Soybean Rust

Melvin Newman, Professor
Plant Pathologist
UT Extension


Soybean Rust
It's here !

Progression of Rust on Soybean

Day 1 – 0% symptoms

6 Days later

13 Days later

27 days

Defoliation caused by rust


Defoliation caused by rust


Defoliation caused by rust


Defoliation caused by rust

Soybean Rust

- **Caused by two species of fungi:**

  - ***Phakopsora pachyrhizi***
    aka “Old World” isolate
    More aggressive pathogen

  - ***Phakopsora meibomiae***
    aka “New World” isolate
    Not as aggressive

Soybean Rust Causes

- Premature defoliation
- Increase in number of unfilled pods/plant
- Decrease in number of normal pods/plant
- Decrease in number of seeds/plant
- Decrease in weight of seed/plant
- Decrease in 1000-seed weight
- Decrease in germinability of seed

Current Global Soybean Rust Situation

Zimbabwe	1997/1998
South Africa	2001
Paraguay	2001/2002
Brazil	2002
Argentina	2002
USA (SE states)	2004

Reported yield losses.

Historical .

Country	Yield loss (%)
Australia	60-70
India	66
Indonesia	81
Japan	15-40
Philippines	30-80
South China	10-50
Taiwan	12-80
Thailand	10-40
Vietnam	50-100

New reports .

Country	Yield loss (%)
Uganda	40
Zimbabwe	40-60
South Africa	10-80
Nigeria	100
Brazil	10-80
Paraguay	30-80
Argentina	Not determined
Bolivia	Not determined

Economic impact

In Brazil, yield loss estimates of 5% for the total soybean crop were given for the 2002 harvest.

In 2003 losses of 15 and 35% were reported in the provinces of Bahia and Matto Grosso.

From these two provinces alone, yield losses exceeded $700M, combined with $400M in fungicide costs.

- There are 70-78 million acres of soybeans planted in the USA.
- Average yield of the crop is 30-40 bushels per acre.
- 2.1B to 3.1B bushels of soybeans produced
- At $6.00/bushel = $12.6B to $18.6B
- A 5% yield loss = $630M
- Plus additional costs to the producer for fungicide applications.

Risk Analysis Predictions for the USA

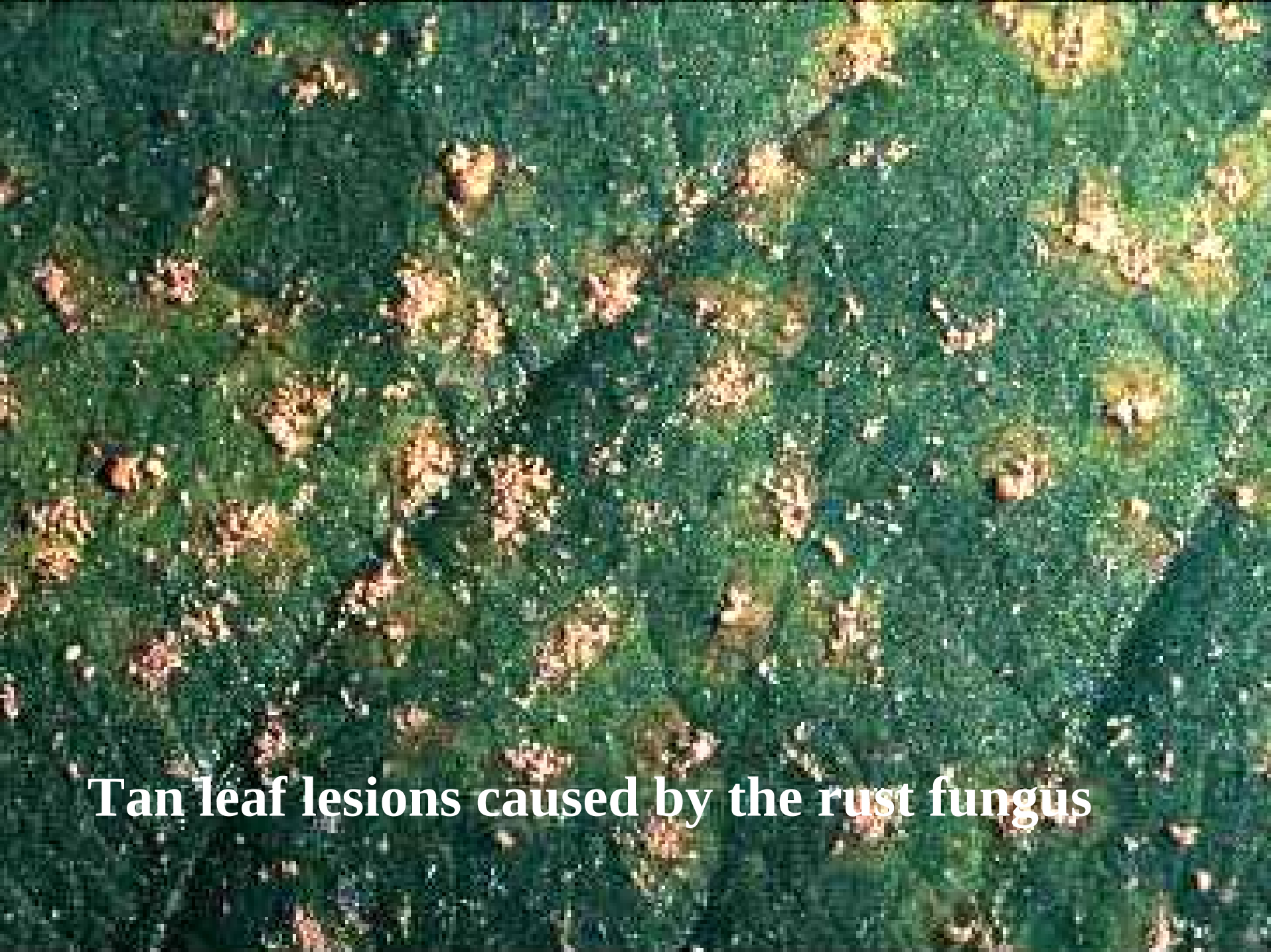
- Southeastern and Delta States can expect losses of 50% while Mid Western states can expect losses of 10% if conditions for maximum disease are favorable.
- Weather driven risk model

