The Current and Future Role of Biopesticides in U.S. Agriculture

Alan Schreiber

Why biopesticides?

To make a long story short, there will be more biopesticides coming available to us than conventional pesticides. We need to embrace them.

BUSINESS

Amazon Puts Whole Foods on Fast Track to Conventional Supermarket

Specialty grocer will no longer allow 'brand advocates' in stores, a potential blow to local sellers

By *Heather Haddon* and *Annie Gasparro*

Sept. 21, 2017 5:33 a.m. ET

Whole Foods will change the way companies can sell and market their products in stores beginning next year, one of the biggest moves yet in its continuing push to operate more like a traditional market.

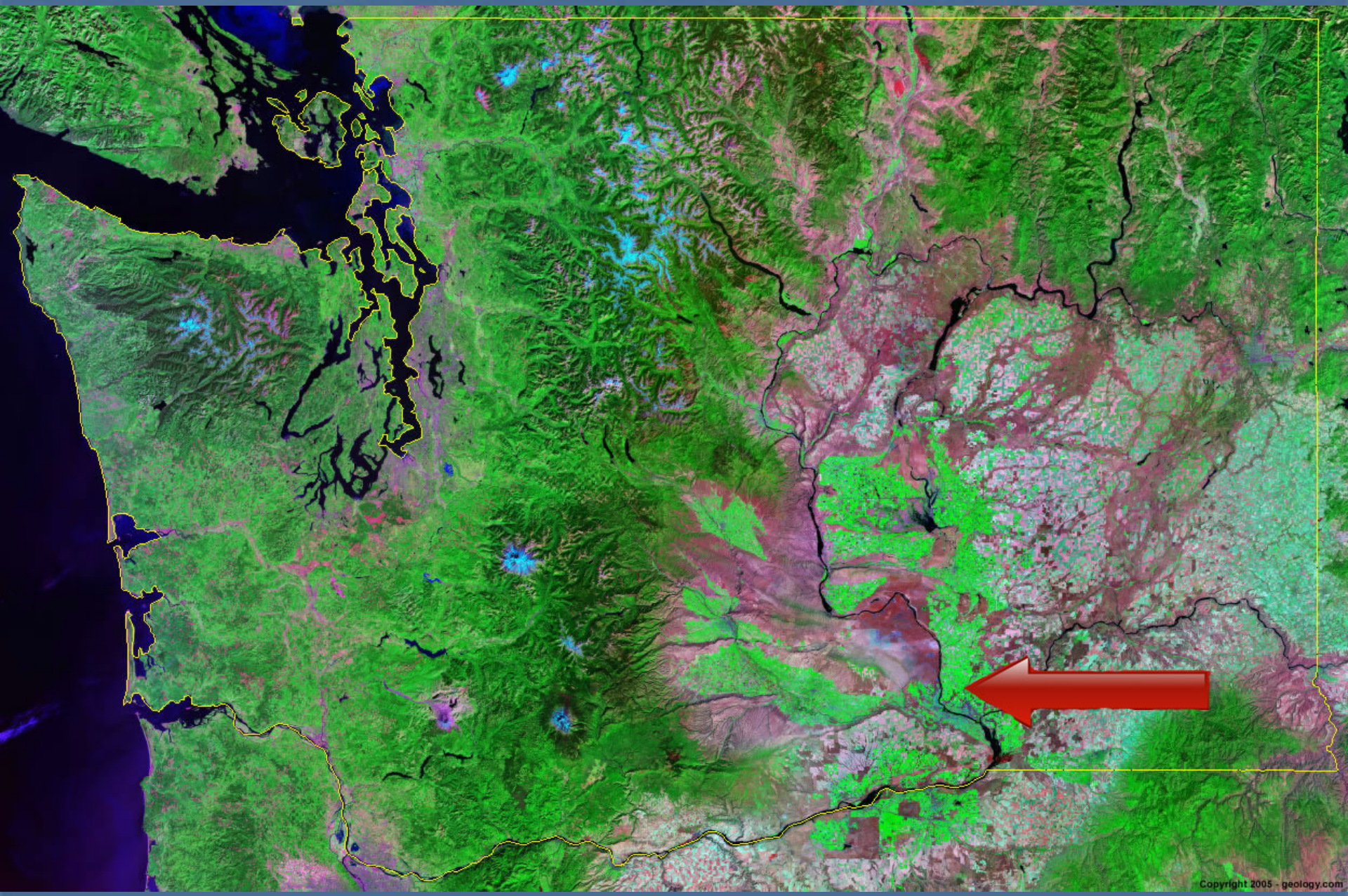
Under the changes planned to begin in April, Whole Foods' 470 locations will no longer allow brand representatives to promote their products or check to make sure they are

