Energy Crop Research at the Florida Energy Systems Consortium (FESC)

ABFC 2016 June 7-8, 2016

Canan Balaban, Associate Director, FESC

www.floridaenergy.ufl.edu

Florida Energy Systems Consortium (FESC)

Created by Florida Statute in 2008

Purpose…Unite Florida energy experts - including Florida's 12 Universities - so that the State leads in energy research and develops innovative energy systems giving rise to…

Improved energy efficiency and
Expanded economic development

Strategic Activities

- Research
- Technology Commercialization
- Outreach
- Education

FESC involves more than

- 400 Faculty
- 100 Centers and Institutes
- 200 Companies within Florida

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Strategic Research Thrusts

- Developing Florida's Biomass Advantage for Renewable Fuels
- Harnessing Florida's Solar Resources
- Enhancing Energy Efficiency and Conservation
- Securing Energy Delivery Infrastructure and Energy Storage
- Capturing Florida's Marine Energy Resources for Power Generation

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FESC Energy Crop/Tree Research

- **Oil seed crops**
  - Carinata, Canola, Camelina
- **Grasses**
  - Elephant grass, Sweet sorghum, Energy cane
- **Energy beets and energy tubers**
- **Energy intensive tree development**
  - Loblolly pine

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Oil Seed Crop Research

Carinata Feedstock Development

By David Wright and Carinata Team

FESC Florida Energy Systems Consortium

UF UNIVERSITY of FLORIDA IFAS

Oilseed Crop Production in FL (Nov.- late May) Produced with conventional equipment as for wheat, etc.

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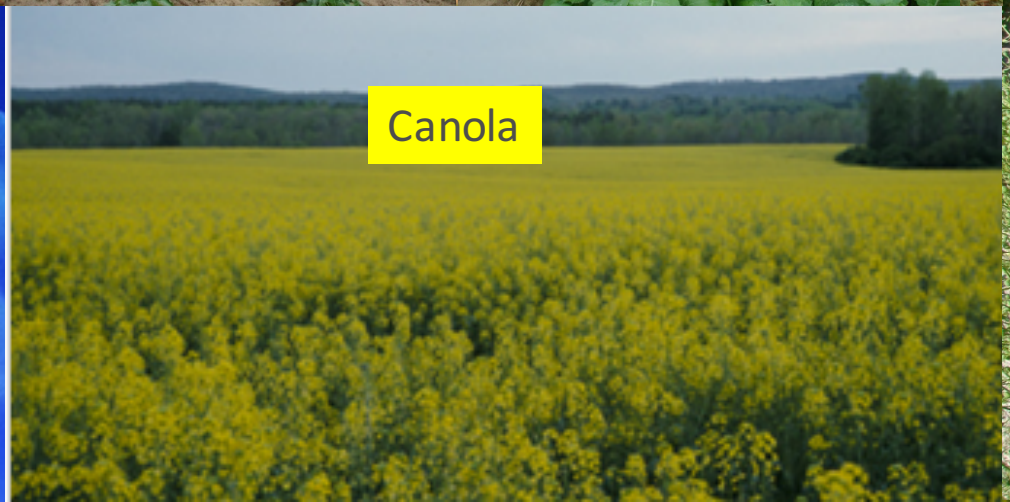
Carinata



Canola

Camelina


March 11


March 26


April 15


April 27

White mold – *Sclerotinia sclerotiorum*

Applying a fungicide in March

750 acres in Columbia Co.

