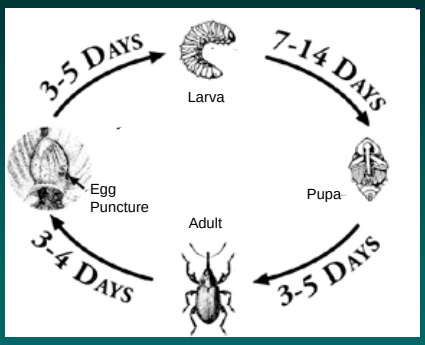
The boll weevil: what is it?

Kingdom: Animalia
Phylum: Arthropoda
Class: Insecta
Order: Coleoptera
Family: Curculionidae
Genus: *Anthonomous*
Species: *grandis*
Subspecies: *grandis*

Family Curculionidae: true weevils

> 60,000 species worldwide !!

Boll weevil life history



Boll weevil biology

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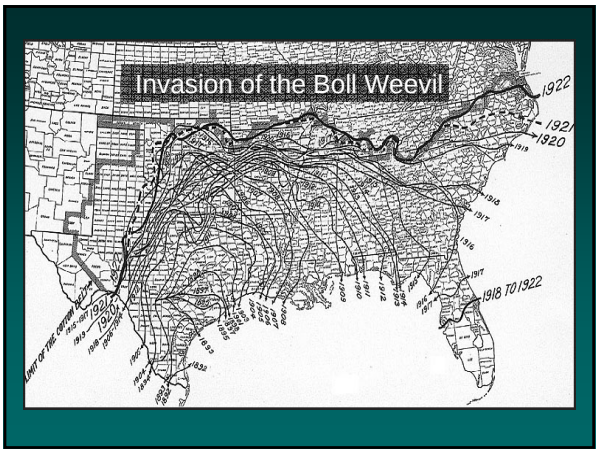
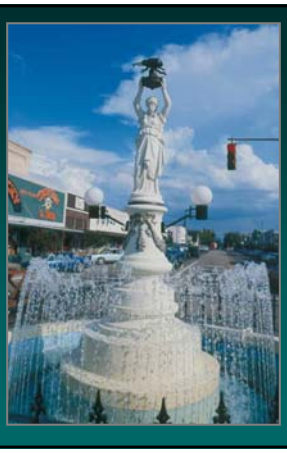


Impact of the Boll Weevil on Georgia's cotton production: 1919-1922

Year	Bales of Cotton
1919	19,789
1920	11,685
1921	1,509
1922	710



Enterprise Alabama

1915- Boll weevil appears
1918- Cotton being lost
1918- Crop diversification
1919- Statue dedication; cost $1,800; Italy
1949- Boll weevil added
1949-1998- many thefts
1998- Resin replica
1998- present- original in Enterprise Depot mus.

Insect control far easier after WWII:

Synthetic insecticides developed, such as chlorinated hydrocarbons & organophosphates (OP's)

Easy insect control; short-lasted:

resistance to these compounds was evident by the mid-50's

Boll weevil management

A. Crop management
- Cultivar selection
- Early planting
- Trap crops
- Row and plant spacing
- Fertilizer management (N)
- Growth regulator (Pix®)
- Irrigation management
- Chemical termination
- Crop residue destruction

Boll weevil management (cont.)

B. Population monitoring
   1. Adult monitoring - pheromone (Grandlure®) traps
   2. Field scouting for damaged squares

C. Thresholds
   1. Overwintering population (pinhead-square)
      3 weevils / trap / week
   2. In-season generations 10 - 25% squares damaged

Boll weevil management (cont.)

D. Insecticides - target adults only
   1. Overwintered emerged adults targeted (termed pin-head square applications)
      a. O. P.'s - malathion, methyl parathion, guthion
   2. In-season generations
      a. O. P.'s same as above
      b. Pyrethroids - all used for bollworm control
   3. Diapause control - O. P.'s above

ERADICATION of the boll weevil has been the impossible dream of the cotton industry since the pest invaded Texas in the late 1800's.

The concept of ERADICATION has provoked bitter debate among entomologists

The problem is one of definition

Most eradication programs have resulted in costly failures. Successes have been limited to recent invader species (fruit flies) or to localized areas of a species range (screwworm).

1969 - National Cotton Conf. appointed a Special Study Comm. on Boll Weevil Erad. which selected South Miss. as the site for the initial boll weevil eradication trial (PBWEE).

PBWEE was designed
to answer one question:

Was the technology available to eradicate the boll weevil from the United States?