For those of you that do not know me; some background

- I grew up on farm in Missouri.
- Ph.D. in entomology/pesticide toxicology. U. of Missouri
- Worked at EPA Office of Pesticide Programs in D.C.
- Department of Entomology-Washington State University.
- WSU IR-4 Coordinator through 1997, on the CLC.
- Left WSU to form my own research company in 1998.
- Started farming in 2003.
- Manage 3 state Commissions.
- Consult on ag, pest management and pesticide issues.

Schreiber & Sons Farm
Agriculture Development Group, Inc.
Paladin Agriculture Research, Inc.

- Research insect, weeds, diseases, nematodes, varietal evaluations, fertility, organic issues.
- Local markets, farmers markets, restaurants, CSA.
- Over 300 crop varieties.
- Wholesale markets focus on asparagus, kale, eggplant, peppers, tomatoes, melons and watermelon.
- Certified organic.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Taylor Flats Rd
Agriculture Development Group, Inc
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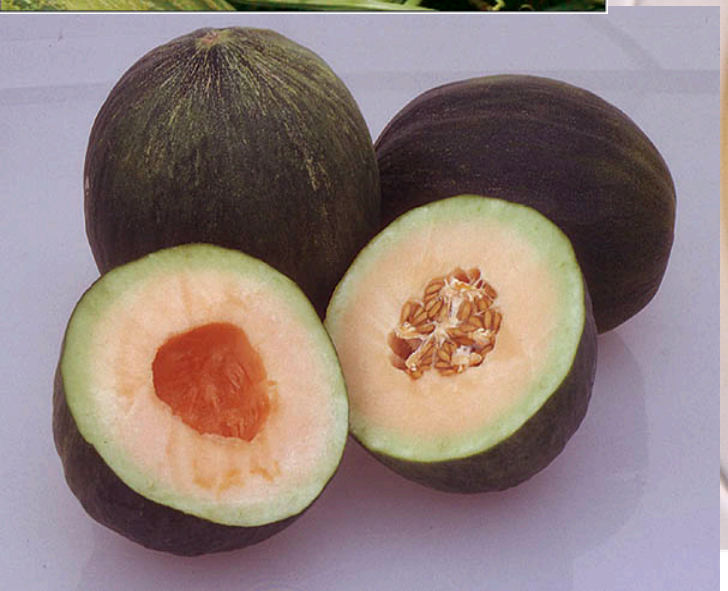



AUG 5 2005


ORANGE OR YELLOW
PEPPERS
$3.99 A POUND
EGGPLANT
.49 A
SEP 17 2004


LOW
Side
TALL
STACKS


nic Cut
cermelon
st served chilled.
lb
ington
northwest
Local Organic
Charentais Melons
Smooth light-green striped rind with creamy-yellow, salmon flesh,
superb French gourmet flavor.
$1.79 lb
Grown in Washington/Schreiber and Sons
6327
northwest
PRODUCED

My involvement with biopesticides are on multiple levels.

- Administer 3 pools of research funds that involve funding pest management research.
- Personally conduct between 40 to 60 pest management trials annually.
- Write management guidelines for various pests on multiple crops such as insects on potatoes, SWD in blueberries and botrytis on small fruits.
- I have to control pests on my farm on a variety of crops.

Increasingly, I conduct research on biopesticide/organic means of pest management.

- Clients pay for this research.
- I use the results of this work to development control recommendations for growers.
- Frequently, I use the results of this research on my farm.

The Washington Asparagus Commission wanted an organic means to control European asparagus aphid.

This is a production ending pest.

The industry is currently in an emergency situation for controlling the aphid, in its 8th year of a Section 18 for lambda cyhalothrin.

