

Plant Bugs (*Lygus spp.*)

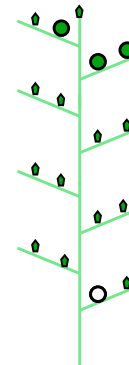
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Ellsworth/UA

“Plant Bugs”



- Tarnished Plant Bug
 - *Lygus lineolaris*
- Western TPB
 - *Lygus hesperus*
- Other *Lygus* spp. & mirids
- Polyphagous & mobile
- Reduce yields by causing square abortion (fewer fruiting sites)
- Reduce quality by disrupting carbohydrate allocations

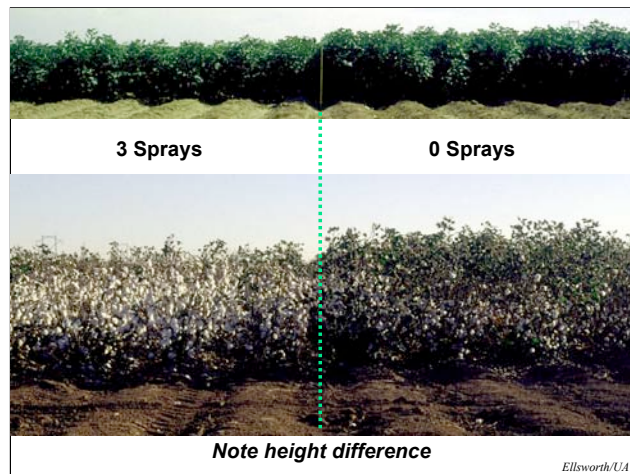


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This presentation was invited by Craig Brown (NCC). The goal is to provide more detail, from a beltwide perspective to the extent possible, on the losses and recommended management practices for plant bugs.

Those familiar with *Lygus* are very familiar with the potential losses to yield by this pest. However, there are other costs that producers should be aware of. *Lygus* damage also affects the pattern of fruiting to such extent that large gaps can sometimes be created. These gaps represent disruptions to the allocation of carbohydrates. Where normally, carbohydrates are shunted to the boll sinks, now they are redirected to the growing tip of the plant, making for a taller plant, one that is more difficult to defoliate (also because of disrupted / excess N-balance). This leads to more leaf trash in the harvest, which in turn, lowers lint turnouts and produces lint of poorer quality.

Each of these effects has been measured in our studies and represents some of the hidden costs of *Lygus* damage. Yield impacts can be great, but we should not forget these other losses as well.



To show this re-allocation of carbohydrates graphically, we can look at a field that was all planted to the same Bt variety. One half was sprayed 3 times for Lygus and the other was left untreated for this pest. No other insect pests were yield-limiting. On the right, you can see in profile an increase in height of the plants.

Closer to harvest, it becomes apparent why. There is only one third the yield on the untreated side in comparison to the well-managed left side.



- Boll weevil eradication (1991 in AZ)
- Bt transgenic cotton (1996)
- New, more selective insecticides
 - Lepidopteran IGRs (1993–)
 - Whitefly IGRs (1996)
 - Narrower spectrum neonicotinoids
 - More selective soil insecticides / seed treatments
- Changes in landscape
 - Reduced tillage
 - Land in conservation

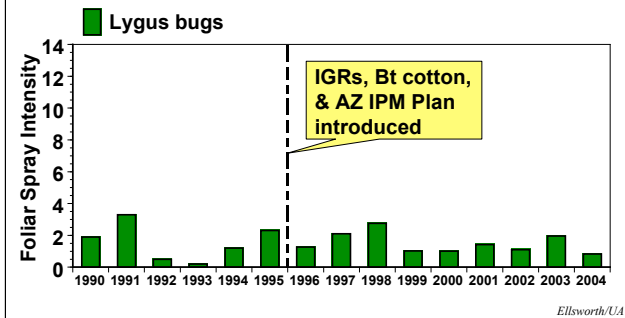
Clearly, Lygus can be very damaging to cotton both in AZ and beltwide. However, do Lygus represent the “next generation” of cotton pests? Perhaps, but I rather think of them as a bad actor that has simply become more apparent now that the cast of characters has shrunken somewhat. That is, we’ve made so much progress on so many fronts in cotton that some pests have been eliminated or greatly reduced in impact, while other ecosystem changes have provided for a more hospitable environment for Lygus.

