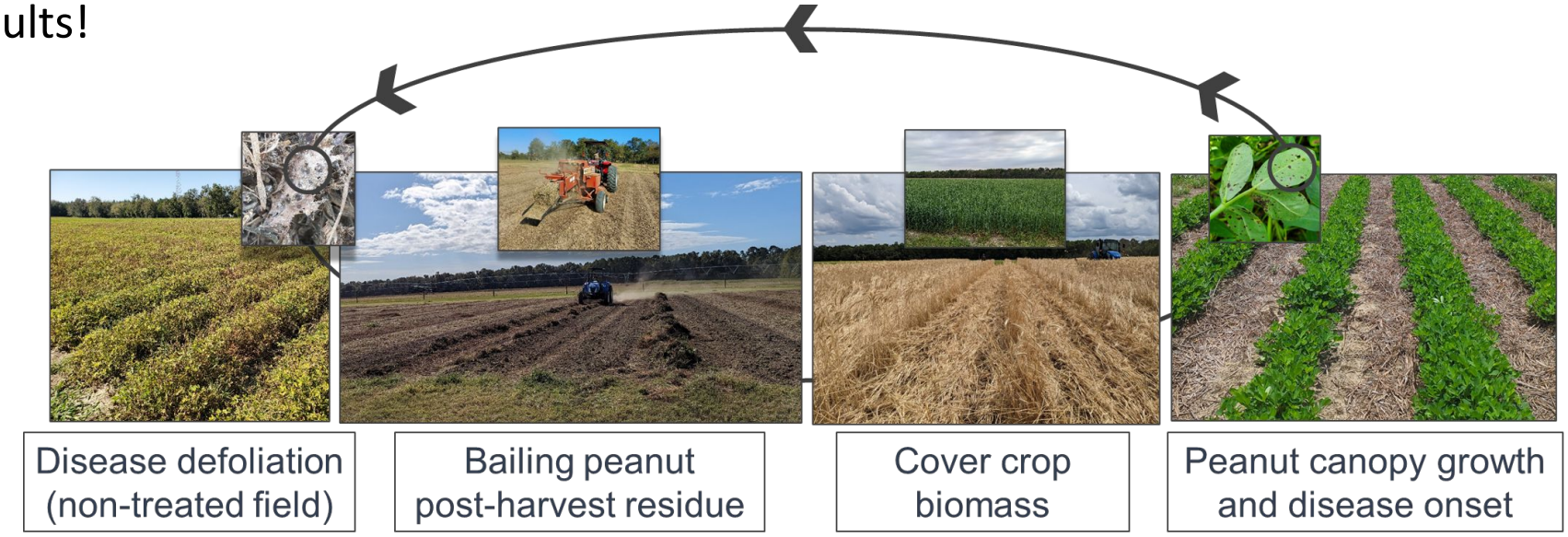


Preliminary study only – severe deer feeding in 2023

No yield data. Live Oak 2023 discarded, Quincy 2024 cancelled

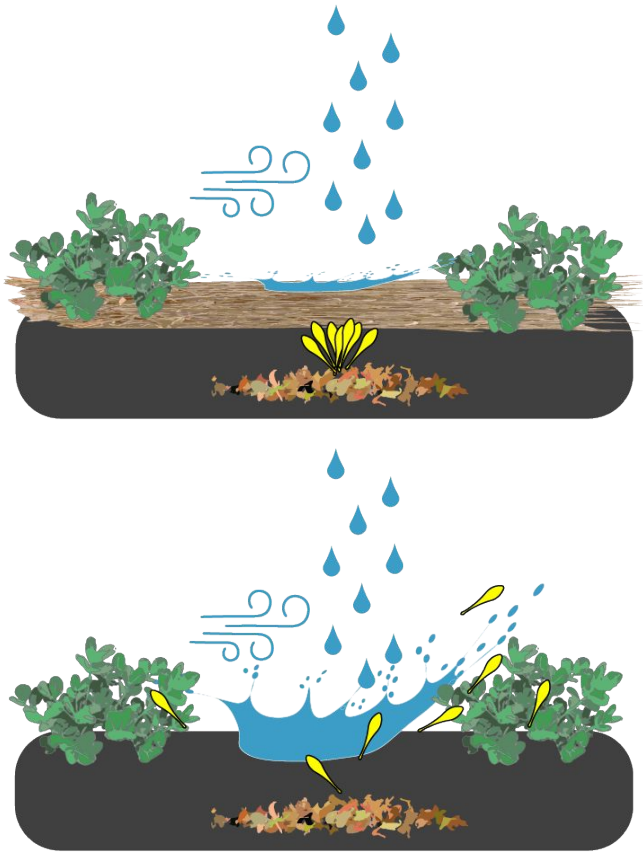
Varying rye biomass as mulch for peanut

- Current research trial - Hay x Rye Biomass x Fungicide
  - Rye ‘Wrens Abruzzi’ varied by planting date and nitrogen fertilizer
  - Bailing for hay may remove pathogens but also removes nutrients for rye
- Early leaf spot (*Passalora arachidicola*), Late leaf spot (*Nothopassalora personata*)
- Also look for stem rot (*Agroathelia rolfsii*), rust (*Puccinia arachidis*), and TSWV
- Stay tuned for results!

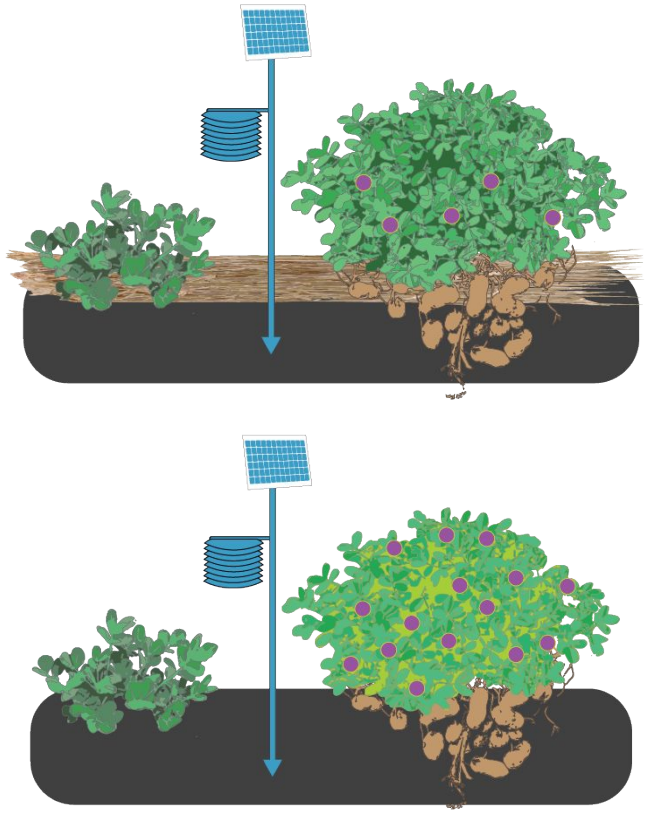


Including a cover crop factor for a leaf spot risk model

Develop new model
Dispersal from soil to leaves



Current available model
Favorable leaf infection
Canopy T/RH



Potential trade-offs and (my) questions

- May promote saprophytic pathogens that grow on soil and residue (*Fusarium* spp., *Rhizoctonia* spp., *Pythium* spp. *Agroathelia rolfsii*)
  - Do legume cover crops cause highest risk?
  - How effective is brassica allelopathy?
  - Some cereal crops can have allelopathic activity towards pathogens, including *A. rolfsii* (Stapleton et al. 2010)

Peanut stem rot (*Agroathelia rolfsii*)

Tomato southern blight (*Agroathelia rolfsii*)
Photo credit: Thirunarayanan Perumal, Banaras Hindu University, Bugwood.org

Potential trade-offs and (my) questions

- Can mulch inhibit crop growth and yield due to nitrogen immobilization?
  - Incorporating into soil vs mulch above soil
  - Mowing/chopping vs roll down
- Can growing for mulch delay planting?
- Does allelopathy inhibit emergence?

- Strategic timing of termination may alleviate these concerns

Thank you!

What are your questions or ideas about the pros and cons of cover crops on plant diseases?

NFREC Plant Health Lab (PI: Ian Small)

Literature review

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