European Asparagus Aphid

Seven applications, every seven days, four replications, heavy pressure, counts for 49 days.

Trt No.	Treatment Name	Total aphids per plant	
8	Ecozin	261.0	a
5	OXIDATE	215.5	ab
7	NEEMIX	211.3	ab
4	Saf-T-Side	203.4	abc
1	UNTREATED CHECK	186.0	abc
3	SUCRASHIELD	176.0	abc
2	PESTOUT	128.3	bcd
6	AZA-DIRECT	121.5	bcd
11	Pyganic/Ecozin	92.5	cd
9	Pyganic/Aza-Direct	64.3	d
10	Pyganic/Neemix	59.5	d

2012 Trials

14 treatments

Focus on rates and comparing singular treatments with combinations.

Control of European Asparagus Aphid in Organic Aspar

Days After First/Last Application: 48-10				Total # EAA
Trt. No.	Treatment	Rate Applied	Applic. Code	TOTAL
2	Pyganic	16 fl oz/a	ABCDE	370.0 a
2	Neemix	8 fl oz/a	ABCDE	
5	Oxidate (H202)	25 % v/v	ABCDE	273.3 ab
1	Untreated			189.5 ab
13	Trilogy	2 % v/v	ABCDE	163.5 ab
14	Pyganic	64 fl oz/a	ABCDE	165.5 ab
4	Saf-T-Side	2.5 fl oz/gal	ABCDE	83.5 ab
8	Neemix	8 fl oz/a	ABCDE	122.8 ab
7	Neemix	16 fl oz/a	ABCDE	77.8 ab
3	Pyganic	16 fl oz/a	ABCDE	71.8 ab
3	Neemix	16 fl oz/a	ABCDE	
6	Aza-Direct	3.5 pt/a	ABCDE	46.8 b
9	Pyganic	64 fl oz/a	ABCDE	35.5 b
9	Aza-Direct	2 pt/a	ABCDE	
11	Pyganic	128 fl oz/a	ABCDE	20.0 b
11	Neemix	16 fl oz/a	ABCDE	
10	Pyganic	64 fl oz/a	ABCDE	17.0 b
10	Neemix	16 fl oz/a	ABCDE	
12	Trilogy	2 % v/v	ABCDE	10.3 b
12	Pyganic	64 fl oz/a	ABCDE	

All treatments included Surfact 50

Partially as a result of the ability to control EAA organically, Washington is the primary supplier of organic asparagus in the U.S.

Production of organic asparagus in Washington is increasing by 25% a year.

Application of Pyganic + AzaDirect
Eggplant – August 24, 2015

A more critical pest has been spotted wing Drosophila in small fruit.

This has been a devastating pest for berry growers, particularly for those growing organically.

