Questions about Map Construction for Proactive Resistance Management Project

Yves/John/Steve/Nilima,

As I don't have time to visit with you each or worse as a group, **please invest some time reviewing the attached maps and the questions outlined here** and respond to the group. To facilitate your varied modes of response, I am also placing this same thread in a Word document in case you'd rather comment there — it is likely easier (maps are included in the Word document, too). I need your feedback! Thanks!

Peter

Update

Much progress is occurring on this project. The team is aggressively plowing through the 2014 data to finish corrections of errant records. ADA is entering the last of 2014 data as we speak. I expect to have the first round of "draft" maps available for all chemistries in about a week's time. John and I will be tasked with assessing them and determining whether there are any irregularities that require more examination or attention in data correction.

Today, I want to share with you the attached set of pre-production maps right now so that you can assess their general features **to address one very specific question**. Please note that we are going to chop up the state a little differently than is currently depicted. Please do not share these with others.

Attached Maps

These data shown are for pyrethroid usage on all crops. Note, we have established a standard of FIVE categories of use from lowest to highest (i.e., binning). Perhaps this class of chemistry is impacted more than for other chemistries by my question to follow. While we still need to debate just what scale of insecticide use intensity we are going to chart out, **there remains a question of static vs. dynamic binning by region.** So let me clarify.

These maps are all on one standard binning routine. I.e., deep purple means the same thing statewide. My default thought on this has always been that yes, we should represent the intensity of usage using the same binning pattern statewide. Pyrethroids are kind of interesting, because they are SO MUCH more important in Yuma than in any other place. Hence, it is a sea of deep purple. **Is it o.k. that the rest of the state is a light pink?** Will that unfairly bias perception to thinking there is less need for resistance management of pyrethroids in these other areas?

Or should we consider establishing a binning scheme that is dynamic or specific to each map scene?

I think it is likely that resistance evolves independently in each region, at least from year to year. I would suggest binning independently for each region.

I tend to think that PCAs would be interested in what the intensity of usage is like in their region as well as in others (e.g., Yuma vs. La Paz). I'm not sure whether PCAs will be biased if use is different in another region, particularly for pyrethroids.

I suspect this may be less of an issue for all other chemistry as there may be more or less similar range of usage statewide.

Still a global map is less likely to show within-region variation in use of products.

Questions of Chemistry

Common Name	[1]IRAC Number	Chemical Group	Whitefly Crop Hosts Targeted	Resistance Status	Assayed Life Stage(s)
synergized pyrethroids	1B + 3A	Pyrethroids + Organophosphates	All	Resistance detected	Adults
acetamiprid	4A	Neonicotinoid	Cotton, Melons, Vegetables	Field complaints	Adults
clothianidin	4A	Neonicotinoid	Cotton, Vegetables	–	
dinotefuran	4A	Neonicotinoid	Cotton, Melons, Vegetables	–	
imidacloprid	4A	Neonicotinoid	Cotton, Melons, Vegetables	Resistance detected	Adults
thiamethoxam	4A	Neonicotinoid	Cotton, Melons, Vegetables	–	
pyriproxyfen	7C	Juvenoid	Brassicas, Cotton, Melons	Resistance detected	Eggs
buprofezin	16	Chitin inhibitor	Cotton, Melons, Vegetables	None	Nymphs
spiromesifen	23	Lipid synthesis inhibitor	Cotton, Melons, Vegetables	None	Nymphs
spirotetramat	23	Lipid synthesis inhibitor	Vegetables	None	
cyantraniliprole	28	Diamides	Melons, Vegetables	None	Nymphs

On a separate issue, we'll need to finalize the list of chemistry to be represented in this way. We are committed to at least 6 maps of chemistry (by class and/or MoA). There are multiple questions below. John may be in the best position to answer some of these, but everyone should way in. They are:

If there are data showing positive cross-resistance between some of the 6 types of chemistry, we should consider producing maps that show use of all classes of chemistry linked by cross-resistance instead of separate maps.

We will be able to perform analyses to test for such cross-resistance, which will allow us to refine presentation of the maps.

I would think this would be most likely if at all for neonicotinoids and diamides

1. Pyrethroids (with or without OPs?)

Do we represent all pyrethroid usage?

Do we represent only pyrethroid usage when and where an OP is included in the application, too?

Seems to me that both pyrethroid alone and PYR + OP should contribute to evolution of resistance to pyrethroids. I would guess maps plotting both would be most useful.

Analyses of data will tell how to plot these: we can ask if pyrethoids alone, PYR + OP, and the interaction between both are significantly associated with resistance to PYR + OP.

