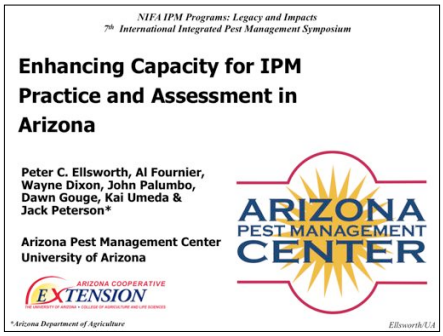
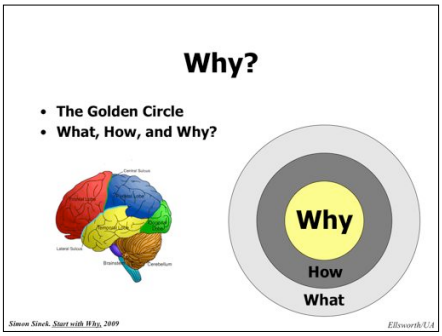


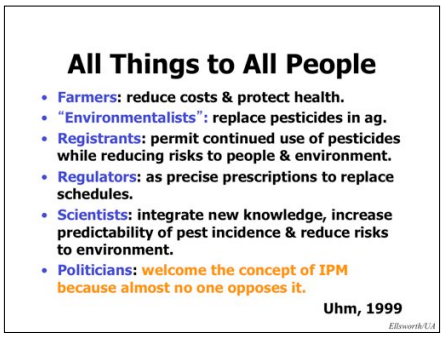
In Arizona, we are investing considerable IPM resources to develop infrastructure that permits us to assess IPM in Arizona.

The presentation I wish to give today will be of a different kind, because I will focus on this infrastructure and how it has helped us develop some of the measurement systems that we use in IPM Assessment. More importantly, I hope to convey the issue of "why" these investments are so important in recruiting peers, stakeholders, and sponsors to your vision for IPM.



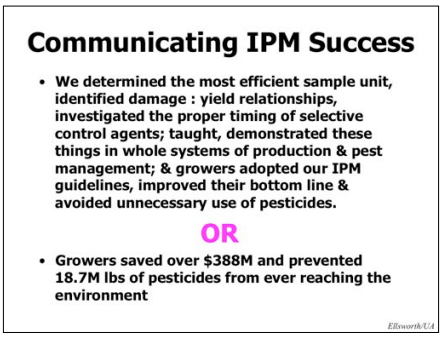
People from all walks of life judge the value of things in their life by understanding the central question of Why? Simon Sinek's book, Start with Why, attempts to link brain physiology with function, suggesting that the primitive brain should be the target of our efforts to influence and motivate people because it is there that we "feel" the "why" about everything.

As scientists and practitioners we often place too great an emphasis on the what and how we do things, and not enough emphasis on why we do things or why people should care about what we do.



IPM really is "all things to all people". In my view, it is very main-stream, perhaps to its own detriment. The concept is robust and has stood the test of time, but it doesn't have the flash and edginess of something brand new. You can go to the grocery store and buy goods that are branded as "organic", "pesticide-free", "GM-free", and "natural". "IPM" has not penetrated our social consciousness and thus you will unlikely see things sold as compliant with IPM. However, the big buyers, the wholesalers who buy from growers and sell to supermarkets, restaurants, and beyond, are starting to better understand IPM and make demands of their suppliers.

The question is how do we reach the larger audience when it comes to IPM? I think you do so by addressing the "why" in what we do.



As IPM scientists we are exceptionally good at creating new knowledge and applying it to systems of pest management. We are proud of our accomplishments and sometimes wish to be very descriptive of "what" we have done.

But even seeing such a thing on a slide, as an example, is enough for most people to glaze over.

Instead by focusing on "why" someone should care about IPM, we can effectively recruit them to our cause without them ever really having a working knowledge of how or what we do in IPM.

So which statement is better?

A Re-Thinking of 'Why'

(our E-IPM investment)

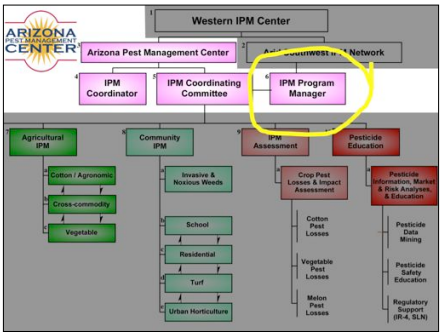
- 5/03, Concept proposed to EC
- 1/04, 1st funding for APMC approved
- 5/05, Dr. Al Fournier hired as IPM Program Manager; Expertise in Assessment!
- 6/06, 1st APMC Summit convened (120 attend)

ARIZONA PEST MANAGEMENT CENTER

Ellsworth/UA

The concept for the Arizona Pest Management Center was conceived by John Palumbo, Paul Baker, and myself in response to various changes in the federal climate, new opportunities that resulted, and a need to develop transparency with respect to our federal 3(d) obligation in IPM.