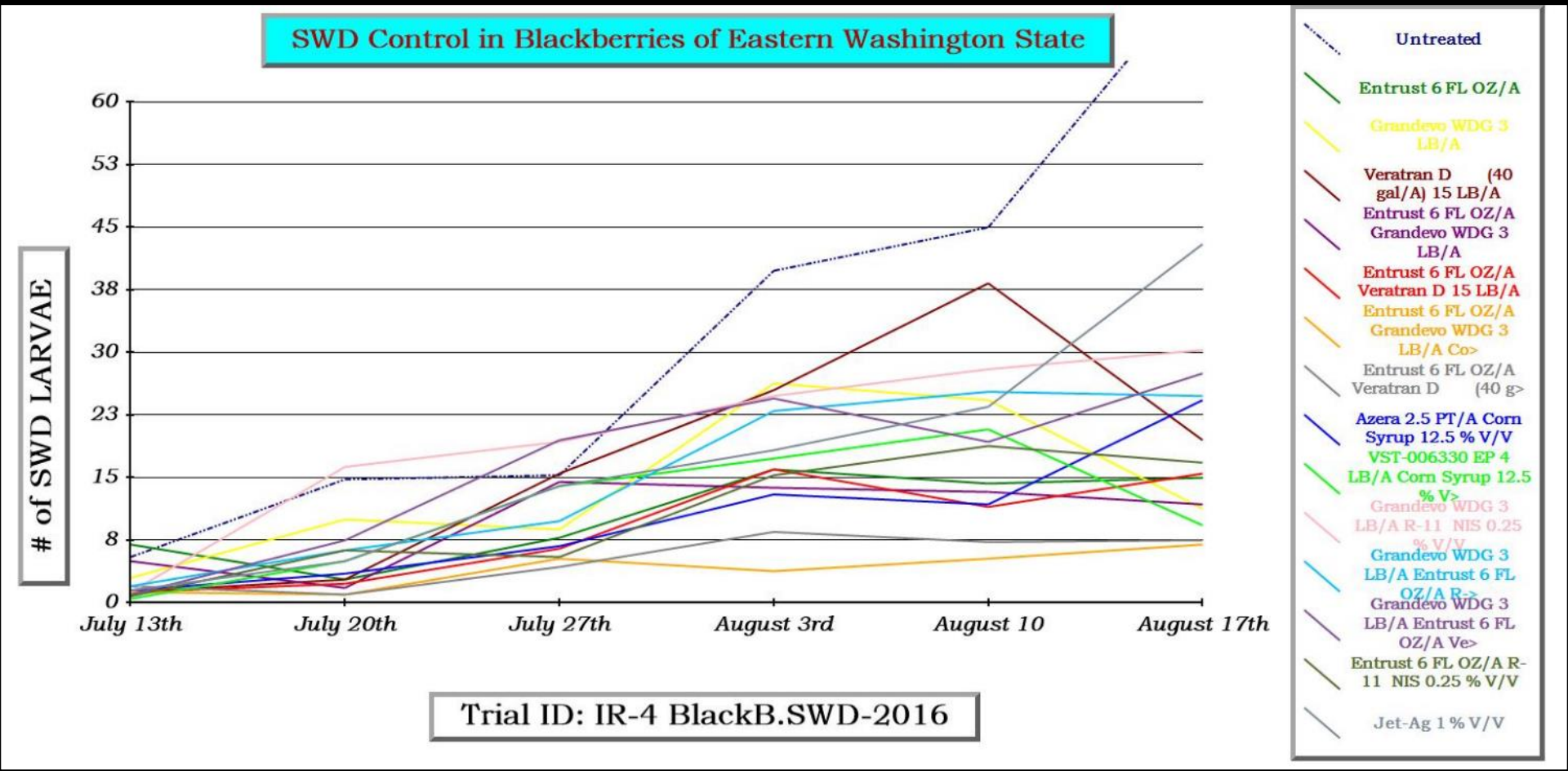
Trt No.	Treatment Name	Appl Code	Total Larvae /20 fruit six samplings	
14	CimeXa Silica tm/d Veratran	ABCDEF	453.3	a
1	Untreated Check		446.5	ab
4	Venerate XC	ABCDEF	434.0	abc
6	Entrust r w Grandevo	ABEF	431.5	abc
5	Veratran D (40 gal/ac)	ABCDEF	425.8	abcd
9	CimeXa Silica Gel Dust	ABCDEF	421.3	abcd
3	Grandevo	ABCDEF	416.8	abcde
13	CimeXa Silica tm'd Venerate	ABCDEF	416.5	abcde
23	Grandevo w corn syrup	ABCDEF	407.5	abcdef
27	Light Corn Syrup	ABCDEF	396.8	abcdef
25	MBI- 203 DF8 w corn syrup	ABCDEF	391.5	abcdef
7	Entrust r w Venerate	ABEF	388.0	abcdef
11	CimeXa Silica r w Entrust	ABEF	379.5	bcdefg
12	CimeXa Silica tm'd Grandevo	ABCDEF	378.8	bcdefg
22	MBI - 203 w corn syrup	ABCDEF	373.0	cdefg
24	Venerate XC w corn syrup	ABCDEF	366.0	cdefg
10	CimeXa Silica Gel Dust	ABCDEF	357.8	defg
21	Cyclaniliprole	ABCDEF	346.3	efgh
8	Entrust r w Veratran	ABEF	345.8	efgh
2	Entrust	AB	344.8	fgh
15	Experimental 1	ABCDEF	312.0	gh
20	Cyclaniliprole	ABCDEF	279.8	hi
26	Entrust SC w corn syrup	ABCDEF	215.3	ij
16	Experimental 1	ABCDEF	192.0	jk
19	Mustang Maxx	ABCDEF	148.8	jk
17	Experimental 1	ABCDEF	127.0	k
18	Experimental 1	ABCDEF	121.5	k