Production field at harvest in early June

No invasiveness problems

Resonance Carinata:

Sustainable Fuel and Animal Feed

- Seed sold to farmers in 50 lb bags
- One bag of seed can produce 18 tons of grain when grown in Florida (~ 10 acres)
- That provides ~2000 gallons of carinata oil.
- The amount of feed (meal) is enough to produce 3600 pounds of beef or 6200 pounds of poultry

AGRIsoma
Sustainable Energy Founded in Agriculture

resonance CARINATA

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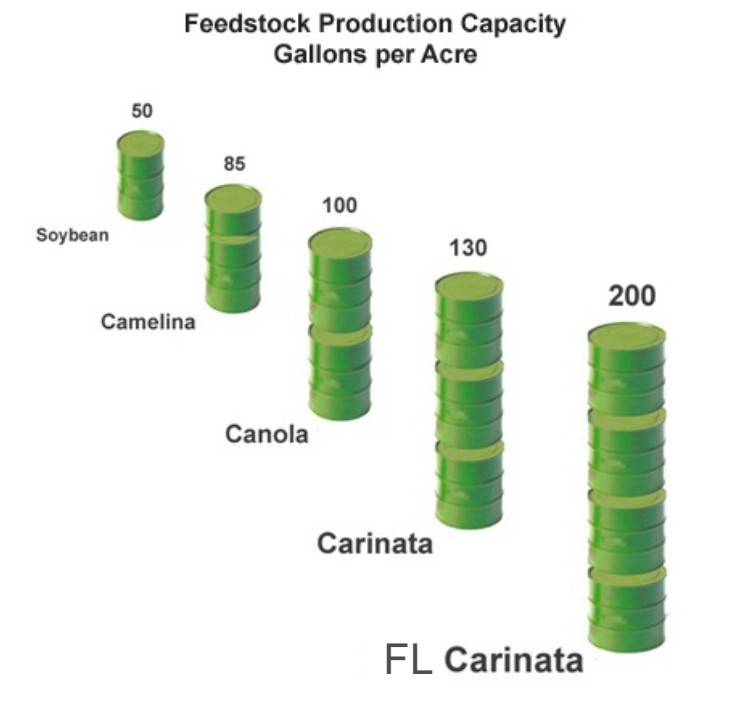
Production Capacity

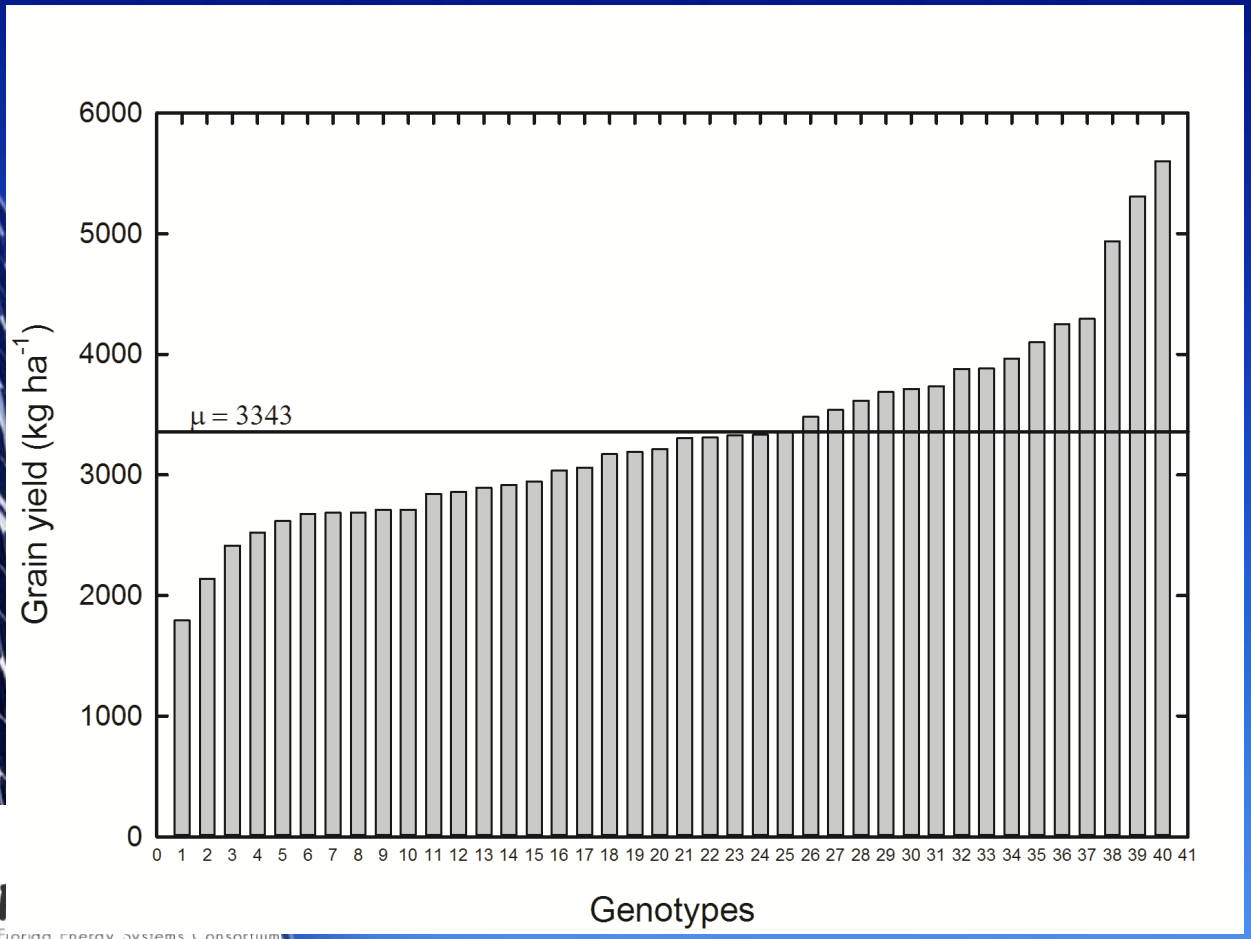
Initial goal was to produce 200 gallons of oil/Acre or about 3500 lbs of seed