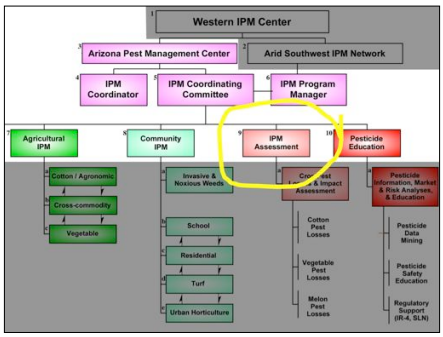
But it started with a re-thinking of "why" are we doing what we do in IPM. It was my belief then that we needed a more organized approach to assessing and evaluating our IPM programs and that infrastructure was needed to help us do assessment. After all, we are scientists in our disciplines and wish to involve ourselves in the "doing" of IPM science and application, not its assessment. The decision to hire a dedicated resource in Dr. Al Fournier was critical to the formation of this new capacity.



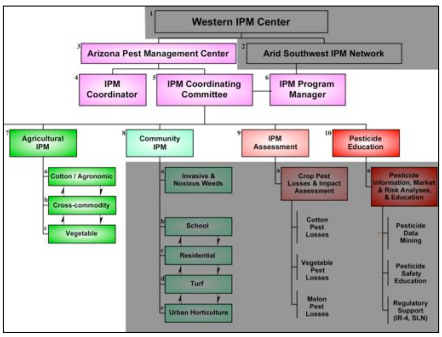
Along with the State IPM Coordinator (Peter Ellsworth) and IPM Program Manager (Al Fournier), the 25-member IPM Coordinating Committee* oversees our federal obligation (now a multi-year competitive institutional grant) in IPM as well as helps represent our many and diverse IPM programs that make up the Arizona Pest Management Center.

Al Fournier's position as IPM Program Manager was funded in part from Extension IPM funds and in part by extramural funds.

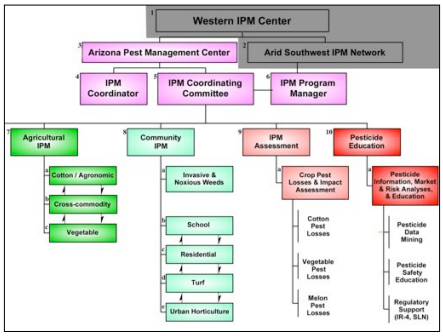
***The IPM CC includes members external to the University as well as internal stakeholders, and is multidisciplinary. We include pest management professionals, industry, regulatory agencies and others.**



All programs are organized around strategic focal areas: Agricultural IPM, Community IPM, Pesticide Education, and a dedicated focus on IPM Assessment, reflecting our investment in this activity which supports all programs.

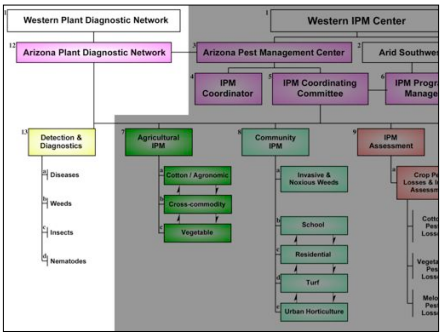


Each focal area houses several teams and within teams projects. These are the functional units of the APMC. These interdisciplinary teams address stakeholder needs in development of research and outreach programs around these themes. There is a great deal of cross-talk between teams, especially since nearly everyone participates in more than one team.

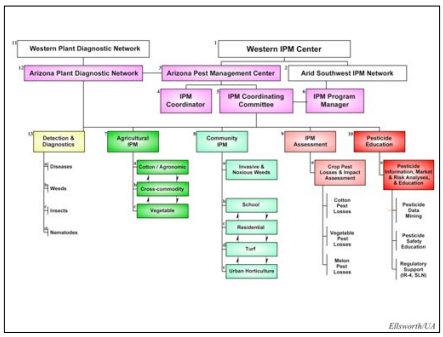


One thing should be made clear. While our structure looks large, there are very few people dedicated to IPM as their sole programmatic thrust. Most people do it "part-time" along with a long list of other programmatic commitments.

