



Arizona IPM Outcomes WERA-1017 2023



Agricultural IPM

IPM Saves Cotton Growers Money While Helping the Environment

The UA Cotton IPM program has supported development & adoption of reduced risk practices and technologies that have saved growers over \$600M since 1996, averaging about \$25M per year, and preventing over 40M pounds of insecticide active ingredient from reaching the environment (Fig 1). Broad adoption of selective insecticides preserves predators and reduces the need for more sprays (Fig 2). In 2022, pest managers reported the lowest insect pest pressures ever, with 33.6% of Arizona's cotton acres remaining unsprayed for insects.

What's New?

Our research and outreach supported adoption of genetically modified ThryvOn cotton, resistant to *Frankliniella* thrips and Lygus bugs. Introduced in 2021, by 2022, ThryvOn represented 8% of upland acres statewide. Unrestricted commercial production began in 2023. Our data show that ThryvOn growers saved 1 to 1.3 foliar sprays, valued at about \$20 to \$26 per acre, or about \$150,000–178,000 saved by the cotton industry per year since 2021.

IPM Saves Growers Money While Helping the Environment

The Vegetable IPM Team supports the produce industry, valued at over \$1.15B/year, with research & outreach to address unique pest challenges. The industry has shifted from broad-spectrum insecticides in the 1990s and early 2000s to selective materials which pose fewer risks to people and the environment. For example, with the exception of pyrethroids, broadly toxic insecticides have been all but eliminated on head lettuce (Figs. 3 & 4). Selective reduced risk materials now account for over 60% of all reported insecticide sprays.

Impacts!

- 80% of IPM newsletter subscribers adopted reduced-risk pest management practices
- 83% reported increased yields
- 80% reported decreased use of broad-spectrum pesticides
- Adoption of reduced-risk IPM strategies saved average grower operations an estimated \$480k to \$1.5mil in insect management costs annually

Reducing Use of the Riskiest Pesticides

In a project funded by Better Cotton Initiative (BCI) in 2022, we analyzed use of 7 highly hazardous insecticides in cotton in Arizona, California, and the rest of the cottonbelt. Today less than 1% of Arizona's cotton acres make use of any of these highly hazardous pesticides targeted for elimination by Better Cotton's sustainability standards (Fig 5). Our Cotton Insecticide Use Guidelines help growers select products that reduce risks to human health, pollinators and other non-target species.

Public Health IPM

Public Health IPM Makes a Huge Difference for Tribal Communities

Arizona is home to 22 tribal nations, more than any other state. Many tribal members live in remote areas with minimal access to medical facilities and advice and are particularly vulnerable to public health threats. Since 2018, the Public Health IPM team has partnered with 15 of Arizona's federally recognized Native American Nations (Fig 6) and has reached nearly 250,000 residents on 42,604 square miles of reservation lands with science-based outreach.

Impacts!

- From 2018 to 2020, we reached 18,286 people in trainings, workshops, IPM demonstrations & other outreach events
- Surveys from 2019 (n=326) indicated up to a 75% increase in knowledge of IPM, public health pests and pesticide safety
- A majority of tribal collaborators say they will use IPM to improve their lives and communities
- At least 4 tribes have adopted IPM within their disease-prevention programs, protecting over 24,300 tribal residents from illnesses such as Rocky Mountain Spotted Fever and West Nile virus that can be spread from brown dog ticks and mosquitoes, respectively.

Bringing IPM Home for Indigenous Communities

School IPM outreach has been impactful across many tribal communities. A member of the Inter Tribal Council of Arizona said of our programs:

"The biggest impact is that our [members] want to learn more. They want to expand it to other communities, not just in schools, but in homes. People want more education and assistance on implementing more of these principles."

Healthier Homes & Schools

The Healthy and Safe Homes Initiative addresses COVID-19 health disparities among high-risk populations. We engage tribal school and housing managers and environmental health leaders to address Indoor Air Quality and IPM needs in tribal homes and schools to facilitate evaluation and corrective action within a One Health framework.

IPM in New Places!

Food Safety *is* IPM.

Both IPM and food safety are rooted in principles of prevention and avoidance, sampling and remediation. Building on relationships with tribes, the Public Health IPM Team now delivers food safety education to tribal growers. This work started with a 2022 Western IPM Center grant project.