- Sustainable Production Basis on Semi-arid Lands
- No Displacement or Competition with Food Crops
- Can Compete with Less than $80/BBL Crude Oil
- Enables Biofuel Production without Subsidies

High yielding genotypes

Value of variety or genotype testing –each evaluated for maturity, yield and oil content and quality

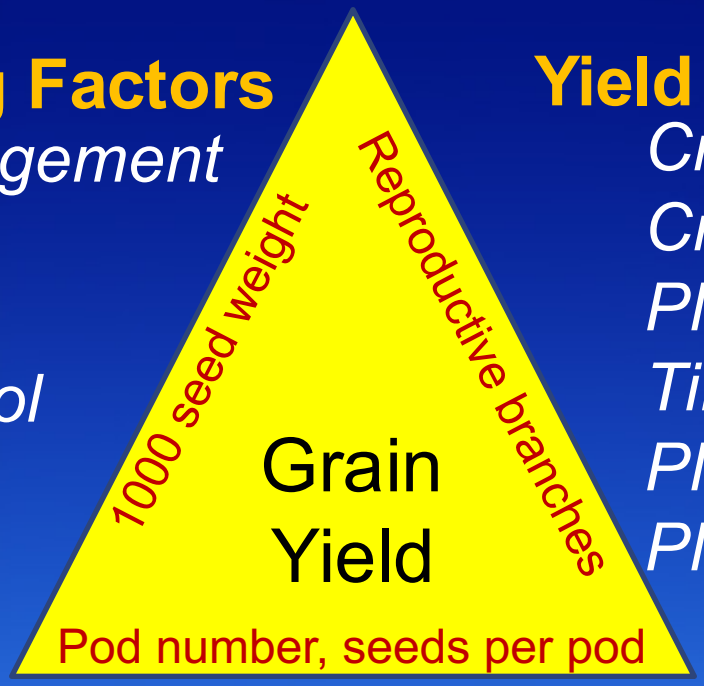


Maximizing Yield Potential

3500 lb seed/acre
200 gal oil/acre

Yield Protecting Factors

Harvest management
Weed control
Insect control
Disease control
Irrigation



Yield Building Factors

Crop improvement
Crop rotation
Plant nutrition
Tillage
Plant density
Planting Date