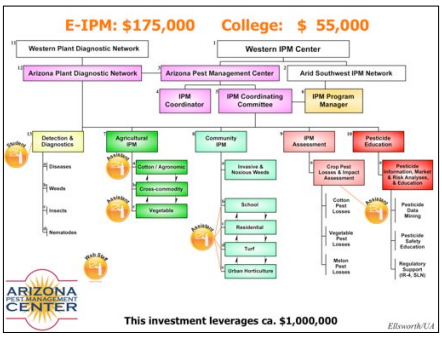
We are a very limited resource stretched essentially to our limits. But without investments in IPM Assessment, we believed that it would not be possible to recruit others to our vision. It is necessary to measure progress in terms that permits all people to know and feel why IPM is so important in this environment.



Panning left, we reveal a 5th area in Detection & Diagnostics, a focus shared with a parallel organization, the National Plant Diagnostic Network. While their activities are very much related to detection of exotics and invasives with regulatory consequence, our interests are in supporting clientele needs for diagnostics in support of IPM.

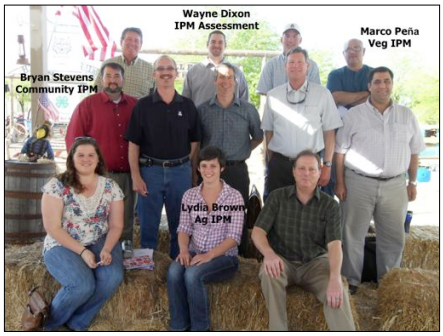


Here is our overall current-day structure. As mentioned, we are stretched to our limits with existing personnel and programs. As part of our strategic process of developing our federal E-IPM grant, we decided that new personnel resources were needed to synergize our efforts and increase our effectiveness.



The orange bubbles and box represent the investments we have strategically made with our E-IPM federal grant ($175,000 / yr) and our CALS contribution ($55,000 / yr). Specifically, we fund 50% of each of these orange human resources. The teams that make use of these resources have to generate the other 50% of the funding needed for each position. And since these people can assist teams in securing new funding, this has generally not been a problem. We also provide small operational budgets to each funded individual and their teams. Our current-year leverage is over $1,000,000 or nearly 20:1 of CALS money or 5:1 of E-IPM money; this is actually low for us as we are between grant cycles in many cases.

The Assistants in Extension that we have put into place are designed to make each team they are assigned to more effective.



This is a photo of a portion of the IPM CC and includes all our new Assistants in Extension, all of which were made in the last year with the exception of Marco Peña who was hired a year earlier.

Wayne Dixon is our APMC-funded Assistant in Extension in IPM Assessment and maintains a large, historical pesticide use database. He is involved in two funded efforts through the state's Specialty Crop Block Grant program and works directly with Dr. Al Fournier in development of IPM Assessment resources for the other teams.

Goal

- *Our goal is to increase the ability of Arizona citizens and professional pest managers to put IPM knowledge into practice in diverse environments, with the end result of reducing environmental, human health and economic risks to end-users.*

Ellsworth/UA

The goal of our program as articulated in our last federal EIPM request is to increase our ability to meet client needs in very diverse environments by putting IPM knowledge into practice. Very noble, but not something that communicates quickly and easily to stakeholders as to "why" we are doing what we do.

While not perfect, our attention should be shifted to…

Goal

- *Our goal is to increase the ability of Arizona citizens and professional pest managers to put IPM knowledge into practice in diverse environments, with the end result of reducing environmental, human health and economic risks to end-users.*

Ellsworth/UA

…those aspects of our goal that speak to Why we are doing what we do.

Approach

- *Measuring and communicating environmental, economic and social impacts of IPM are key to recruiting and leveraging support for our IPM programs, and to maximizing future impacts.*

Ellsworth/UA

Our approach is transparent. We need more personnel on the ground to make us all more effective. Quite literally, many of us cannot do any more than we currently do. Our Agents and Specialists are severely overburdened as it is. So the only option to extend our effectiveness is through very well-placed, strategic human resources.

In this case, that means building our capacity to measure and communicate our impacts as a means to recruiting and leveraging support of our IPM programs.

Measuring & Communicating Why

- Engages stakeholders
- Allows us to plan programs strategically
- Allows for recruitment of others to our vision
- Convinces potential sponsors that their investments are highly leveraged & effective

Ellsworth/UA

Through this focus on measurement and communication, we can engage stakeholders, better and more strategically plan our programs, recruit others to our vision, and convince potential sponsors that their investments are highly leveraged and effective.