Boll weevil has been eradicated or is on the run in virtually all U.S. acreage. Some areas, like AZ, have not made a spray against this pest in 10-20 years! There there is Bt cotton. We’ve not had to spray for pink bollworm on these acreages in 10 years. Essentially, on Bt cotton acreage, we have eliminated the economic threat of tobacco budworm, pink bollworm in AZ, and lessened our exposure to many other lepidopteran pests.

We’ve also made greater use of new and more selective insecticides beltwide, some specific on worm pests, and others for whiteflies which has helped us in AZ where we combat the whitefly regularly. At the same time an important class of insecticides, the neonicotinoids, have been used broadly, but have a more narrow spectrum of activity than the products they replace. Even the methods for deploying insecticides have limited the exposure of Lygus to insecticides, such as seed treatments and other soil insecticides.

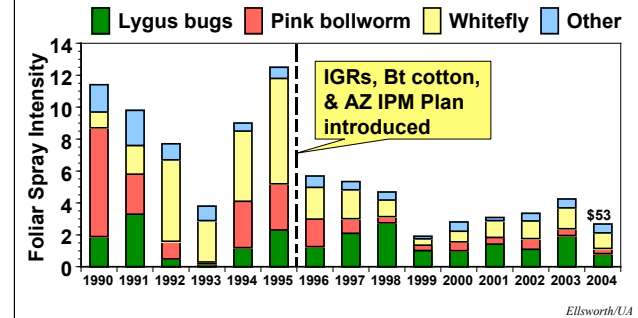
Lastly, we’ve seen broad changes in the landscape in certain parts of the Belt, particularly with increasing adoption of reduced tillage options and various federal land conservation programs.

Historical Trends in Lygus Control in Arizona Cotton



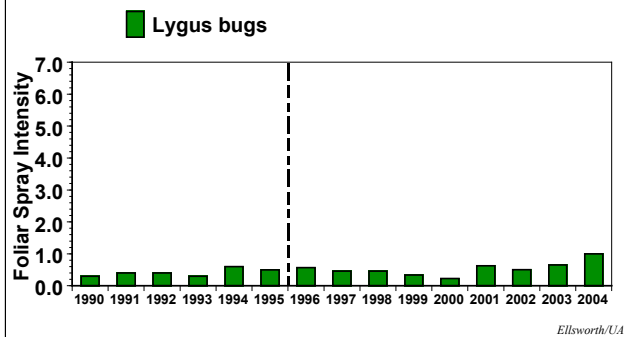
This chart shows the statewide foliar spray intensity for Lygus bugs since 1990. In general, you can see that we have been spraying Lygus ca. 1-3 times per season. This trend appears consistent even after the introduction of Bt cotton and selective whitefly IGRs. As such, this is not a “new” pest, just one we continue to battle regularly in AZ.

One of Three Key Pests



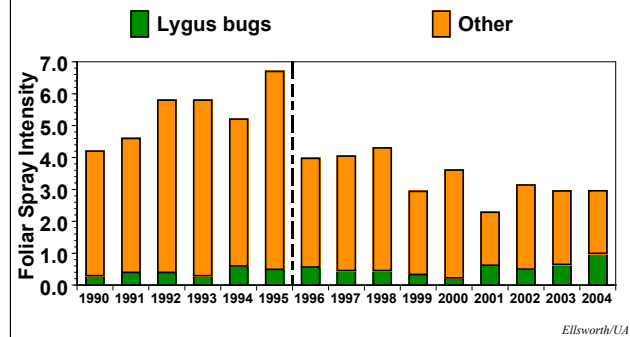
As just one of our three key pests, Lygus has gained in importance simply because it occupies a greater proportion of our spray requirements and budgets. In fact, it is the largest yield threat to AZ cotton, and has been our number 1 pest since 1997. So while our sprays are about the same against this pest, sprays for everything else has gone down dramatically.

Beltwide Lygus Sprays



Beltwide trends are similar though there does seem to be a recent trend upwards in the Lygus sprays that are made. This is heavily influenced by cotton grown in the Delta and impacted by Lygus lineolaris.

Beltwide Insect Sprays



However, either way, Lygus occupies more of our growers attention as compared to our systems over a decade ago.