Best Management Practices

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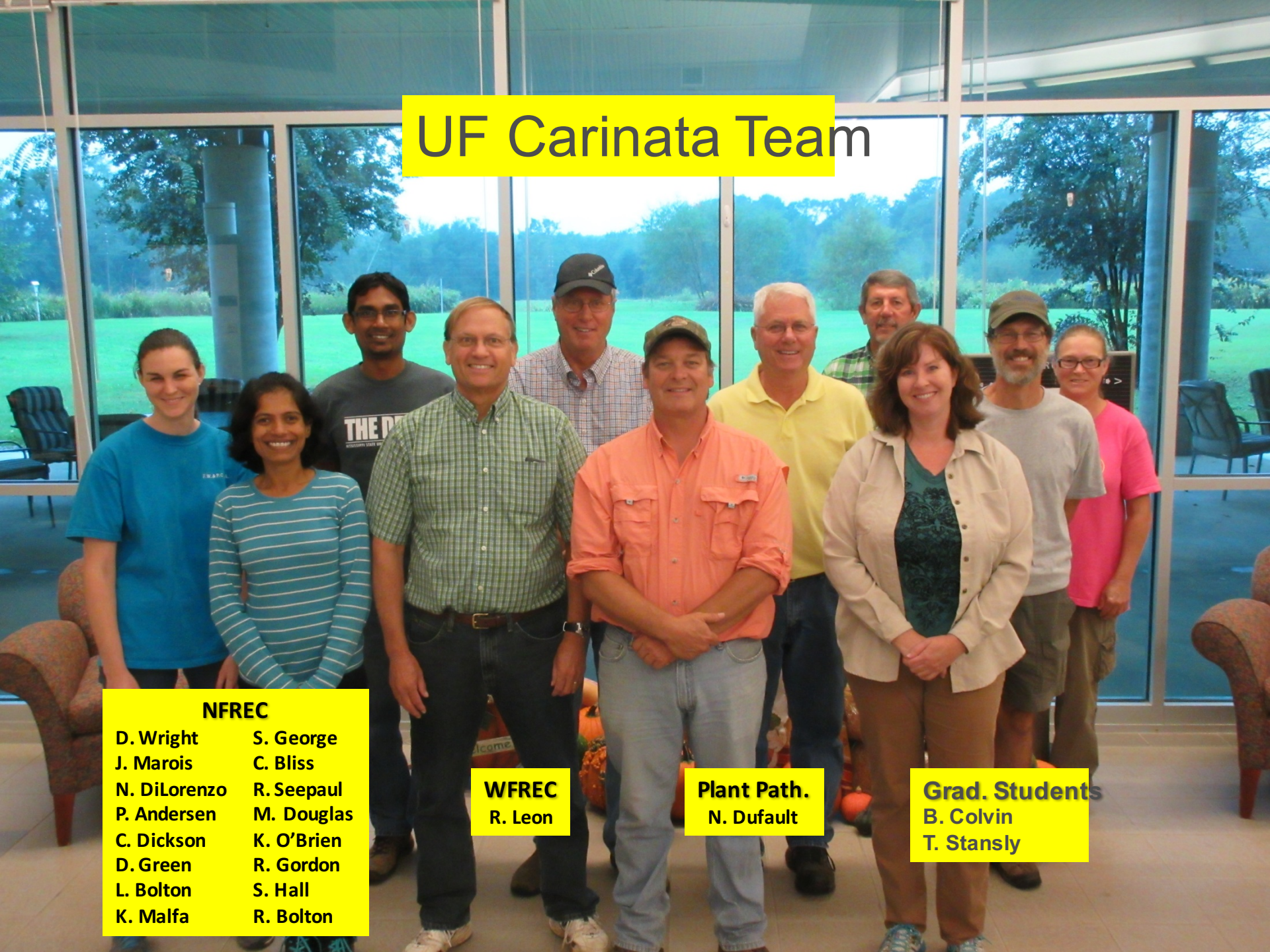
Products from carinata

Partnerships

Industrial oilseeds leverage the existing agricultural infrastructure to achieve scale and suitable economics for aviation within a secure and stable value chain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Grad. Students
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T. Stansly