I agree with Yves, but I think what you'll see in Yuma is high usage of pyrethroid in general, across crops. It will likely be rare to find a pyrethroid used alone. It will either be used with a OP or other chemistry.

2. Neonicotinoids

A default may be to include all, but there is a potential pitfall in that imidacloprid, dinotefuran and to a lesser extent thiamethoxam are most often used as a soil application that is poorly represented (i.e., under-represented) in our PUD.

True, but has become less the case in produce and melons where a fair amount of dinotefuron and thiamethoxam are used as foliar sprays. I would predict in more use of both as foliar sprays in melons now that Sivanto has been registered for soil use in melons.

Thus, we might be best confining our "estimate of neonicotinoid intensity of use" by limiting to acetamiprid with or without clothianidin. These are most often used foliarly and are better represented in the data. **Agree with that, but**… [Note we intend to exclude newly reported golf course / turf uses, unless someone has a compelling reason to include them.]

It might be useful to map imidacloprid, dinotefuran uses also even if they are under-represented in 1080 DATA.

John, please comment on above.

Acetamiprid alone?

Acetamiprid and clothianidin?

Or, all neonic's?

Again, analyses will tell. For now I would map all. I also agree with that.

3. Pyriproxyfen (all uses)

4. Buprofezin (all uses)

John, I assume we'll include those products that include buprofezin as a premix?

Yes, I believe in Yuma there is much more usage of Vetica than Courier, at least in melons and produce.

5. Lipid synthesis inhibitors / Keto-enols

John/Steve/Nilima, we presume to lump together all Oberon and Movento uses unless there is compelling need to do otherwise?

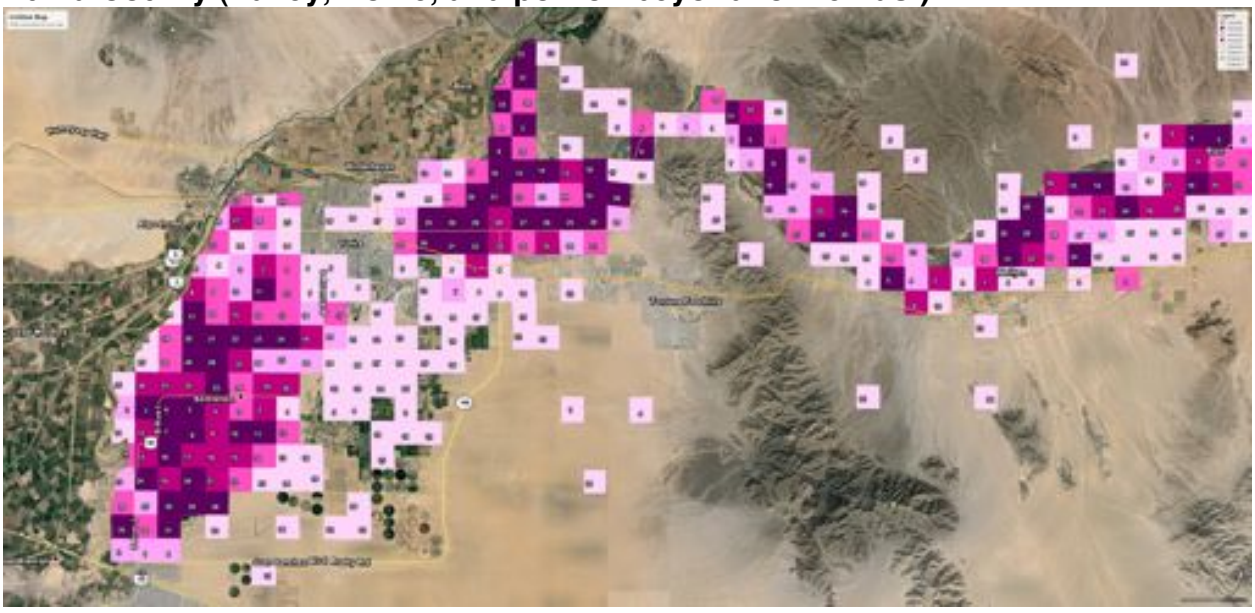
6. Diamides

This is a tough one. We need everyone's input. Most whitefly active diamides (chlorantraniliprole and cyantraniliprole) are used as soil applications in vegetables. **Not true, Voliam Xpress and Coragen are used on more acreage as foliar sprays than Coragen or Durivo in soil. At least that is what Lettuce Insect Losses suggest for the past 3-4 years. Furthermore, soil use of cyantraniliprol will not be used until DuPont lowers the price.** Soil applications are poorly represented in the PUD. However, my understanding is cyantraniliprole is hardly used anyways. **Based on recent LIL survey data, Exirel was sprayed on a few thousand acres last fall, and was applied to fall melons statewide last year. I predict that its use will gradually increase in both produce and melon crops.** There is one other diamide registered for crop use, flubendiamide, with foliar registrations in alfalfa and cotton, at least, where it is used for lep control in summer alfalfa and in non-bt cotton. **However, to my knowledge, this molecule is not active against whiteflies? Thus, does it represent any selection pressure? Do we include it or not?** Please comment.