Lygus Control Dynamics

(6-yr average)

	No. of Sprays		Control (\$/A)		Yield Loss (%)	
	AZ	Belt	AZ	Belt	AZ	Belt
1990–1995 ▶						
1999–2004 ▶						

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We can examine Lygus control dynamics comparing the most recent 6-yr period to the 6-yr period prior to the introduction of Bt cotton and other important insect control technologies. These data are from the NCC's Beltwide Cotton Insect Losses annual database that is coordinated at Mississippi State University by Dr. Mike Williams. We can track no. of sprays, foliar insecticide control costs (including application costs), and yield loss.

No. of Lygus Sprays

(6-yr average)

	No. of Sprays		Control (\$/A)		Yield Loss (%)	
	AZ	Belt	AZ	Belt	AZ	Belt
1990–1995 ▶	1.6	0.42				
1999–2004 ▶	1.2	0.56				

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In Arizona, we've seen a slight decline in the spray requirement, though the 2005 data might increase this number somewhat. Beltwide, no. of sprays against Lygus is up slightly.

Lygus Control Costs (\$/A)

(6-yr average)

	No. of Sprays		Control (\$/A)		Yield Loss (%)	
	AZ	Belt	AZ	Belt	AZ	Belt
1990–1995 ▶	1.6	0.42	\$16.62	\$ 2.70		
1999–2004 ▶	1.2	0.56	\$21.16	\$ 4.67		

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Control costs have certainly gone up considerably. This is reflected both in the cost of insecticides and the increases in rates used beltwide to control this pest.

Yield Loss to Lygus (%)

(6-yr average)

	No. of Sprays		Control (\$/A)		Yield Loss (%)	
	AZ	Belt	AZ	Belt	AZ	Belt
1990–1995 ▶	1.6	0.42	\$16.62	\$ 2.70	2.35	0.89
1999–2004 ▶	1.2	0.56	\$21.16	\$ 4.67	3.26	0.86

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Yield loss has gone up in AZ significantly and is in part a reflection of the much greater yield potential we now have with PBW and whiteflies controlled so well with selective technologies. Beltwide, these numbers are static, but I expect we'll see 2005 start to change this pattern, too.

Of course, this is not the only way to examine the impact this pest has had on our production. One must also consider how much this is costing us relative to the full spectrum of potential pests.

Lygus Control Dynamics

(6-yr average, as proportion of total)

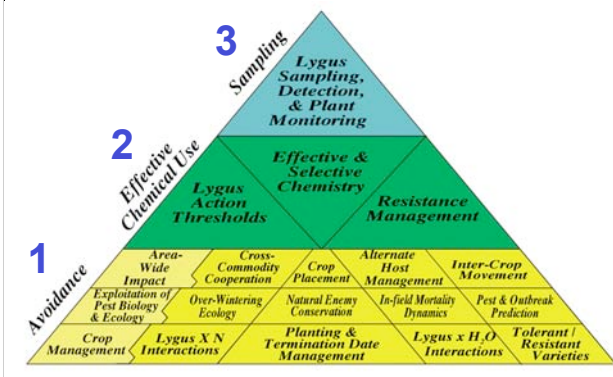
	No. of Sprays		Control (\$/A)		Yield Loss (%)	
	AZ	Belt	AZ	Belt	AZ	Belt
1990–1995 ▶	16%	8%	13%	6%	33%	13%
1999–2004 ▶	41%	20%	36%	8%	59%	17%

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Relatively, we can see that in almost every case, Lygus relatively speaking gain in importance on the field of potential insect pests. As a proportion of our total no. of sprays, our control budgets, or total yield loss to insects, Lygus have gained in prominence. We're at a point now where Lygus are responsible for the majority of yield loss in AZ cotton.

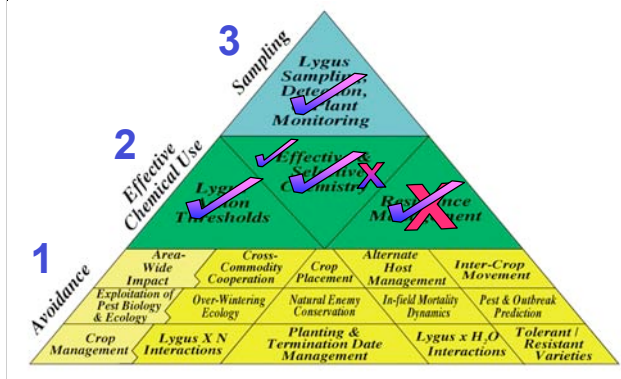
Lygus IPM...