Energy Crop Research - Grasses

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Sweet Sorghum - Improving yields in the SE US through breeding and management

Dr. John Erickson and Dr. Wilfred Vermerris
Ana Saballos, Jose Lopez, Jeffrey Fedenko, Terry Felderhoff, Ishmael Nieves, and Lonnie Ingram

- Tolerant to drought and heat compared to sugar cane
- Compatible with sugarcane production
- The UF sorghum breeding program is focusing on developing regionally adapted sorghums that give high yields with limited inputs

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Enhancing Sugar Yield in Sorghum

Sugar Yield = Sugar Concentration × Juice Volume

- Genetic basis of both traits poorly understood
- Multiple genes involved
- Influence of the environment
- Mapping studies with the sweet sorghum 'Rio' have identified consistent loci associated with sugar concentration
- Juice volume is difficult to predict based on the appearance of the stem

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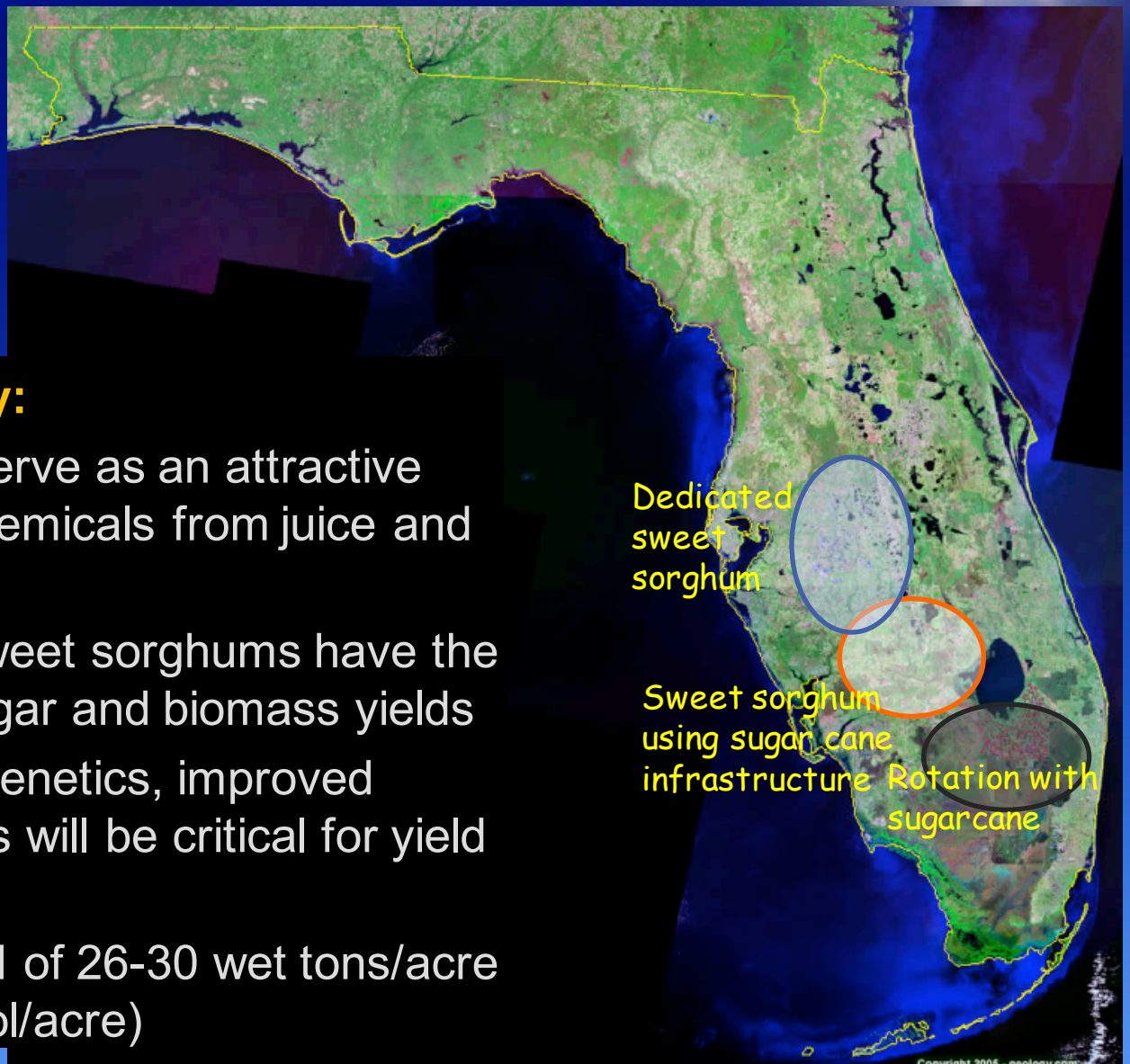
Insect & Nematode Management