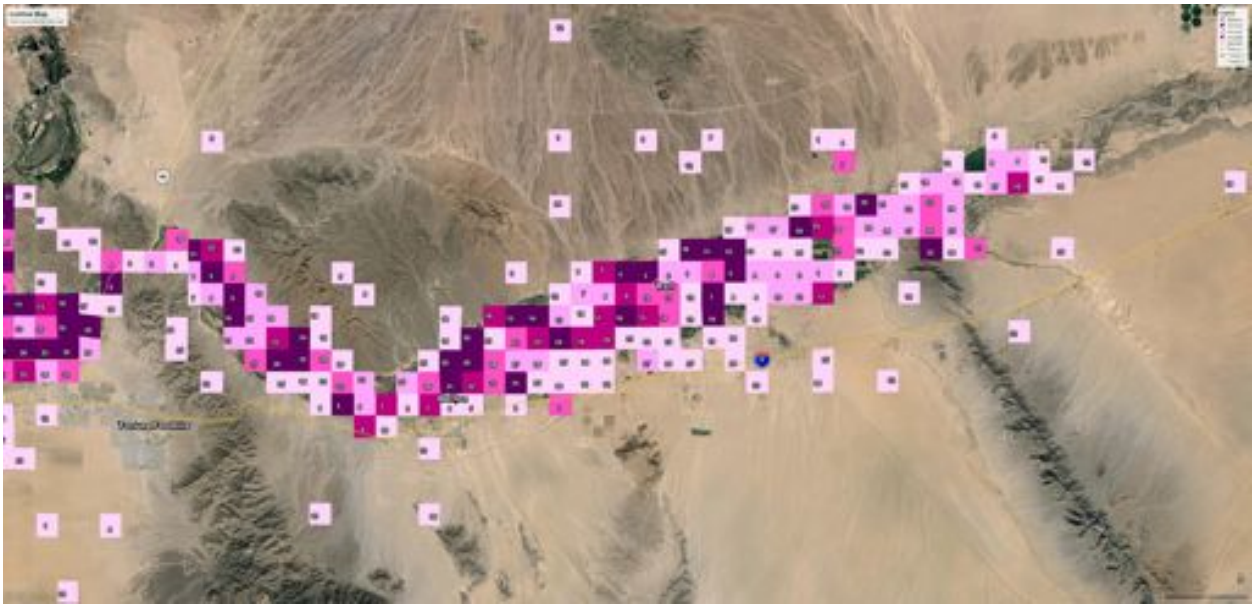
How shall we summarize diamide usage?

All whitefly-active diamides plotted for now. Could change with analyses performed later. Agree.