Arizona has the largest concentration of American Indian farms in the US, with nearly 2M acres tended to by producers on tribal land. Native farmers are exempt from the Food and Drug Administration training and certification requirements, but they are not exempt from the marketplace. These new programs have the potential to protect millions of consumers from food-borne illness while fostering economic success of tribal growers and communities.

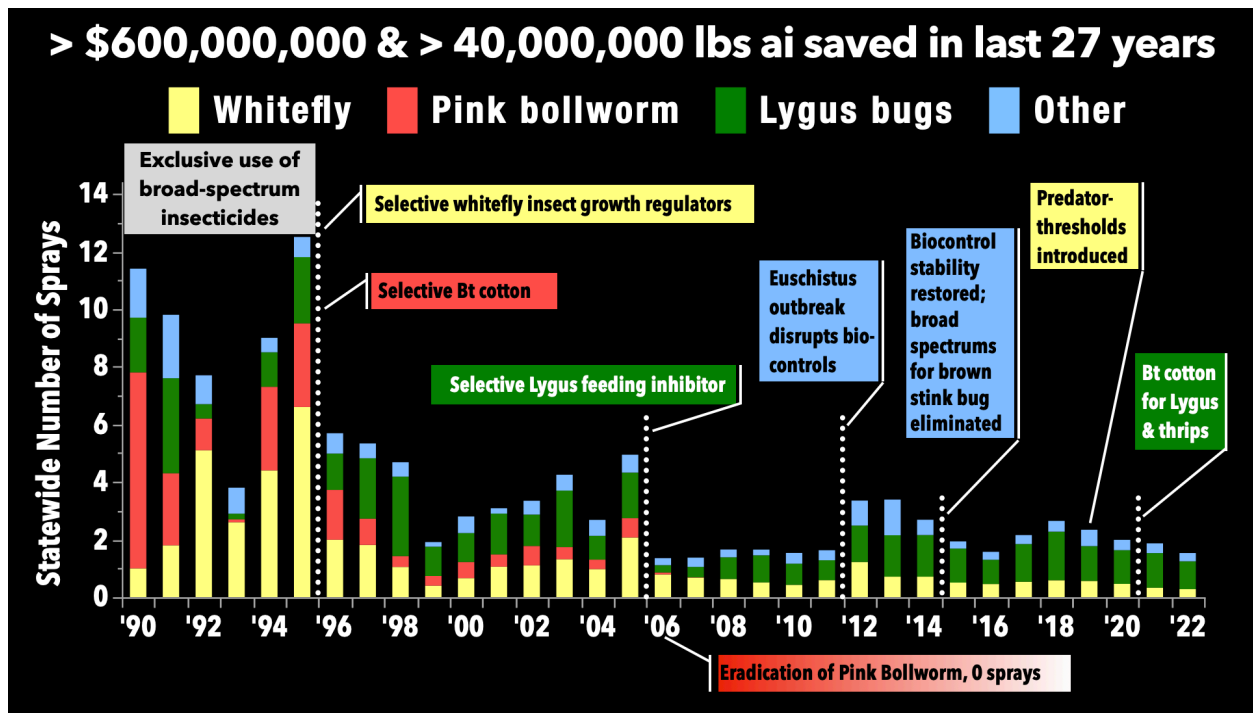


Figure 1. Average number of sprays made statewide to Arizona cotton, 1990–2022, by major insect pest group, noting major pest management periods. 2022 continues a trend towards fewer sprays (1.53). The 17-year statewide average is 2.04 ± 0.16 sprays for all arthropod pests. Cumulatively since 1996, Arizona cotton growers have saved over \$600M and prevented more than 40M lbs ai of insecticide from going into the environment. Source: Cotton Pest Losses Database, Ellsworth, unpubl.

