Hurdles of the Past and Challenges in the Future of Cotton Insect Management and Control

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One could argue that the past 30 years have been the “worst of times and the best of times” in cotton insect control. I consider it to be the most exciting and revolutionary period in cotton insect control history. The worst of times was the period of 1987 to 1995 with uncontrollable beet armyworm outbreaks and the development of pyrethroid resistance to the tobacco budworm. The best of times was made possible by the eradication of the boll weevil and the introduction of genetically altered cotton varieties. The “best of the best” times were experienced by many growers in 2011 and 2012, with two of the highest yielding years in history, the best market prices in my career and the lowest insect loss year in history. Both Alabama and the U.S. reported total losses to insects in 2011 as 2-3%, the lowest ever recorded.
Hurdles of the Past

• Boll Weevil
  – From early 1900’s to about 1995 in southeastern U.S.
  – Boll weevil was the key pest that dictated the initiation of control programs each season
  – Three to five day spray schedules required from about July 4th to cotton maturity
  – Growers needed a dedicated hycycle and driver for approximately every 500 acres of cotton
  – Primary insecticides were organophosphates
  – Excessive phosphates led to delayed maturity
  – Special session at the January 1976 Beltwide Conference to deal with the delayed maturity issue
  – Pyrethroids given emergency or conditional registration in 1976 eliminating the delayed maturity issue
Beet Armyworm Outbreaks

- No effective chemistry available
- Parasites and predators, if present, gave effective control—but not possible during active eradication
- Experimental insecticide, Pirate, highly effective but not approved by the EPA for emergency use until too late (August 1995)
- The original efficacy work on BAW control with Pirate was done at Prattville Experimental Field with ACC support
- Meeting with EPA in Senator Heflin’s office- Washington D.C.
Pyrethroid Resistant Tobacco Budworms

- No effective chemistry available
- 1994-95- highest TBW numbers in history, up to five escape larvae per plant
- Yield losses astronomical
- Introduction of Bollgard cotton in 1996 is one of the most significant events in past 100 years
- Introduction of novel caterpillar chemistry (Tracer, Steward, Prevathon and Belt)
- This new lep chemistry would have had a greater impact if genetically altered varieties had not been developed
Transition from In-Furrow Granules to Seed Treatments for Thrips Control

- Loss of Temik for early season insect control (thrips, spider mites) and nematodes
- The impact of this change is still playing out
- Could lead to major problems with spider mites in years ahead
Challenges for the Future

• I will limit my discussion to the four pests that I think will be the major players in cotton insect management for the next 5-10 years. These are: stink bugs, early season thrips, spider mites and whiteflies (both banded wing and silverleaf whitefly).
Stink Bugs

• In the southeastern U.S., stink bugs will likely remain as the #1 most economically damaging insect on cotton. However, as we have experienced in the past several years, the potential damage from this pest can change greatly from year to year. This is most likely influenced by both winter temperatures and spring/summer drought and high temperatures.
Stink Bugs

• I feel that, at present, we have a good understanding of how to manage this insect. Scouting techniques, period of peak damage potential, dynamic thresholds and effectiveness of the various chemical choices are all well understood by consultants and many growers. The bottom line with the stink bug is that we need to all be utilizing the knowledge available about this pest because they will likely be a major player in cotton for the remainder of our lifetime.
Stink Bugs

- Stink bugs have always been a pest of cotton. They were just interrupted by chemical sprays to control boll weevils for about 85 years. Old publications printed before the arrival of the boll weevil list stink bugs as an economic pest of cotton.
- As already stated, we currently have a good base of knowledge to work with for stink bugs due to the excellent work and team effort of the Southeastern Entomology Working Group (Roberts, Toews, Bachelor, Reisig, Greene and Herbert).
Stink Bugs

• When asked to do this presentation, the topic of “Controlling Stink Bugs Without Methyl Parathion” was suggested. My thoughts on this topic would not quite fill a 20-30 minute presentation.

• I don’t see a major impact of the loss of methyl in cotton. However; soybeans, corn, fruit and nut crops are the big losers here. For these crops, the loss of methyl puts a lot of pressure on the pyrethroids, especially bifenthrin, since Bidrin is not labeled.
Stink Bugs

• The most effective chemical choice for crops other than cotton would be Bifenthrin at the mid to highest labeled rate, depending on whether the stink bug population is the green, southern green or brown species. My concern here would be whether our chemical choices would be effective enough if we are targeting a high population of primarily brown stink bugs.