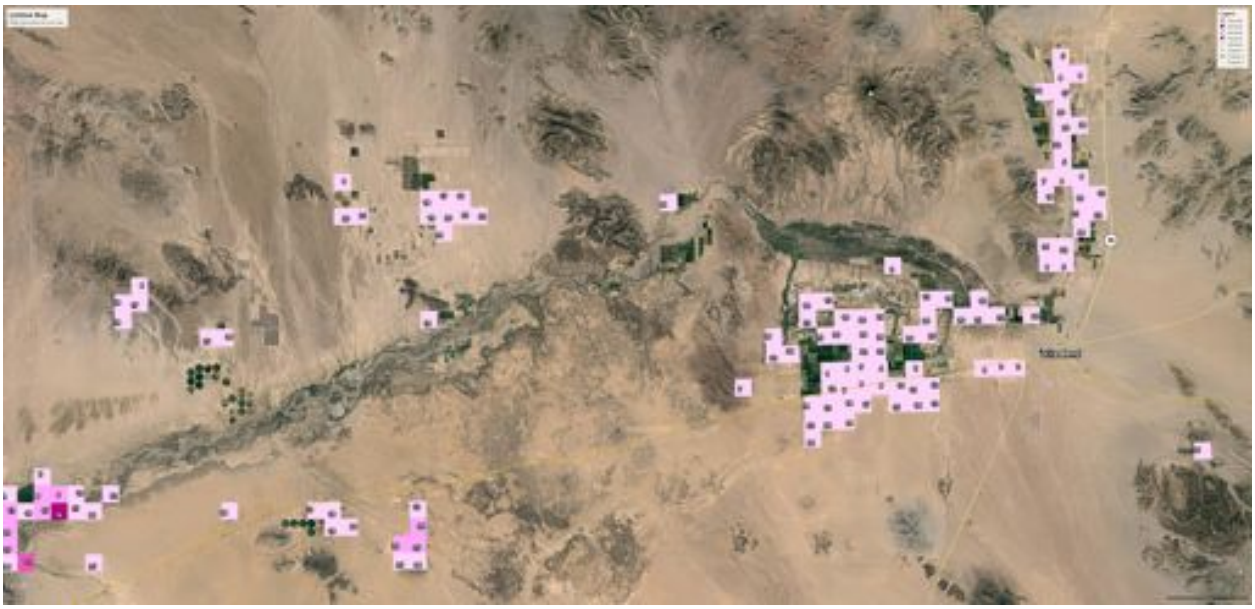
MAPS (All draft just for discussion purposes; these are uncorrected data)
Yuma County (Valley, Dome, and portion beyond to the East)