Leverage

- RFAs now almost universally require an outreach and/or evaluation plan
- E-IPM RFA. Detailed outreach plan
  - project benefits
  - how impacts will be measured
  - likelihood of solutions that lead to measurable benefits to producers and consumers

Ellsworth/UA

Leverage is surely not a new concept, but it is becoming the more common currency in everything that we do. Nearly every RFA that IPM scientists address contains requirements for an outreach and/or evaluation plan.

The last Extension IPM RFA is just one example of how these RFAs prompt us for the underlying "why" in what we do.

Leverage

- RFAs now almost universally require an outreach and/or evaluation plan
- AFRI – Food Safety
  - Clearly identify anticipated outcomes
  - Plan for evaluating and documenting the success of the project
  - Lead to measurable, documented changes in learning, actions, or conditions

Ellsworth/UA

Even large programs like NIFAs AFRI program in this case for Food Safety mentions the importance of measuring, evaluating and documenting changes. There is likely to be even greater emphasis placed on these grant programs to show the public Why these investments are so worthwhile. It is an issue of accountability, too. But ultimately, a public that is trying to "shrink government" or its investments in society will need to be informed by the great value that IPM and other agricultural research provides to our citizens.

Investment & Leverage

Federal Extension IPM	$69,000	2011	$189K
Western IPM Center	$35,000	2011	
ADA-Specialty Crops Block Grants	$60,978	2011	
ADA – In-kind Support	$24,000	2011	

Ellsworth/UA

Just to give you a snapshot in time of our investments in IPM Assessment, I list here the portions of several grants that support our Assessment infrastructure and capacity from 2011.

Investment & Leverage

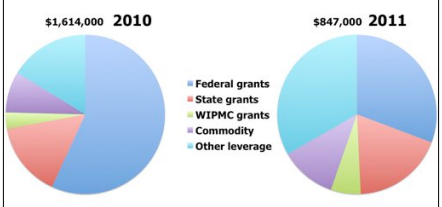
Federal Extension IPM	$69,000	2011	$189K
Western IPM Center	$35,000	2011	
ADA-Specialty Crops Block Grants	$60,978	2011	
ADA – In-kind Support	$24,000	2011	
USDA-Risk Avoidance & Mitigation Program (RAMP)	$2.5 million	5 yrs	$3.1M
USDA-National Research Initiative (NRI)	$359,000	3 yrs	
USDA-Pest Management Alternatives Program (PMAP)	$197,198	3 yrs	
USDA-Regional IPM Program, Western Region	$60,000	3 yrs	

Ellsworth/UA

That investment (ca. $189K per year) is activated and helped secure the additional extramural efforts shown here.

APMC Leverage (7-fold)

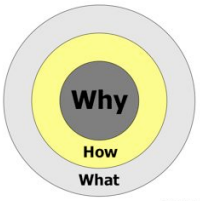
Ca. $2.5M leveraged by $350,000 (E-IPM) support



We believe that our enhanced capacity which is seed supported by our Extension IPM grant has enabled us to significantly leverage a much larger effort in IPM research and Extension. These are just two annual snapshots of very diverse funding to show our better than 7-fold leverage of two-years of E-IPM support.

Assessment: How?

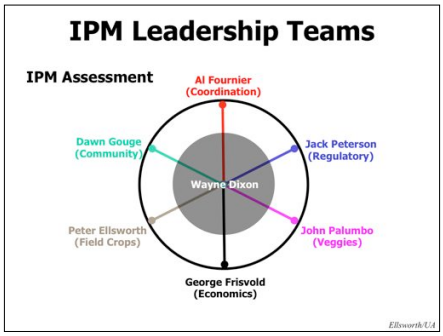
- Infrastructural investment
- Dedicated working groups
- Key partnerships in development of data*



*Posters #P051 & P056

Ellsworth/UA

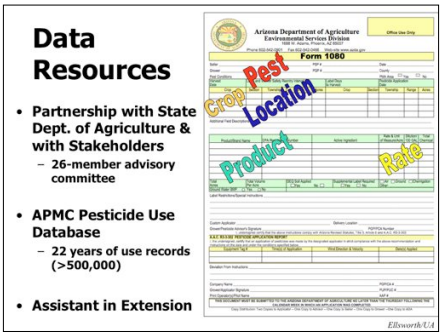
How do we provide for this success? By investment in our infrastructure, largely through E-IPM, by constructing working groups dedicated to the function of IPM Assessment, largely funded through Western IPM Center grants, and by forming key partnerships with stakeholders to develop assessment data, funded through grants and in-kind support by partner organizations and agencies.