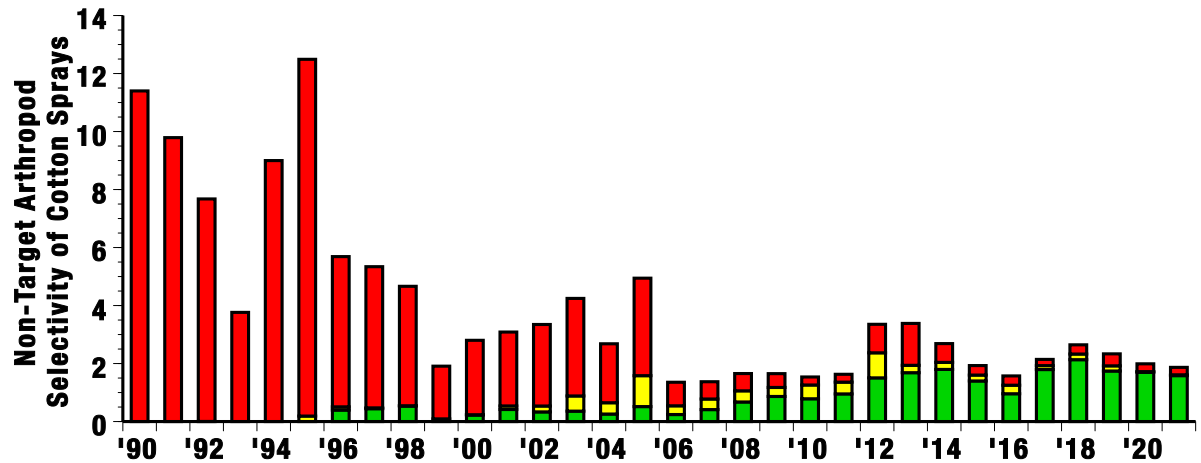
For More Information

Bordini I., A. Fournier, S. Naranjo, N. Pier, P.C. Ellsworth. 2020. Cotton Insecticide Use Guide – Knowing and Balancing Risks. University of Arizona, Arizona Pest Management Center. <http://hdl.handle.net/10150/665532>

Wynne, K., A.J. Fournier, P.C. Ellsworth. 2023. Highly Hazardous Pesticide Phase-Out for US Cotton Growers: Alternatives, Risks, and Opportunities. Cotton Beltwide Conference, February 10-12, 2023, Fairmont Hotel, Dallas, TX. <http://hdl.handle.net/10150/667319>

Ellsworth, P.C., I. Bordini, N. Pier. 2021. Tips on How to Manage Lygus Efficiently in ThryvOn™ Cotton. IPM Short. University of Arizona, Arizona Pest Management Center. <http://hdl.handle.net/10150/668029>

Palumbo, J.C. 2023. Insecticide Usage on Conventional and Organic Lettuce in the Desert, 2022-2023. Vegetable IPM Update, Vol. 14, No. 13. University of Arizona <https://acis.cals.arizona.edu/agricultural-ipm/vegetables/vipm-archive/vipm-insect-view/2023-insecticide-usage-on-conventional-and-organic-lettuce>