• Is 50-80% control good enough when targeting brown’s with Bifenthrin, other pyrethroids, acephate or Belay (a third generation neonicotinoid containing clothianidin)? Research indicates that Belay performs better in soybeans than cotton.
For the Future: Factors That Could Make Stink Bugs a Lesser Problem

1. Colder winters and a lower overwintering population
2. Reduced acreage of corn, corn seems to be a major contributor in building current season populations
3. More experience by consultants and other advisors as to scouting, thresholds, effectiveness of the various control options and timing of controls
For the Future: Factors That Could Make Stink Bugs a Greater Problem

1. Stink bug resistance to pyrethroid chemistry
2. The removal of the remaining phosphate insecticides from the market (Bidrin, Acephate)
3. The establishment of the brown marmorated stink bug as a major economic pest (The BMSB has now been found in four AL counties and was found in soybeans in 2013 at Prattville, AL)
   a. The BMSB is spreading much slower than the Kudzu bug but presents a much greater economic threat.
   b. If the BMSB becomes established as an economic pest of cotton, we would have to reaccess our entire approach to stink bug management in cotton since they will feed on bolls up to 25 days old. Infestations in soybeans and corn would also present major problems without a phosphate insecticide to work with.
Seedling Thrips

• The management and control of thrips will likely continue as our second (near term) most economic insect of cotton. Many factors impact thrips management and damage: planting date; plant vigor (variety); weather (as it impacts both thrips populations and the crop itself); tillage systems; the latitude where cotton is grown (length of growing season); and, the use of foliar sprays when utilized as a supplement to seed/in-furrow treatments at plant.
Factors That Could Make Thrips a Lesser or Greater Problem:

- **Less:**
  1. Higher labeled rates of seed treatments
  2. New seed treatment or in-furrow chemistry

- **Greater:**
  1. Thrips resistance to the neonicotinoid chemistry (resistance documented to thiamethoxam – Cruiser in the mid-south states of Arkansas, Louisiana, Mississippi and Tennessee)
  2. Shifts in thrips species (Ex: to more western flower thrips which are more difficult to control)
  3. Regulatory impact from concerns about neonicotinoid chemistry and honey bees
  4. Greater impact of interactions between preplant herbicides targeting resistant weeds and seeding growth of cotton
  5. The increase in yield potential of newer varieties, leading to a greater importance of earliness for a longer more extended fruiting season. (Time needed to reach the 3-4 bale milestone).
Seedling Thrips

• I will end my comments on thrips by stating: The best thing to remember with thrips management is that you want seedling cotton plants to grow through the thrips susceptible window (1st to 5th or 6th true leaf) as quickly as possible. Thrips cause less injury to rapidly growing plants.
Spider Mites

- History:
  - Spider mites were an old late-season pest of cotton.
  - Mites are listed as a pest of cotton in textbooks printed in the early 1900’s.
  - The mite problem increased with the development and use of organo-chlorines in the 1940’s.
  - Problem intensified in some areas such as the Tennessee Valley of north AL until about 1970.
  - I am personally familiar with complete field wide defoliation from this pest in the 1950’s and 1960’s.
  - From about 1970 to the mid 2000’s mites were a minor problem in cotton (primary use period of Temik in-furrow).
  - For most of the last decade mites have returned as an economic pest, even to now an early season seedling cotton event.
Spider Mites

• The trend for increased mite pressure in cotton is evident. Spider mites have always been known as a dry-hot weather pest – but in the excessive rainfall year of 2013, mites could be found during wet periods in many fields. What has changed:
  1. Loss of Temik (1970-2010) which was the most effective miticide ever
  2. Adoption of seed treatment and the resulting need for foliar thrips/cutworm sprays
  3. Reduced tillage – mites now overwinter within fields instead of on the border as in the old days
  4. Changes in chemistry – organochlorines to phosphates to pyrethroids to neonicotinoids
Spider Mites

- Consultants and advisors should have a plan for spider mite management in future years. Populations could explode in non-irrigated dry seasons.