Early Infection in the light

Heavy infection of Rust

Early leaf spots caused by the soybean rust fungus

Rust on soybean leaf grown in lab



Tan leaf lesions caused by the rust fungus

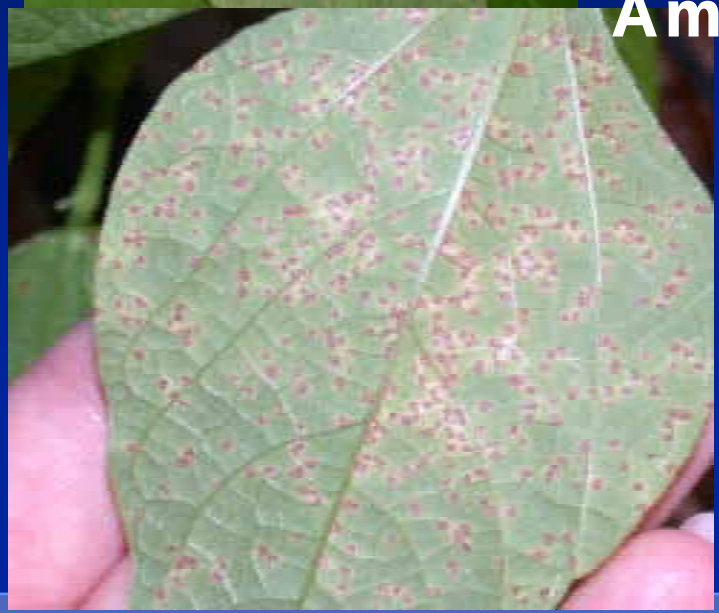
Red type rust lesions

Pathogen and Rust Development

- Urediniospores requires 6-8 hours of moisture to infect.
- Temperatures of 18 to 28 C will allow rust to develop.
- The first urediniospores develop 6 to 7 days after infection.
- High humidity promotes spore production.
- As plants mature the rate of the epidemic increases.

