

Cotton IPM: A Quiet Revolution Reduces Costs, Losses and Risks for Arizona's Cotton Growers

University of Arizona College of Agriculture and Life Sciences 2013 Impact Report

Plant Systems; Environment, Water, Land and Natural Resources; Marketing, Trade and Economics

Issue

During the mid-90s, insecticide applications in cotton typically accounted for about half of all insecticide use in the United States. In 1995, nearly 100 percent of Arizona's cotton acreage was sprayed multiple times for pink bollworm, Lygus bug and silverleaf whitefly. New technologies have enabled cotton growers to reduce their spray applications significantly while achieving among highest cotton yields worldwide. Arizona now produces the highest-yielding cotton in the world, well over 1,500 pounds of fiber per acre, far exceeding the U.S. national average of about 750 pounds per acre. These technologies also help growers implement more ecologically-based, sustainable IPM programs and become less dependent on broadly toxic insecticides.

What has been done

An integrated pest management program (IPM) established in Arizona in 1996, refined in 2006 and continued through 2012 uses insect growth regulators (IGRs—effective against whiteflies), transgenic cotton (with Bt—*Bacillus thuringiensis*—effective against pink bollworms), and a reduced-risk feeding inhibitor (effective against Lygus bugs.) Safe for humans, these tools kill only their target pests, allowing natural processes to play a larger role in the management of all other pest insects. Growers have been taught to deploy fully selective materials first and whenever possible. The UA College of Agriculture and Life Sciences initiated the program in collaboration with growers, USDA, Arizona Department of Agriculture, Arizona Cotton Growers' Association, Cotton Incorporated, Arizona Cotton Research & Protection Council, industry and others.

Impact

The fully implemented, collaborative cotton IPM program has registered significant gains since its inception in 1996:

- Statewide averages for cotton insecticide use patterns in Arizona from 1979 through 2011 show that insecticide use on cotton for all insects combined—including whiteflies, pink bollworm, Lygus bug and others reached a 33-year low over the last 6 years, while also reducing costs to all-time lows. The estimated cumulative savings in control costs and yield (from reduced losses to insects) from 1996 through 2011 was more than \$388 million.
- Growers applied 4.15 pounds of active insecticide ingredient per acre of cotton in 1995. Over the last 6 years, the amount of active ingredient applied per acre was reduced by 3.26 pounds, or 77 percent, to less than 16 oz per acre. This is the equivalent of applying less than a can of soda on an area the size of a football field just once over the cotton season (March to October).
- The last 6 years have shown the lowest insecticide use in cotton on record (33 years), at just 1.5 sprays season-long, reducing insecticide loads on the environment by more than 1.6 million pounds of active ingredient annually, although 2012 was challenged by more pest pressures from Lygus, whiteflies and a new outbreak of Brown Stink Bug (the first in Arizona since 1963) resulting in a statewide average of 3.35 sprays.

- Compared to 10 years ago, the types of insecticides used now are much safer, with high selectivity and safety for beneficial insect populations. Specifically, there has been a 92 percent reduction in organophosphate use, comparing the last 6 years to an all-time high in 1995; a 97 percent reduction in pyrethroids; 82 percent reduction in endosulfan; and 97 percent reduction in carbamates; with an 85 percent reduction overall in cotton insecticide use. By 2011, 76 percent of all cotton insecticides used were either fully (55 percent) or partially (21 percent) selective, meaning they are safer to use and safer for the natural enemies in the cotton system. The total number of sprays applied in cotton has been reduced by 85 percent.
- For Lygus control, the percentage of cotton growers choosing reduced-risk insecticides over standard broad-spectrum options increased from 0 percent in 2005, 52 percent in 2007 and 75 percent in 2008 to 81 percent in 2009, the most recent year measured. One grower reported adopting this feeding inhibitor on 1,200 acres, resulting in 0 percent loss to Lygus in 2007 and again in 2010.
- For the first time in over 40 years, Arizona cotton growers did not apply a single spray against pink bollworm in the years 2008 through 2012. Through statewide grower-coordinated strategic uses of Bt cotton, sterile moth releases and pheromones, farmers are close to eradicating this pest from our borders.
- The percentage of cotton acres never sprayed for insects in 2011 was 29.3 percent, the highest level ever measured. Overall, cotton acreage in Arizona expanded from 150,000 acres in 2009, to 201,000 in 2010, and over 266,000 acres in 2011, indicating a health in the industry that can be attributed at least in part to higher yields and lower pest control costs. However, Arizona cotton acreage dropped 20 percent in 2012 due to reduced market prices.
- The cotton IPM plans developed in Arizona have been exported for use in California, Texas, northern Mexico, Australia and Latin America. During 2011 the Arizona cotton industry supported the state's economy with \$700 million in economic activity and sustained 9,000 jobs.
- A one-year cotton IPM program in the Mexicali and San Luis Valleys in Mexico directly caused over \$1 million of a safer, selective Lygus feeding inhibitor to be used in Mexico for the first time by cotton growers in 2011, replacing multiple sprays of broadly toxic, older insecticides. The EPA solicited and funded a proposal for further work in their "Border 2012" program to help shift Mexican cotton growers to practices and strategies modeled on those used in this Arizona program.
- The entire cotton industry of Mexicali Valley and San Luis Valley has participated in the UA's exported Extension program. Arizona Cooperative Extension worked directly with 11 different cooperatives that account for more than 95 percent of the cotton acreage in the area: 93,500 acres. The largest cotton cooperative in Mexico now uses the UA Cotton IPM program's specific evidence-based recommendations for Lygus and whitefly management. Numbers for that cooperative show that compared to 2010, insecticide sprays were reduced by about 33 percent in 2012. At least 75 percent of those sprays were reduced risk-insecticides, safe to beneficial insects and to workers. This represents a reduction of more than 60 percent in the use of broadly toxic insecticides. Yields from this cooperative were higher than in 2010 or 2011. This cooperative will increase their acreage by about 500 acres in 2013, despite market conditions

and overall reductions in the remainder of the Mexicali/San Luis Valleys (decreasing by almost 20,000 acres). See http://cals.arizona.edu/apmc/Mexicali_cotton.html

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