- Some management points by Phillip Roberts and Barry Freeman:
  1. Avoid or reduce risks associated with mite outbreaks
  2. Timely application of burn down herbicides – burn down at least one month before planting to prevent mites from overwintering in the field
  3. Utilize a cereal cover crop of wheat or rye
  4. Conserve natural enemies, miticides are not the ultimate answer
  5. Avoid un-needed insecticide applications
  6. The presence of mites should influence management decisions for other pests
     - Utilize thresholds and give thought to insecticide selection
     - Least disruptive or obtain mite suppression
  7. Spot treatments for mites are an option
  8. Early and mid-season mite infestations are more economical than late season infestations
Miticide Selection

• Mite control is more difficult on a rapidly growing plant
• Prior to about mid-July dicofol has provided the best suppression
• When the plant vegetative growth has slowed or stopped (3rd or 4th week of bloom), abamectin has provided the most economical effective mite control
• Other products recommended for mite control in Alabama are: bifenthrin, chlorpyriphos, dimethoate, Zeal, PORTAL, Comite and OBERON.
• Certain of these options will work in some regions but not others.
For the Future, Spider Mites:

- Factors that could make mites a lesser or greater problem:
- Lesser: Another mode of action or class of chemistry for thrips seed treatments or for mite control.
- Greater:
  1. Resistance to the current miticides (Ex: mite resistance to abamectrin is now present in Louisiana)
  2. Regulatory or label loss of certain currently available miticides
Whiteflies

• Banded wing and silverleaf (SLWF) species.
• Banded wing are much easier to control.
  – Tank mixes of bifenthrin plus acephate have given effective control in recent years.
• Incidence of SLWF are increasing and spreading. Infestations were originally reported in the Tifton, GA and Mobile, AL areas (likely influenced by winter vegetables and the nursery industry respectively).
• Now can be found in several other areas as well.
• A population was observed at the Wiregrass Research Center, Headland, AL in 2013
Whiteflies

• Dr. Phillip Roberts has made the following comments in newsletters in recent years:
  – Over the years we have noticed that when we observe whiteflies in cotton during July, we should anticipate economic problems
  – SLWF infestations can be unpredictable, but in general, dry-hot environments favor development
  – Heavy rains will often suppress adult SLWF, but will likely not solve the problem alone since reproduction is occurring and new adults will be constantly emerging
  – Late planted cotton infested with SLWF will likely need treatments (cotton planted behind wheat could be at greatest risk)
  – Hairy or semi-hairy leaf varieties seem to be more attractive to SLWF compared to smooth leaf varieties (both hairy and smooth leaf were equally infested at Headland, AL in 2013)
Controls for Whiteflies

• Banded wing
  – Acephate, Intruder, imidacloprid (Trimax) and thiamethoxam (Centric) recommended in Alabama

• SLWF
  – Effective control cannot be achieved with adulticides alone
  – IGR’s will be needed and must be used before the population reaches economic levels
  – The conservation of beneficial insects can be of great benefit in a SLWF management program
  – Intruder, Venom and the IGR’s Courier and Knack are recommended for SLWF control in Alabama
In Conclusion:

• I have only discussed four cotton pests because I feel that they will prove to be the most economic and/or challenging to manage and control in the foreseeable future. There will always be sporadic or occasional pests, but most can be controlled effectively if discovered in time. I do not see a time in the future where an experienced professional person will not be needed to monitor and advise growers in insect management. Stink bugs, and the other three pests discussed, would dictate the need for field monitoring in the future; just as the boll weevil did from about 1908 up to 1994 when they were eradicated; and, the tobacco budworm did from about 1960 to 1996 when Bt cotton was introduced.
In Conclusion:

- Eradication, insecticides and GMO development have produced changes in cotton pest management. Examples during my career are the light stable pyrethroids, neonicotinoids, new novel lep chemistry and Bt gene development.
- These advances have and will continue to create areas of need. In cotton we eliminated the boll weevil, gained an upper hand on leps (initially with pyrethroids and later with new novel chemistry and Bt cotton) only to have true bugs, aphids, spider mites and whiteflies come forward as increasing problems. More change is likely coming. Where do we go from here?
- Outside the field, future factors to be contended with:
  - Food safety
  - Concerns over non target organisms such as honey bees
  - Government Involvement in insecticide development and use
  - Demands for precision application
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