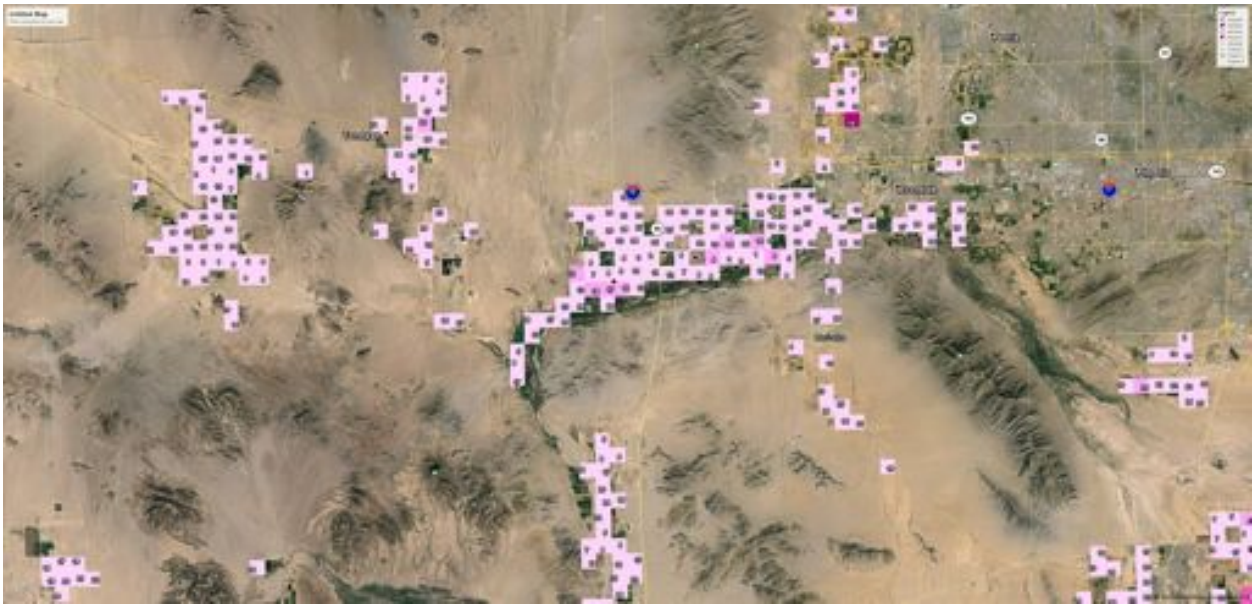
Balance of Yuma County



Paloma/Gila Bend/Cotton Center

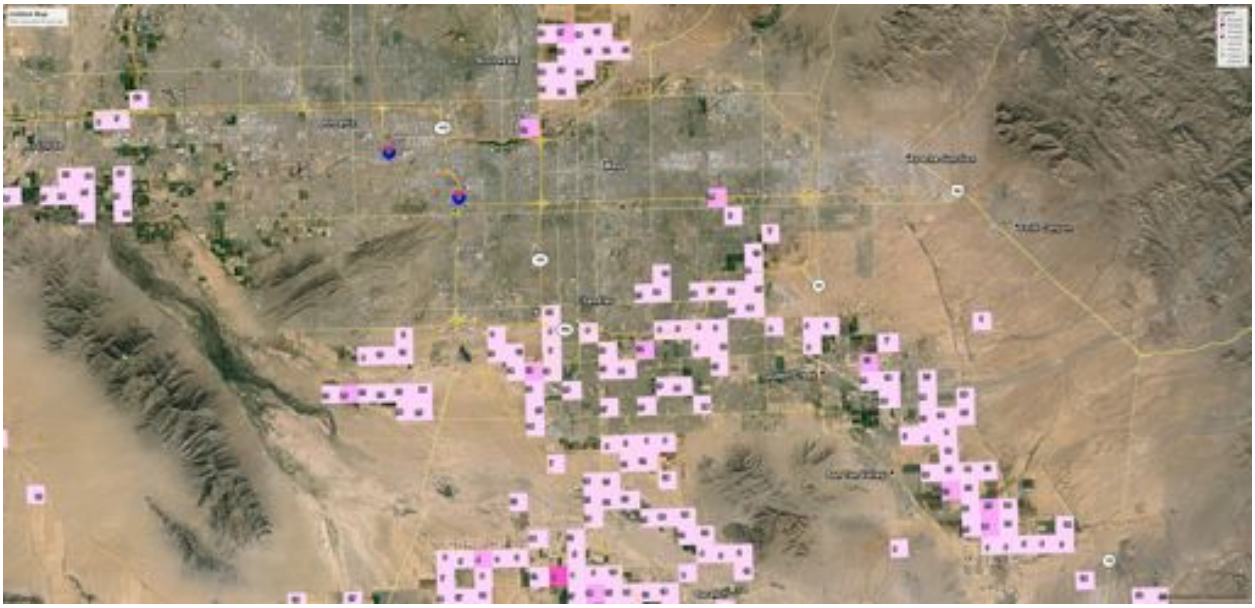


Arlington/West Side of Maricopa County

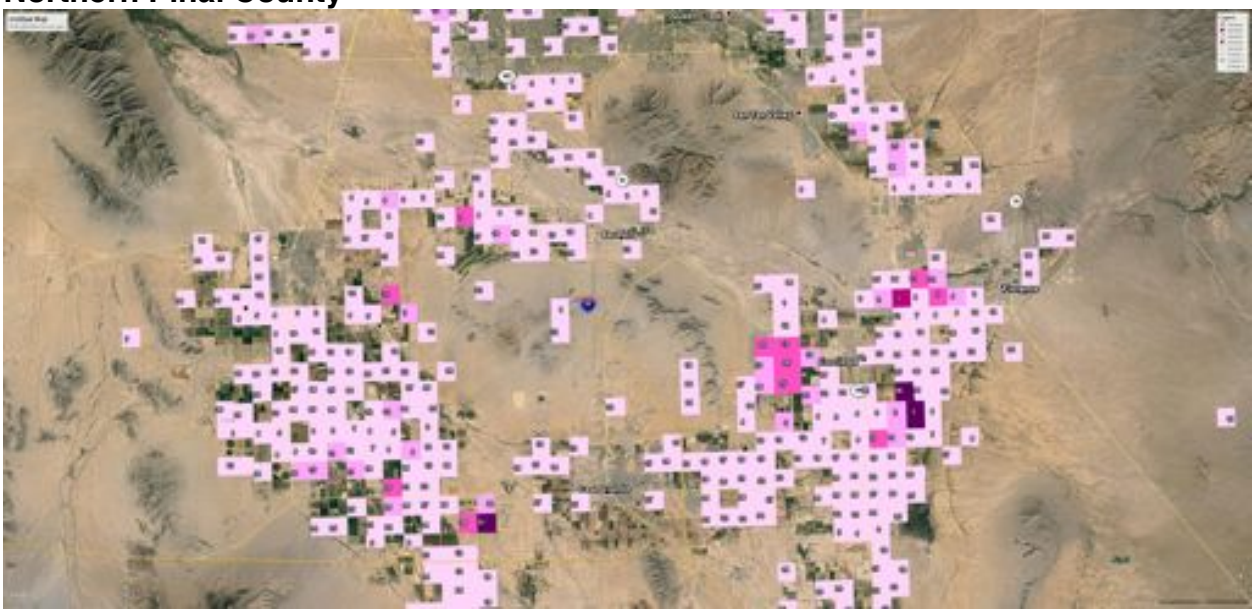


La Paz County

East Side of Maricopa County



Northern Pinal County



Southern Pinal County and Marana/Avra Valleys