- Sorghum insects
  - Stem borers
  - Fall armyworm
  - Sorghum midge
  - Greenbug
  - Chinchbug
- Nematodes




- **Counter** (8.9 lbs/acre) at planting
- **Bt – Dipel** (2 lb/acre) in-season
- **Sevin** (2 qt/acre) in-season

Primary Sweet Sorghum Production Areas in FL



Conclusion of the Study:

- Sweet sorghum can serve as an attractive source of fuels and chemicals from juice and bagasse
- Regionally adapted sweet sorghums have the potential for higher sugar and biomass yields
- Along with improved genetics, improved management practices will be critical for yield improvement
- Average biomass yield of 26-30 wet tons/acre (300-500 gal of ethanol/acre)

Energy Crop Research – Grasses

Water-Use Efficiency and Feedstock Composition Study in Florida Environments by:

Drs. L. Sollenberger, J. Erickson, J. Vendramini, and R. Gilbert

Energycane

Sweet sorghum

Elephant grass

- **Comparisons of water-use efficiency and feedstock composition of candidate grass species (several locations)**
- **Graduate students trained in the ecology, physiology, and chemical composition of bioenergy grasses**

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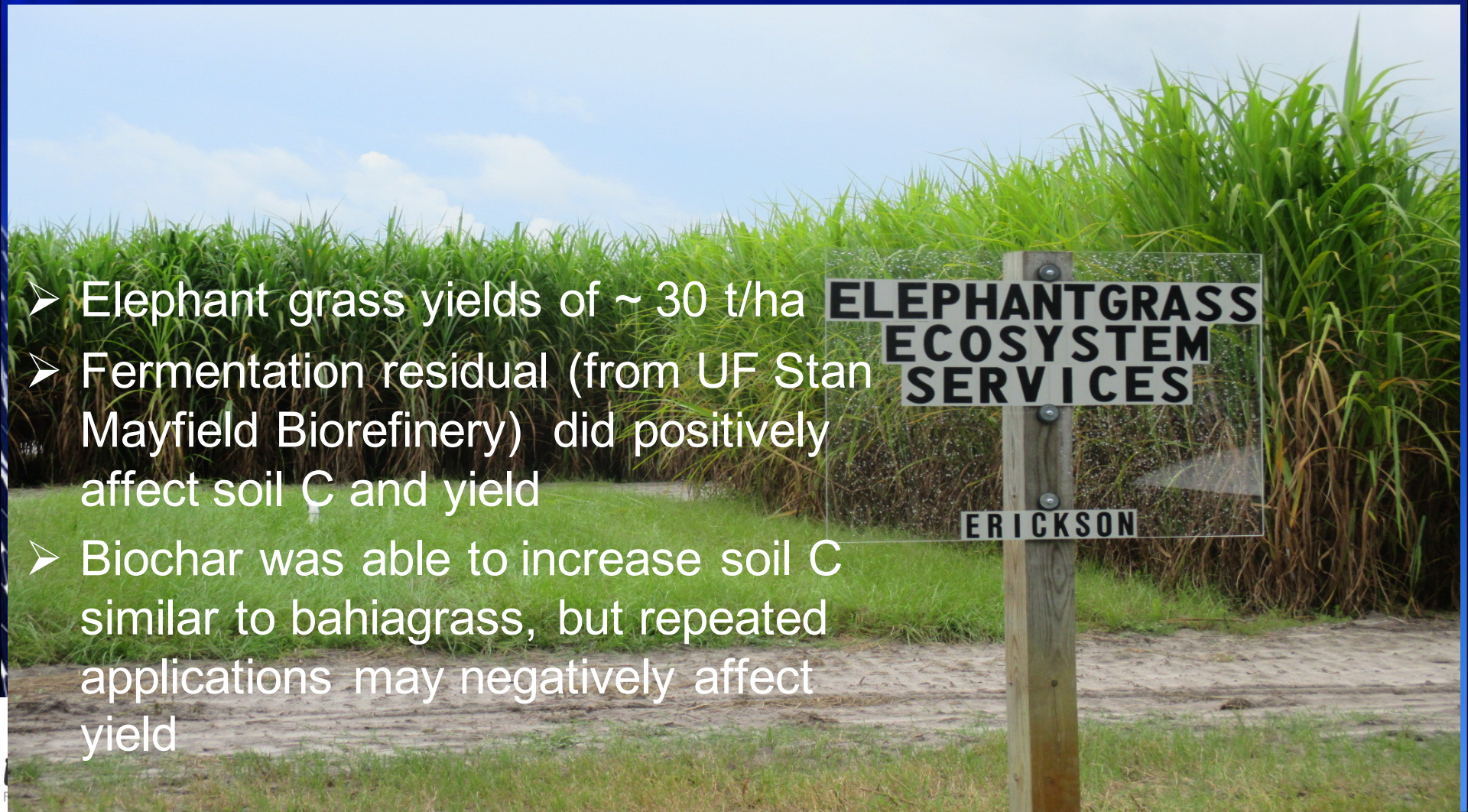
Elephant grass - Biochar and fermentation residual as nutrient to enhance its biomass yield and soil carbon