Events responsible for PBWEE

- Development of the theory for total population control
- Success of the reproductive - diapause control method
- Adaptation of the sterile male technique to boll weevil control
- Improved mass rearing procedures
- Perfection of a highly sensitive detection system

Techniques employed in PBWEE

- In-season insecticides
- Reproductive - diapause control
- Cultural controls
- Pheromone traps
- Early-season insecticides
- Sterile males

E. F. Knipling (1978)

"Eradication is to get rid of an existing population from a defined area. Elimination of the original population would be permanent if the area is not subject to reinvasion."

L. D. Newsom (1978)

"Eradication is the destruction of every individual of a species from an area surrounded by naturally occurring or man-made barriers sufficiently effective to prevent reinvasion of the area except through the intervention of man."

Two technical committees evaluated PBWEE

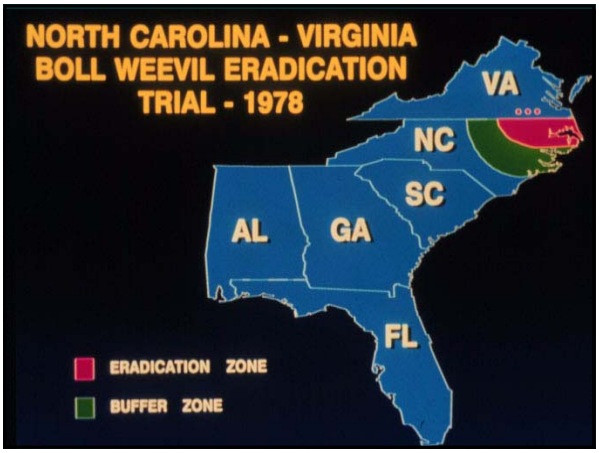
- Technical Guidance Committee (TGC) for PBWEE
- ESA Review Committee

Technical Committee conclusions

- TGC - That it is technically and operationally feasible to eliminate the boll weevil as an economic pest in the U.S.
- ESA - Data indicate that eradication was not accomplished in the core area

NC - VA Boll Weevil Eradication Trial (BWET)

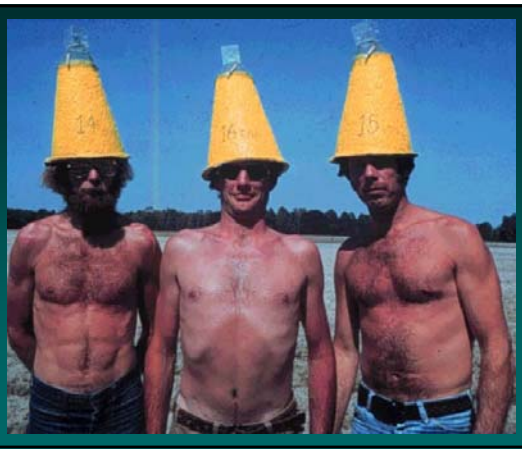
- Core zone (13,000 acres) isolated
- Buffer zone ~ 85 miles
- Good weevil habitat
- Excellent area for expansion



Suppressive techniques BWET year one (1978)

- In-season insecticide applications - 2.2
- Reproductive - diapause apps. - 5.0 based on pheromone trap captures

Boll Weevil Containment Program:
(pheromone trap-based)



Suppressive techniques BWET year two (1979)

- Pheromone traps (1.3 traps / acre); only 7 overwintered weevils caught
- Release of sterile male weevils (1 million)
- Dimilin application to selected fields
- Reproductive - diapause applications

Suppressive techniques BWET year three (1980)

- Pheromone traps (1.0 trap / acre)
- Selected insecticide treatments

NC producer costs ($ / acre) for BWET

- Year 1 (1978) - $ 46.54
- Year 2 (1979) - $ 23.47
- Year 3 (1980) - $ 15.29
- Current costs (2009) - $1.25 (maintenance)

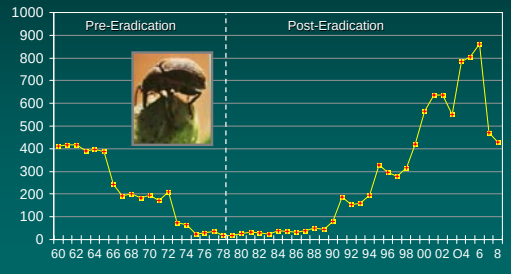
Economic benefits of boll weevil eradication
(Carlson et al. 1989)

- Lower insect control costs
  (71% reduction - 10 apps. to 3)
- Higher cotton yields
  (69 lbs. lint / acre)
- Increased land values
  (20% increase)