■ Fully Selective
 ■ Partially Selective
 ■ Non Selective

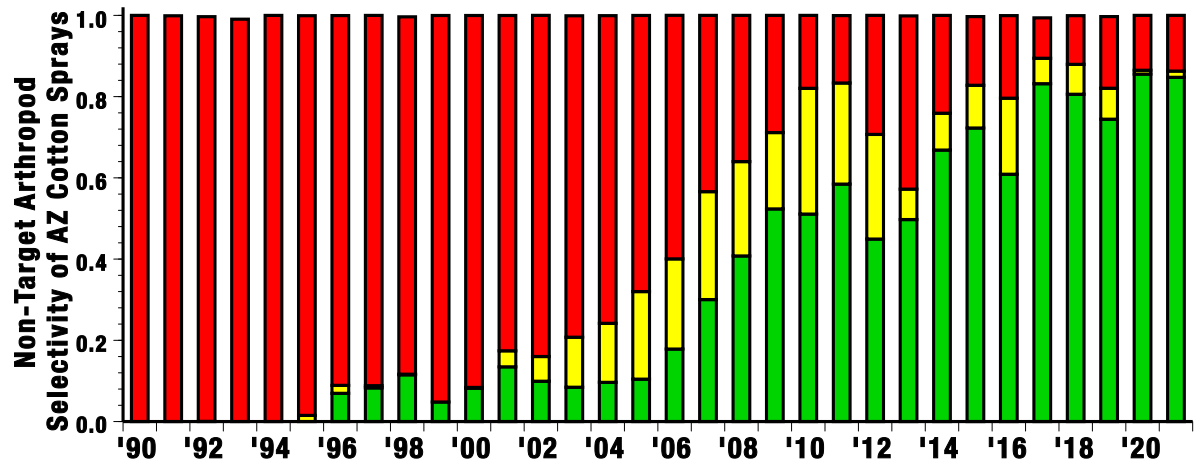


Figure 2. Longitudinal analysis of cotton insecticide use (actual spray frequency, above, and proportional use, below), with each bar depicting proportion of sprays made that are fully (green), partially (yellow) or non-selective (red). This shows a dramatic shift toward higher selectivity to non-target arthropods in Arizona in recent years. There are concomitant reductions in spray frequencies, increases in safety towards predators that support conservation biological control, and large savings to growers. However, when growers use non-selective insecticides, increased spraying results in significant losses. For example, in 2012–2014, as rates of non-selective insecticide use increased in Arizona to cope with a brown stink bug outbreak, the frequency of spraying doubled because of lost biological control of whiteflies, mites, and aphids. Source: *APMC Cotton Pest Losses and Pesticide Use Databases*, Ellsworth & Fournier, unpubl.

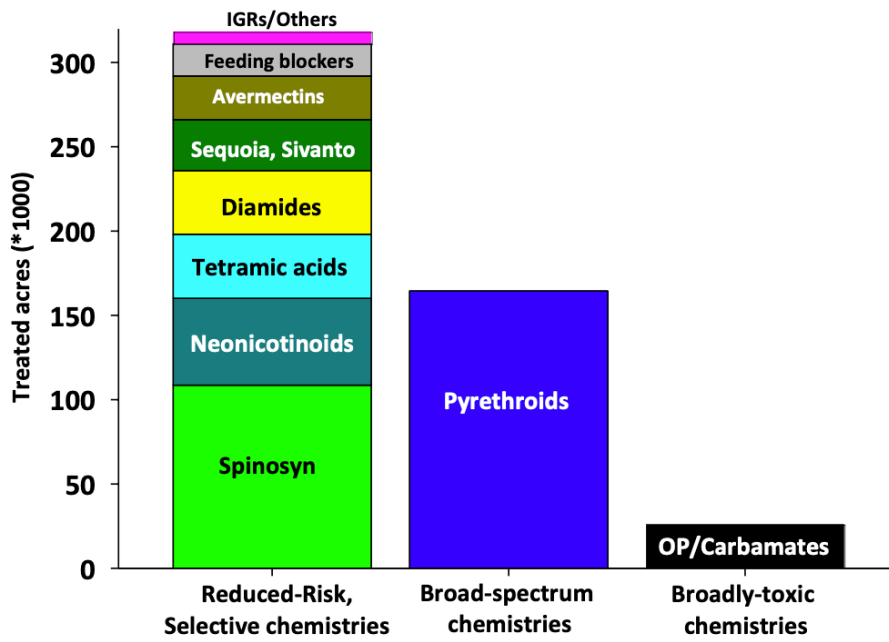


Figure 3. Estimates of total insecticide use for seasonal insect control on Lettuce, 2022-2023. Palumbo, Lettuce Pest Losses survey.

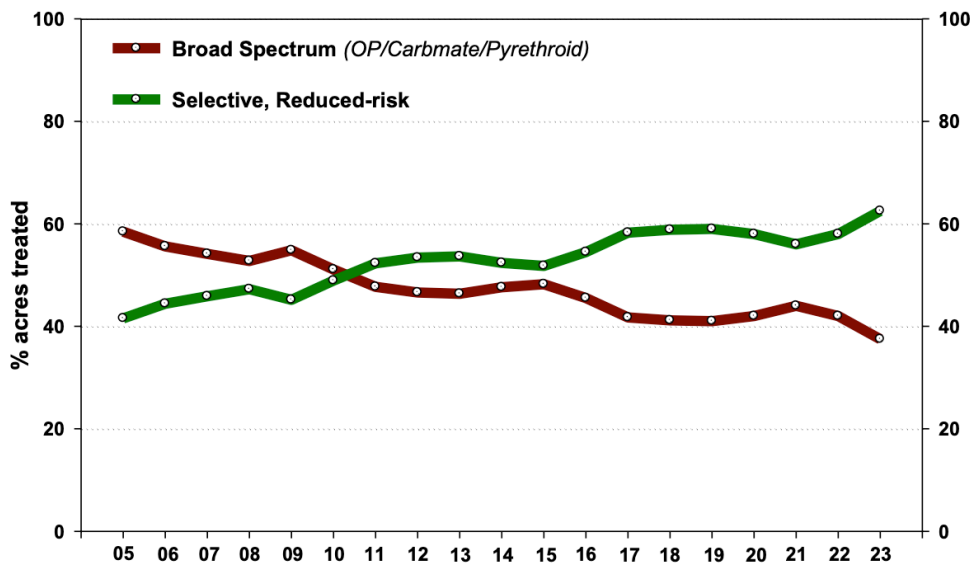


Figure 4. Percentage acreage treated with broad spectrum, and selective, reduced-risk insecticides on desert lettuce, 2005-2023. Palumbo, Lettuce Pest Losses survey.