These new resources, the Assistants in Extension, have been so important to us that we created special Leadership Teams that both support and are supported by this central resource.

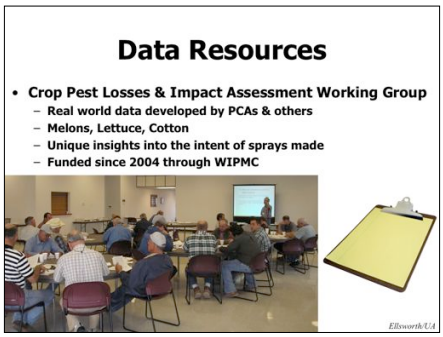
In this case, Wayne is the hub for our IPM Assessment Leadership Team which is comprised of IPM Team leaders and other key personnel, Jack Peterson, our State Lead Agency for pesticide regulation, and George Frisvold, our Ag Economist.

Together, these individuals guide the activities of our Assistant in Extension, and this Assistant in Extension contributes expertise and dedicated time to the theme of IPM Assessment.



We are fortunate to be able to partner with our State Department of Agriculture in maintaining a 22-year historical database of agricultural pesticide use. These reports are submitted by commercial applicators and provide us excellent resolution on the usage of certain pesticides in our state.

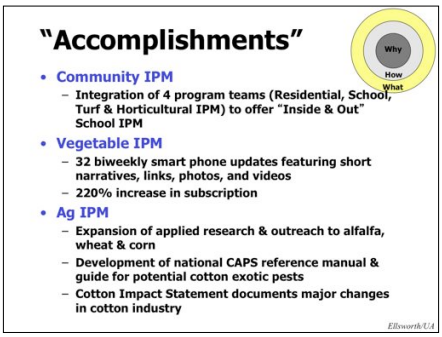
This entire data resource is also overseen by a 26 person stakeholder advisory committee.



We also have a working group dedicated to Crop Pest Losses and Impact Assessment. This is a guided survey process that we deploy in AZ and southern CA through a series of workshops for the cotton, melon and lettuce industries.

What makes these data special is that we get very special insight into "why" pest managers spray. What is the intent of their spray decisions. We also collect extremely valuable economic information.

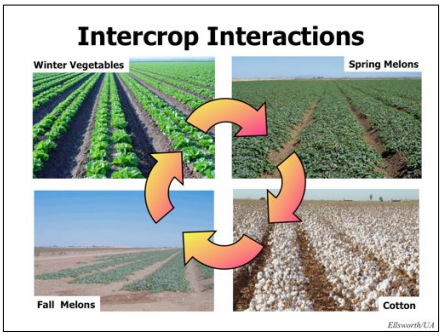
This effort has been ongoing in cotton for many years and continuously funded for by the Western IPM Center since 2004.



The Accomplishments ("What" we do) are many and are generally descriptive of the activities. And while we are very proud of the efforts of our various IPM teams, what is more important is developing the "Why" in all that we do.

Whether it was intended or not, the development of the Federal Road Map for IPM less than a decade ago was critical to re-framing the questions. Why IPM? The answer was clear. We exist as a risk reduction or risk management science that permits people to reduce risks to people, property, resources and the environment. And, that risks were not confined to pesticides, but to the pests themselves (of course) and all the pest management practices called upon to address our pest problems.

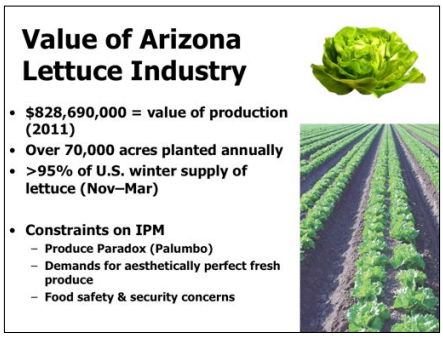
It is from this basis that we develop all our IPM programs. And it is from this basis that we come to know the "Why" of IPM.



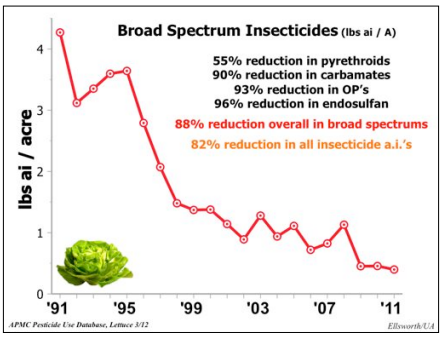
In AZ, our desert ecosystem is transformed by water into a very complex agroecosystem. AZ's year round growing season provides for a sequence of crop plants, winter vegetables like broccoli, lettuce, other cole crops, spring melons (esp. cantaloupes), summer cotton, and fall melons.