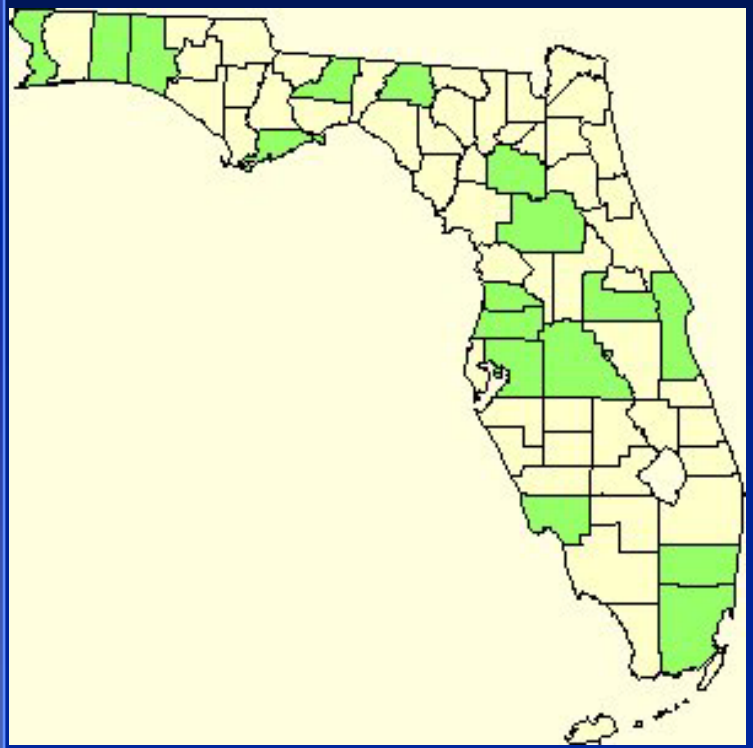
The host range of *P. pachyrhizi* is over 95 species in 45 genera

Included in this list are the wild and domesticated *Glycine* species, several *Phaseolus* species, *Vigna* species and many other legume species. Among them is Kudzu




Kudzu is a host for soybean rust

KUDZU DISTRIBUTION IN FLORIDA



Soybean rust on kudzu leaf

Soybean rust on kudzu

Control/management strategies for soybean rust

- **Short-term**

  Fungicides

- **Long-term**

  Resistant varieties

Fungicides will be the primary tool to control Asian soybean rust in the near future

C. Levy

Soybean Rust

C

Fungicides Registered for Use on Soybean and Labeled for Control of Soybean Rust in the US

Chlorothalonil

- **Bravo (Syngenta)**
- **Echo (Sipcam Agro)**

Azoxystrobin

- **Quadris (Syngenta)**

Fungicides on the Section 18 Emergency Exemption Request

• Myclobutanil	Laredo
• Propiconazole	Tilt
• Pyraclostrobin	Headline
• Pyraclostrobin + boscalid	Pristine
• Tebuconazole	Folicur
• Tetraconazole	Domark
• Trifloxystrobin + propoconizole	Stratego

(products in red have been approved for soybeans for rust control)

All Fungicides Are Not Equal and fall into two type of control

Curative

- Absorbed
- Translocates
- Kills fungal tissue
- Use after infection
  - Triazoles

Protectant

- +/-Absorbed
- +/-Translocates
- Prevents infection or sporulation
- Use before infection
  - Strobulurins and chlorothalonils

Suggestions for Fungicide Control of Soybean Rust

- First application needs to be at or near first flower - 50 dap
- 2 or 3 applications are needed
- 14 - 20 days between applications
- The fungicide needs to penetrate the canopy

Additional Suggestions

- Strobulurin fungicides need to be used as a protectant, once rust is at 5-10% they do not always protect yield.
- Strobulurins are single site mode of action - use only once per season.
- Many triazoles may not have the residual needed for 20+ day intervals ?
- Environment will have an effect.
- Mixes of triazoles and strobulurins
- Rotate triazoles and strobulurins.