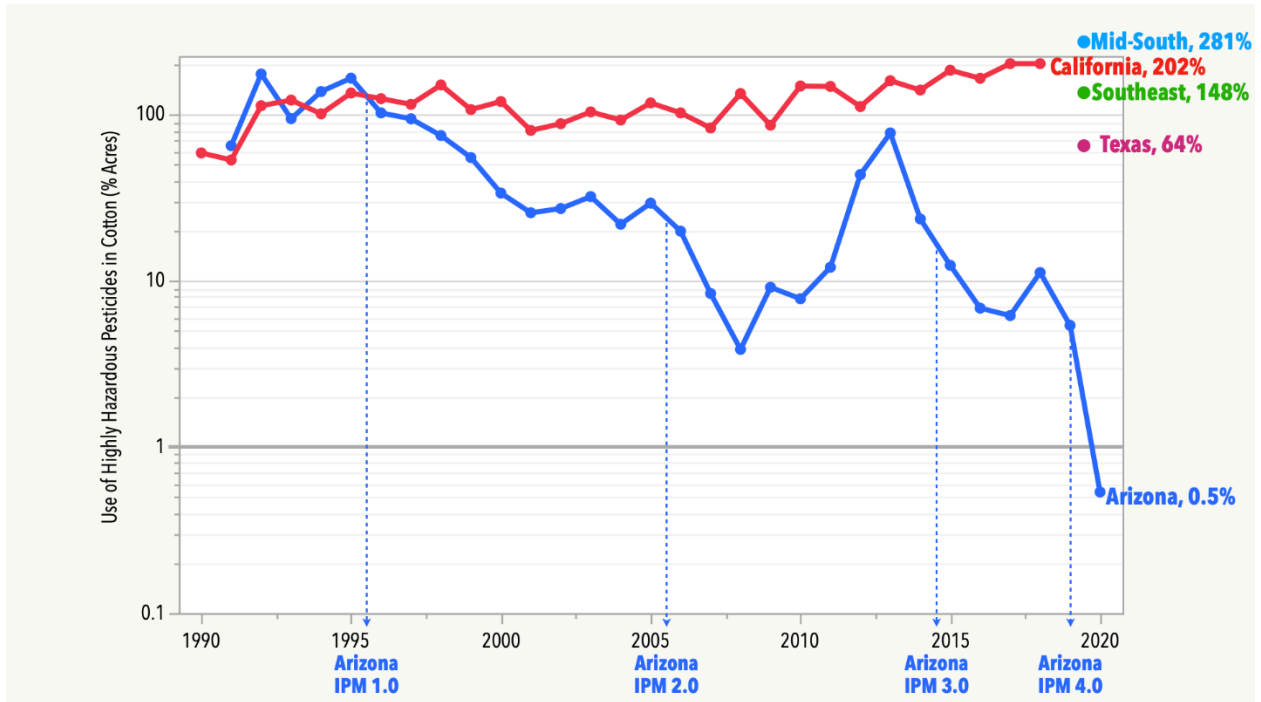
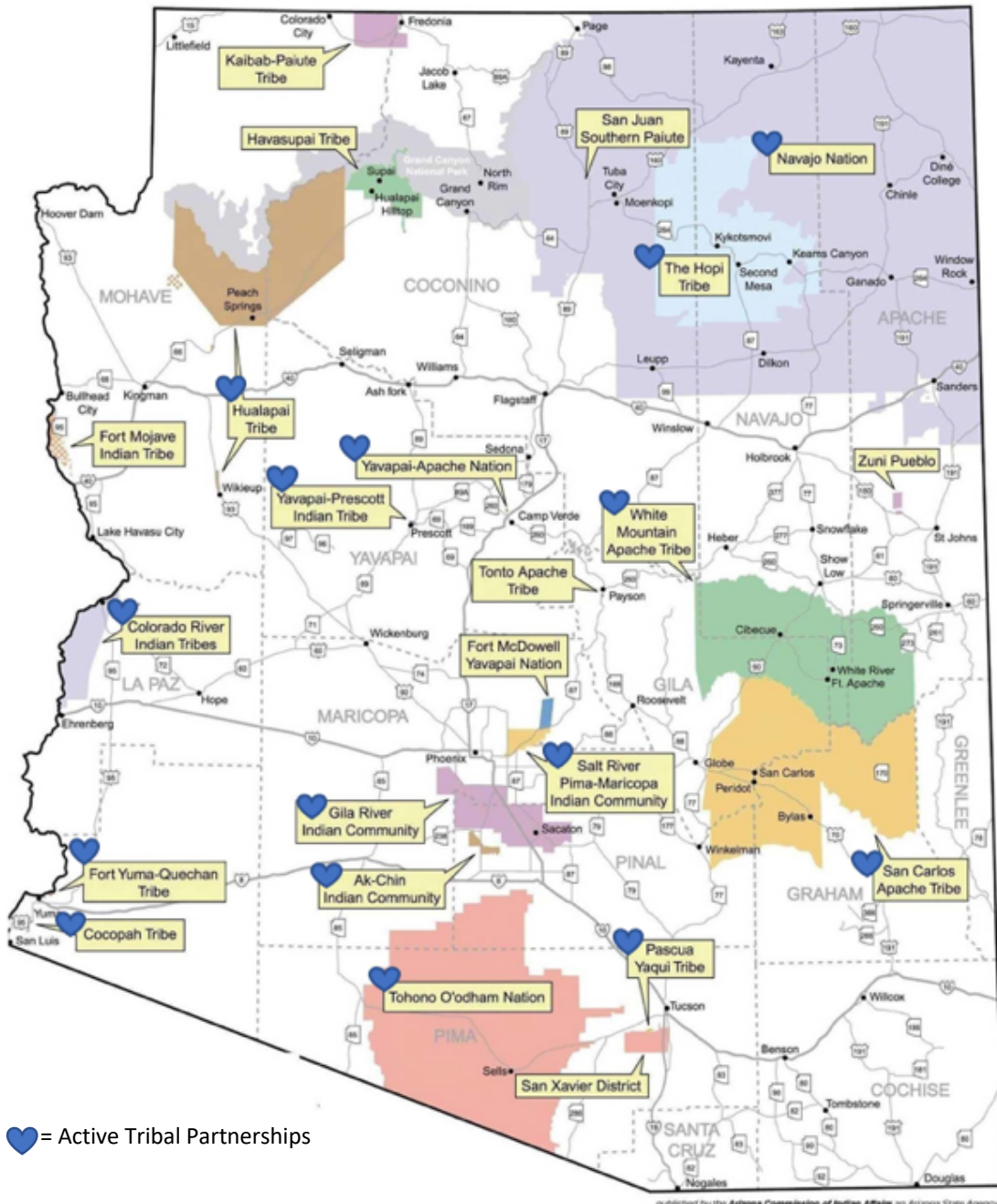


Figure 5. Use of highly hazardous pesticides in cotton as a percentage of acres treated, shown on a log scale for Arizona, California, Texas and Southeast and Mid-south states. Due to innovations spanning 25 years, today <1% of Arizona’s cotton acres make use of any of seven highly hazardous pesticides (aldicarb, oxamyl, phorate, abamectin, bifenthrin, diclofopos, and lambda-cyhalothrin) targeted for elimination by Better Cotton’s sustainability standards. In contrast, California uses these same pesticides on over 200% of its acres, and the rest of the cotton belt remains highly dependent on one or more of these insecticides. (Historical use data only available in Arizona and California).

ARIZONA TRIBAL LANDS MAP



The UA Public Health IPM Team has cultivated trusting relationships with tribal leaders, experts and professionals with 15 Arizona tribes (blue hearts) to address critical health issues through IPM research and outreach. Tribal collaborators include many diverse stakeholders. Our Agricultural IPM program engages four of these tribes as well, each managing individual and large tribal farms (Colorado River Indian Tribes, Gila River Indian Community, Ak-Chin Indian Community, Salt River Pima-Maricopa Indian Community).