By Dr. John Erickson

Drs. Maria Silveira, Ramon Leon, Lynn Sollenberger, and Lonnie Ingram



- Elephant grass yields of ~ 30 t/ha
- Fermentation residual (from UF Stan Mayfield Biorefinery) did positively affect soil C and yield
- Biochar was able to increase soil C similar to bahiagrass, but repeated applications may negatively affect yield

Energy Crop Research

Energy Tubers and Beets

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Evaluating Energy Tubers and Beets as Feedstocks for Biofuels & Biogas in South Florida

Funded by FDACS Office of Energy Farm to Fuel Project

PIs: Drs. Brian Boman, Gilly Evans, Ann Wilkie, Janice Ryan-Bohac

Sweetpotato

Energy Beet

Objectives

- Field trials with eTuber™ industrial sweet potato and energy beet varieties to determine yield potential & growing protocol.
- Determine if crops can be economically produced on fallow citrus land.
- Document input costs and cultural practices need for profitable production.
- Economic analysis of costs and potential returns to growers.

Cooperators & Partners

TCERDA
Treasure Coast Education, Research and Development Authority
2199 South Rock Road, Fort Pierce, FL 34945

Doreva Produce

Mosaic

NCERC at SIUE
400 University Park Dr.
Edwardsville, IL 62025
618-659-6737

Southern Illinois University Edwardsville

Advancing Biofuels Research

Penford Corporation

Penford Corporation

CARENERGY, LLC
N. CHARLESTON, SC

REG
Renewable Energy Group

Energy Tuber Planting

Plugs, rooted cuttings, & slips

Energy Tuber Harvest

Energy Beet

Studies Performed for Energy Crops Include

- Maximization of biomass and biofuel output
- Genetic control of seeds, water use efficiency, yield
- Fertilizer management, alternative nutrients sources
- Planting management
  - Seed bed preparation
  - Row spacing
  - Plant populations
  - Optimum planting times
  - Plant rotations
- Weed, disease, pest management
- Harvest Management
- Invasiveness

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UF Biofuel Research and Facilities

UF Bio Fuel Pilot Plant

UF Stan Mayfield Biorefinery

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