I wish to focus on two of our major crops that dominate our winger and summer agricultural landscapes, Lettuce and Cotton.

Photo credit: JCP

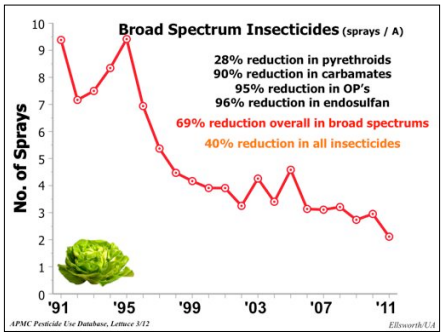


Our lettuce production is very intensive and supplies ca. 95% of the U.S. winter supply each year. Yet, there are severe constraints on production, the main one being the so-called Produce Paradox, where consumers wish to have blemish free, practically perfect produce, yet they wish there to be no pesticides or risks associated with the produce they eat.



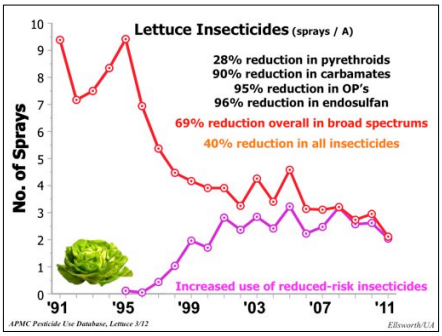
Let's examine lbs of broad spectrum insecticides per acre in use in lettuce in Arizona. We can show large reductions in the broadly toxic pesticide groups such as pyrethroids, carbamates, OPs, and endosulfan.

1991-1995 v. 2009-2011



These gains are also seen in the no. of broad-spectrum sprays made in lettuce. Nearly a 70% reduction in broad spectrum insecticides compared to the early 1990s.

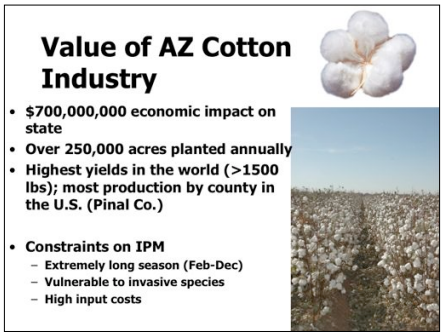
1991-1995 v. 2009-2011



And now, growers are making greater use of reduced-risk insecticides in place of these broad spectrum insecticides.

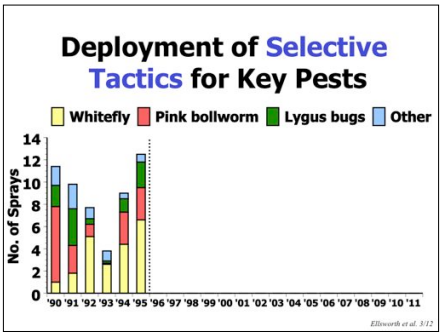
This tremendous progress is largely attributable to the efforts of Dr. John Palumbo, our Vegetable IPM Specialist, and the commitment to the industry to develop and deploy reduced-risk alternatives to the older chemistry. If not for MRL concerns by importing countries, we would likely see even greater gains. Ironically, the concern that some countries have for the newer and safer chemistries is delaying the changeover from the broadly toxic pesticides of 20 years ago.

1991-1995 v. 2009-2011

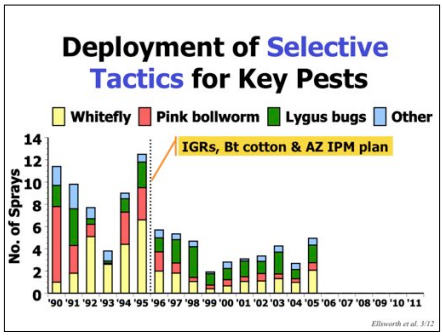


Cotton is the major agricultural summer resource for insects. Some may not realize that AZ produces the highest yields in the world with a statewide average of just over 1500 lbs of lint per acre. Also, in terms of total production of cotton by county, Pinal County, AZ, has the largest cotton production in the U.S..