...depends on 3 basic keys



We are not without our solutions, however. Lygus management, as in the management of any pest, boils down to 3 essential keys of “Sampling”, “Effective Chemical Use” and “Avoidance”. Within this framework, we see once again that the plant or crop is the most important foundation element of our management plan. On this base layer of “Avoidance”, we can overlay many of the building blocks of an integrated and stable management plan. “Effective Chemical Use” is surely important, and when pest densities reach economic levels, we want to be sure that we have effective compounds in our arsenal and some tools for deploying them rationally such as action thresholds and resistance management plans. However, I hope you will also see that our system of cotton pest management is moving more and more towards a selective approach whereby we can strategically eliminate pest threats while still conserving those natural elements -- free pest control, if you will -- that makes the system more sustainable and economical, and less susceptible to pest resurgences and secondary pest outbreaks.

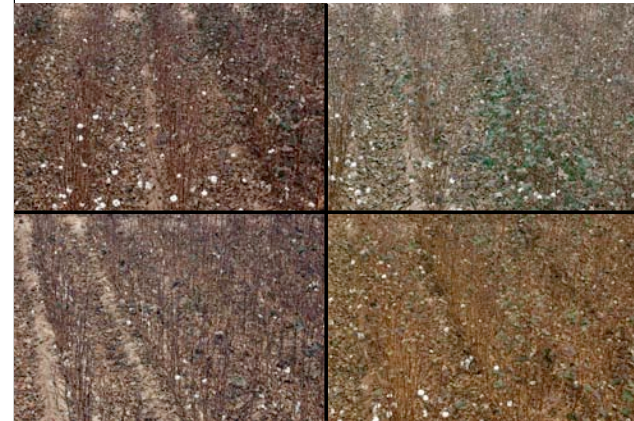
IPM Inventory



Let's take an inventory of what we have and know, and can use to help manage Lygus. We do in fact have "effective" Lygus chemical controls; however, until now, none of these options has been selective, and there has been no opportunity for rotation of modes of action for resistance management. Now, however, there are some new developments, and at least one new class of chemistry; we have a chance to rotate our modes of action and hopefully reduce risks of resistance, and great hopes for the selectivity advantages of flonicamid (Carbine) over things like acephate (Orthene), which is very broad spectrum. More research is needed to understand the specific impacts of flonicamid use; however, it is clear that this is a major advance forward in effective and selective Lygus control.

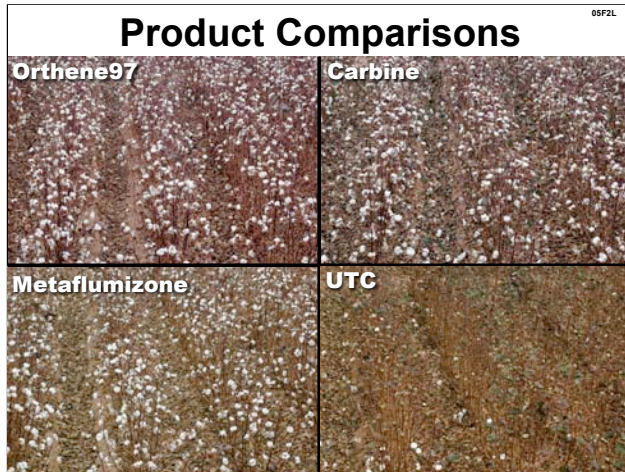
2005: UTC – 0.36 bales / A

05F2L-T0



05F2L-T0

In AZ, I routinely screen new technologies for their efficacy in controlling Lygus. I do this under some of the toughest conditions with respect to Lygus in the entire Belt. Here we can see the untreated check (UTC) plots for each of the four reps we ran in 2005. We harvested just one third of a bale to the acre in this test!



05F2L-T18 Carbine WG in NE, Orthene (1.0) in NW, 320WVI in SW, UTC in SE

In contrast, our star performers yielded well (for the planting date) about 5x that of the UTC, or about 1.5 bales/A. These performers include our old standard of Orthene (1.0 lb ai/A), as well as the newly registered Carbine (2.8 oz / A) and a soon to come chemistry, metaflumizone.



So what are our recommendations to producers for 2006. Stick to the fundamentals. Avoid the problem if at all possible through an array of cultural and biological techniques. Detect it, sample for Lygus routinely accordingly to local guidelines; and Control it, should densities reach economically damaging levels.



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, including a PDF version of this presentation for those interested in reviewing its content.

Photo credit: J. Silvertooth