Common Sense suggestions

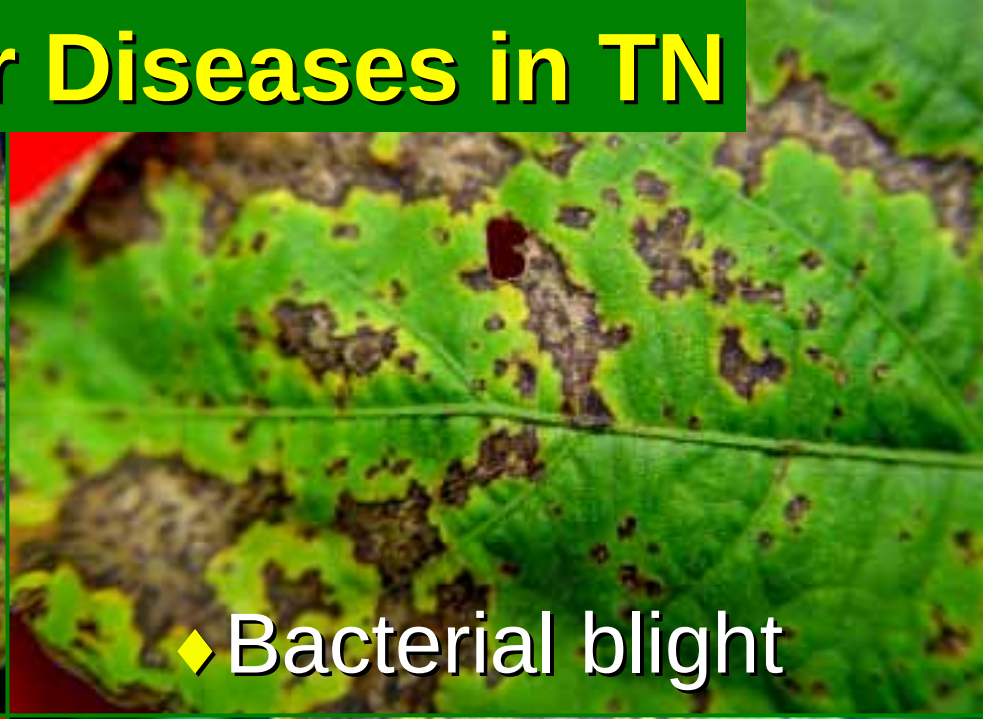
- Avoid the time of year (season) where rust is most severe
- Select the practice that returns the most yield in the absence of rust

Suggestions For Chemical Control

- **Brazil and southern Africa are the sources of information**
- **Formulations we will have will differ from Brazil and Africa**
- **Not all fungicides will be available in the U.S.**