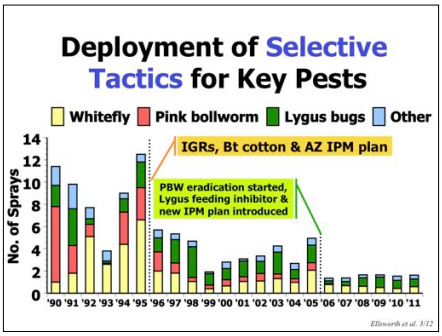
At the same time, we are endeavoring to produce and protect a crop over a very long period of time (Feb-Dec) under conditions of an abundance of heat units.



Let's review the history of deployment of selective tactics against key pests in our Arizona system using the other data resource we talked about, the Cotton Pest Losses and Impact Assessment data. It is a striking history, where we can see the no. of foliar insecticides used to control each of 3 key pests over time, whitefly, pink bollworm and Lygus bugs.

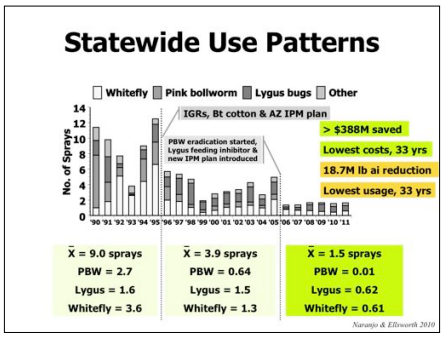


The results have been striking. A watershed of change occurred in 1996 with the introduction of very safe and selective Insect Growth Regulators (IGRs) for whitefly control, and transgenic Bt cotton, along with an IPM plan especially for whitefly management and comprehensive outreach campaign that consisted of extensive grower and pest manager education.



More recently, growers in collaboration with state agencies began PBW eradication in 2006. At the same time, we introduced flonicamid (Carbine) in 2006 as our first fully selective control agent, a feeding inhibitor for Lygus, as well as a new IPM plan that detailed the knowledge needed to properly use these technologies.

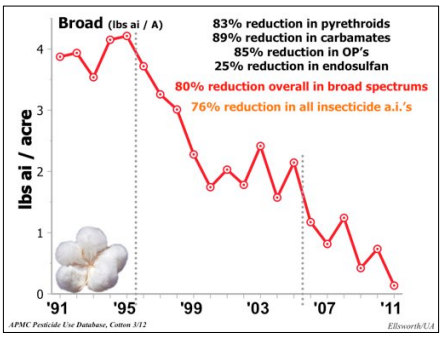
Adapted from Naranjo & Ellsworth 2009.



If we draw out information from these critical periods, we can see rather dramatic declines in overall insecticide use, as well as huge declines in PBW, Lygus and whitefly sprays made by growers.

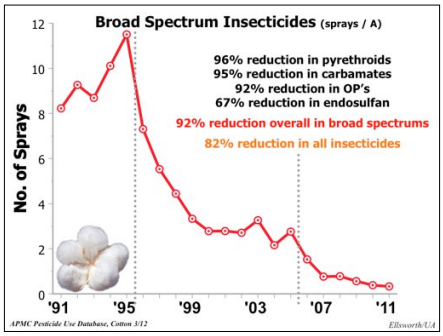
At one time, we averaged 9 sprays. Our 1996 programs cut that by more than half to ca. 4 sprays, and our 2006 programs have cut this by more than half again to just 1.5 sprays. In the process we are in the lowest foliar insecticide control costs in history, we're spraying less than at any time in history, and have saved growers cumulatively over $388M in 2011 constant dollars and prevented nearly 19M lbs of insecticide ai from reaching the environment.

On average today, ca. 23% of our acreage is never sprayed for arthropods, something we never thought would be possible on a single acre 20 years ago.



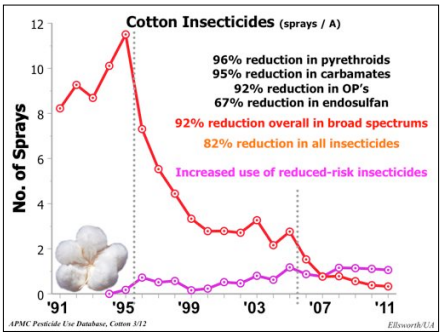
As impressive as these gains are, what has been key has been the shift away from broad spectrum insecticidal inputs. We've seen huge reductions in pyrethroid, carbamate, OP, and endosulfan usage, with an overall reduction in lbs ai / A of 80% in broad spectrum inputs.