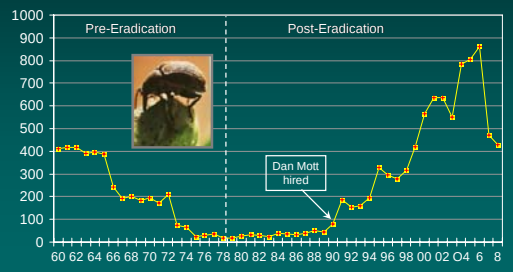
Total economic advantage of eradication in North Carolina-Virginia area:

$ 68.34 / acre / year

North Carolina Cotton Acreage: 1960 - 2008



North Carolina Cotton Acreage: 1960 - 2008



Cotton insect management, foliar sprays: then and now

	1972	2009
Applications/acre	8 to 14	0.8 to 2
Pounds active/ application	1 to 3	0.014 to 0.75
LD_{50}	10 (mallard)	3,000
Safety factor: 7 x 4 x 300 = 8,400-fold < exposure		

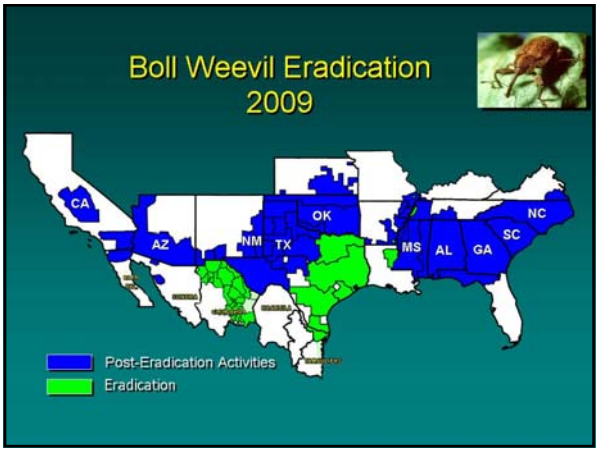
Southeast containment program

- First trap catch triggers mass trapping (5 traps/ acre) in that field and adjoining fields.
- Then all fields within 1 mile radius receive 1 trap / acre
- Additional catches - insecticide applications & additional traps

Boll weevil pheromone trap captures

(Containment Program, 1995 – 2008)

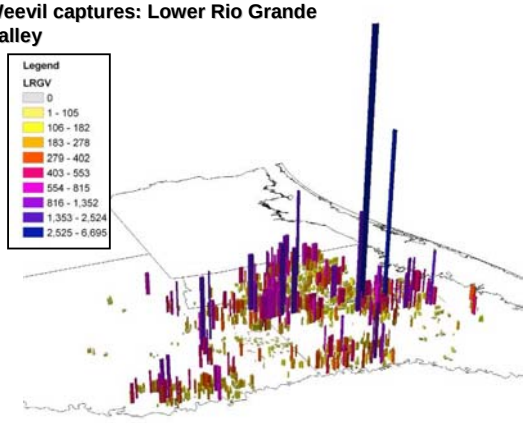
Year	Virginia	North Carolina	South Carolina	Georgia
1995	325	19	17,000	4,750
1996	1	27	1,829	83
1997	0	143	4,115	14,539
1998	0	2,300	1	58
1999	0	4	3	3,175
2000	0	1	1	16
2001	0	174	0	4
2002	0	15	0	82
2003	0	0	0	0
2004	0	0	0	0
2005	0	1	0	0
2006	0	0	0	0
2007	0	0	0	0
2008	0	0	0	0



East and South Texas

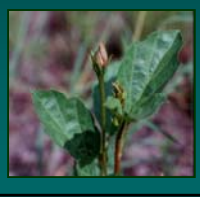
- **713,190 max. mapped cotton acres … down 5% from 748,209 acres in 2007**
- **Year end, 1,936,154 boll weevils caught … down from 2,607,453 year end in 2007**
- **Year end, 3,868,313 acres treated … down 18% from 4,706,571 treated in 2007**

Weevil captures: Lower Rio Grande Valley



Boll weevil eradication: Texas challenges

- ✓ Cotton regrowth throughout winter
- ✓ Volunteer cotton from seed
- ✓ Alternative boll weevil hosts
- ✓ Funding challenges



Post-eradication cotton insect pest status in North Carolina

- Boll weevil - no longer a pest
- Bollworm / budworm/ ECB – pest status reduced (*Bt* cottons)
- Stinkbugs - new pest
- *Lygus* spp. - pest status elevated

Boll weevil summary

- Classic example of a key pest
- The insect responsible for agricultural diversification in the southeast U.S.
- More insecticides have been used against boll weevil than any other insect pest
- Responsible for more economic losses than any other insect despite controls
- Biological controls have little impact
- Cultural tactics are the foundation for management; or eradication
- Subject of the largest eradication program ever