Common Foliar Diseases in TN

♦Frogeye leaf spot

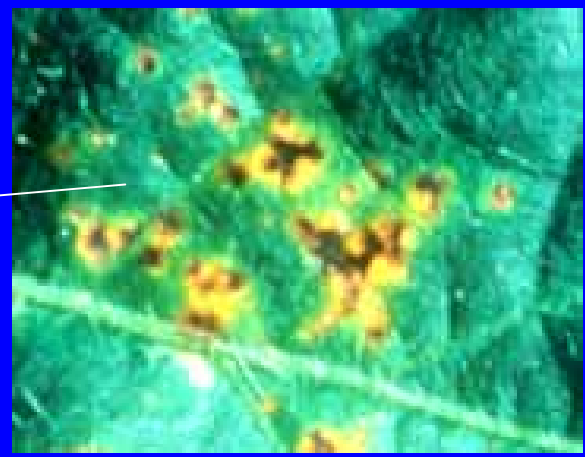


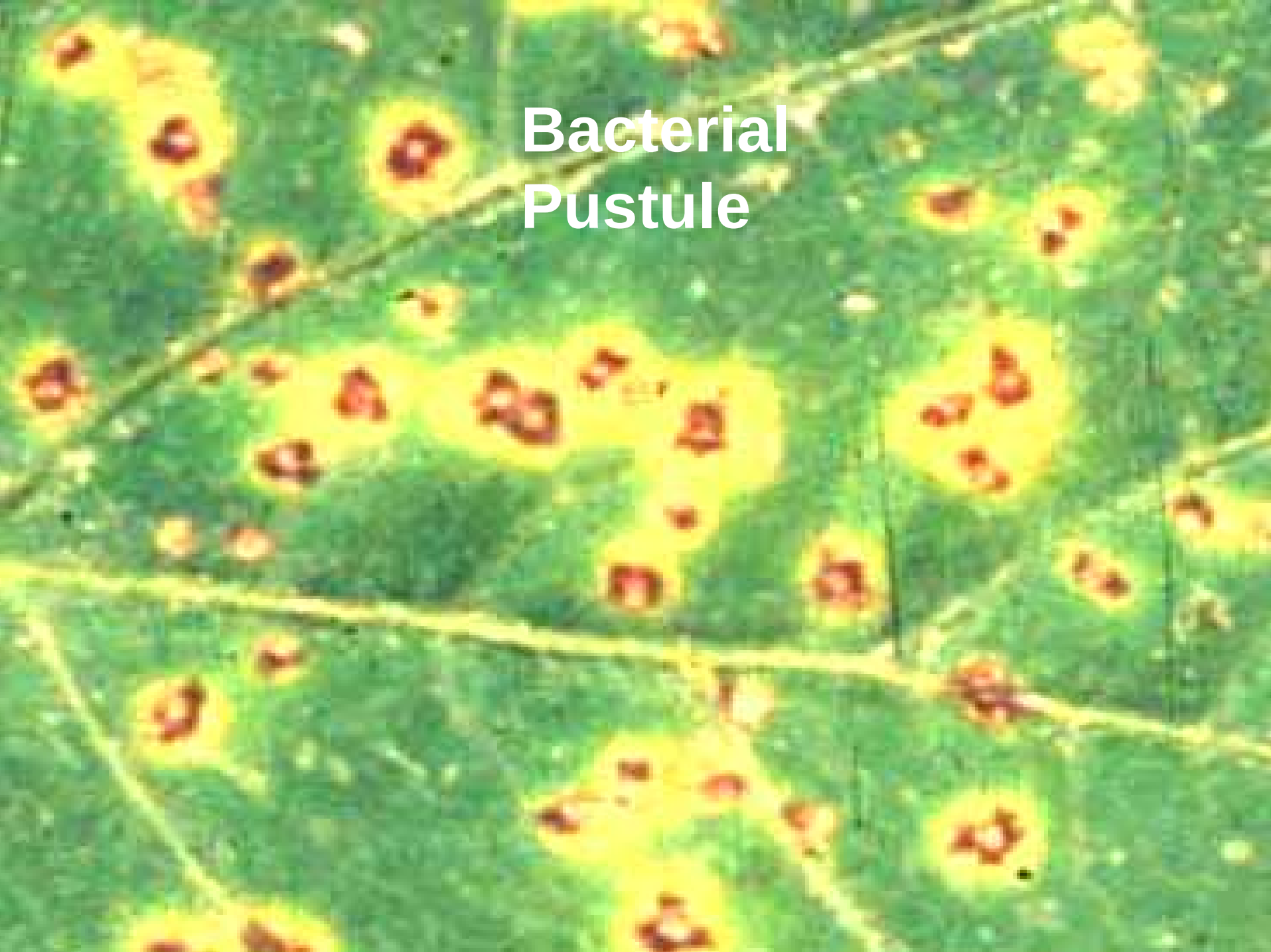
♦Bacterial blight

♦Downy mildew

♦Brown Spot

Bacterial Blight




Bacterial
Pustule

Scouting for Soybean Rust

- **Where to look**
  - Look lower in the canopy
  - Know your other diseases
- **Samples**
  - Collect 20 leaflets, flatten and place in between paper towels
  - Place in sample bags and clearly mark pertinent information, like date, location, name, phone number, etc.
- **Scouting**
  - Scouting patterns may vary depending on the purpose
  - In general, evaluate 20 locations in a field examining five plants per location
  - Other scouting procedures may examine more likely areas where rust could occur due to conducive environmental conditions or strategic areas

Scouting for Soybean Rust

- Equipment
  - GPS unit, hand lens (X20), pocket picture guide, sampling bags
- Plan
  - First occurrence or scouting after it is known to occur in another state or in your own area may dictate the sampling procedure
  - If it is for the first occurrence - know what to do with the sample - where it should be sent - for example submit samples to your state lab. These samples will be forwarded to the regional lab or Fort Detrick, Maryland.
  - If it is for the first occurrence - know what to expect in terms of recommendations, communications, and APHIS regulations.

What is Being Done?

Soybean checkoff, USDA and Homeland Security funding research.

Soybean checkoff – United Soybean Board

1. **Determine resistance of US commercial germplasm to rust**
2. **Identify resistant germplasm from international sources**
   - **Brazil, Paraguay, South Africa, Zimbabwe, Thailand, China**
3. **Determine efficacy of fungicides against soybean rust**
4. **Climate Prediction Models**

Tennessee Efforts:

- Staff training
  - Agents & Specialists and CCA
- Simulated exercises
- State Plans
- State Labs and Regional Lab
- Scouting & Survey program
- Training first detectors and Triage personnel
- Communications
- Producer meetings

Keys for Rust Control

- Symptoms in the field are very hard to see, especially the initial lesions.
- Use training pictures etc.and procedures on how to I. D. rust.
- Spraying early is the key to good control. First bloom ? Two application 21 days apart. Good coverage, ground application best.
- Use hollow cone nozzles, high pressure, more water (15-20 gallons/a).