1990-1995 v. 2006-2011



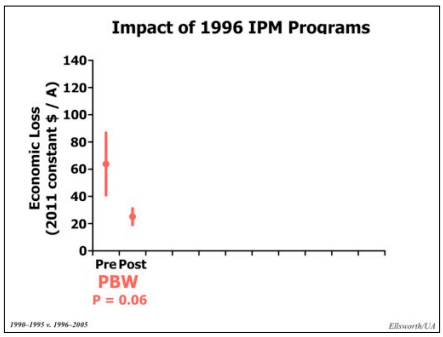
These data are independent from our survey data of pest managers, and they concur what I have shown you in the bar charts. We have reduced all insecticide usage by more than 80% and broad spectrum usage by more than 90%.

1990-1995 v. 2006-2011



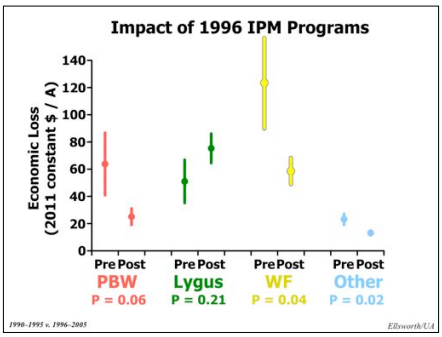
These gains were accomplished by the comprehensive IPM programs enacted in 1996 and progressively improved since with major changes to our Lygus control system in 2006. Furthermore, this was enabled by the strategic introduction of selective technologies into our system, and now we see the usage of reduced-risk insecticides out numbering broad spectrum insecticides. Most importantly, this has created opportunity for an ever increasing role for conservation biological control. In addition, it is difficult to quantify the stability in pest management that growers now enjoy.

1990-1995 v. 2006-2011



Even with such great gains, we are challenged to depict results in a manner that can objectively measure progress. These are not replicated systems. However, we can examine periods of time by pest of cotton and ask the question of whether our IPM programs were coincident with the gains made in pest management.

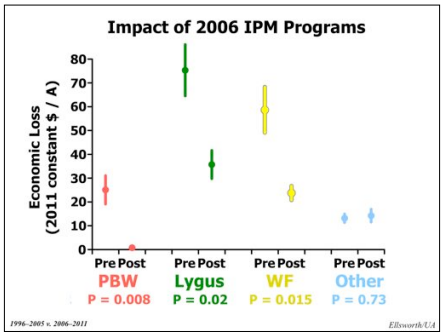
This chart shows "Economic Loss" in 2011 constant dollars per acre by pest both before and after the introduction of our 1996 IPM program. There is a significant reduction in economic loss after the introduction of our IPM programs.



We can look at the balance of pests in our system and see that we made major reductions in whitefly related economic losses as well. By lowering the no. of sprays needed for PBW and whiteflies, we reduced losses to secondary pests as well, because we were stepping off the Pesticide Treadmill. In some sense, we were reversing the treadmill. Lower spray frequencies, especially of broad spectrum insecticides, permits us to further lower spray frequency because secondary pests are held in check.

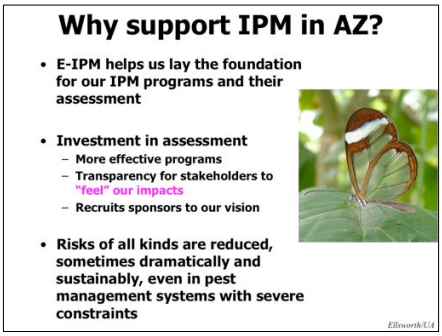
The one major challenge before us remained, curbing losses to Lygus hesperus.

***Exclusive of Bt technology costs.**



And here we can see the impact of our 2006 IPM Programs on these same pests, showing even further gains in PBW and whitefly management. Largely because of investments made in our Lygus management program including a major grant from the USDA-RAMP program, we made dramatic savings in losses to Lygus bugs.

***Exclusive of Bt technology costs.**



In the end, we ask the question of ourselves and pose it to our stakeholders, Why support IPM in Arizona? We believe that the Extension IPM program has been critical in the establishment of our foundation in IPM discovery, development and implementation science, and in IPM Assessment.

Most importantly, our ability to communicate the "why's" in our program allows our stakeholders to "feel" our impacts and just know in their gut that supporting IPM in AZ is a great thing to do!

Thank you for your attention and thanks to the organizers for this opportunity for us to share our story of successful IPM in Arizona.

Thanks, too, to the many growers, pest control advisors and others who collaborate to make this such a successful program. And thanks especially to the Federal Extension IPM Program without which none of this would have been possible in Arizona.

The Arizona Pest Management Center (APMC) as part of its function maintains a website, the Arizona Crop Information Site (ACIS), which houses all crop production and protection information for our low desert crops, *(http://cals.arizona.edu/crops)*, including a copy of this presentation.

Photo credit: J. Silvertooth