2016 Organic SWD Trial Results in Blackberry

ranked by total SWD over the trial

Total SWD over the trial

Trt No.	Treatment Name	Rate	Rate Unit	SWD / 20 Total	
7	Entrust r/w Grandevo + CS	6	fl oz/a	23.5	j
8	Entrust r/w Veratran + CS	6	fl oz/a	30.5	ij
19	Delegate	4.5	oz wt/a	31.3	ij
6	Entrust r/w Veratran	6	fl oz/a	53.0	hij
5	Entrust + Grandevo	6	fl oz/a	60.0	g-j
9	Azera + corn syrup	2.5	pt/a	60.8	g-j
2	Entrust	6	fl oz/a	62.8	g-j
24	Entrust	6	fl oz/a	63.3	g-j
10	Experimental V + corn syrup	4	lb/a	66.8	f-j
18	Experimental D	11.4	fl oz/a	77.5	e-I
20	Malathion 8 Aquamul	20	fl oz/a	80.8	e-h
3	Grandevo WDG	3	lb/a	83.5	e-h
13	DeBug Turbo r/w Entrust	64	oz/a	89.3	d-h
22	Grandevo WDG r/w Entrust (2)	3	lb/a	91.0	d-h
23	Grandevo (3) r/w Ent (2) r/w Ven (1)	3	lb/a	99.3	c-h
4	Veratran D	15	lb/a	103	c-g
25	Jet-Ag	1	% v/v	105.3	b-g
14	Experimental D	1.43	fl oz/a	106.5	b-g
11	DeBug Turbo	64	oz/a	112.8	b-f
21	Grandevo WDG	3	lb/a	119.8	b-e
17	Experimental D	8.5	fl oz/a	120.3	b-e
16	Experimental D	5.7	fl oz/a	137.0	bcd
15	Experimental D	2.84	fl oz/a	140.5	bc
12	DeBug Turbo	104	oz/a	152.5	ab
1	Untreated			196.0	a


SWD Control in Blackberries of Eastern Washington State
# of SWD LARVAE
60
53
45
38
30
23
15
8
0
July 13th
July 20th
July 27th
August 3rd
August 10
August 17th
Untreated
Entrust 6 FL OZ/A
Grandevo WDG 3 LB/A
Veratran D (40 gal/A) 15 LB/A
Entrust 6 FL OZ/A Grandevo WDG 3 LB/A
Entrust 6 FL OZ/A Veratran D 15 LB/A
Entrust 6 FL OZ/A Grandevo WDG 3 LB/A Co>
Entrust 6 FL OZ/A Veratran D (40 g>
Azera 2.5 PT/A Corn Syrup 12.5 % V/V
VST-006330 EP 4 LB/A Corn Syrup 12.5 % V>
Grandevo WDG 3 LB/A R-11 NIS 0.25 % V/V
Grandevo WDG 3 LB/A Entrust 6 FL OZ/A R->
Grandevo WDG 3 LB/A Entrust 6 FL OZ/A Ve>
Entrust 6 FL OZ/A R-11 NIS 0.25 % V/V
Jet-Ag 1 % V/V
Trial ID: IR-4 BlackB.SWD-2016

The majority of organic blueberries in the U.S. now use the aforementioned program, rotating Grandevo/Venerate/Jet Ag (PAA) with Entrust.

Organic blueberry production is increasing at a rate that exceeds that of conventional blueberries. (Washington produces more organic blueberries than the rest of the U.S. combined.)

Seduce – Ant, Earwig and Cutworm Bait

- .07% spinosad bait (same active ingredient as Entrust).
- 20 to 44 lbs. per acre.
- Almost every crop on the label (around 200).
- Soil applied granule insecticidal bait that has an attractant.
- Effective up to four weeks.
- Broadcast, or in row, reapply after heavy rain or watering. Reapply as bait is consumed or every 2 to 4 weeks. Apply around the base of plants (e.g. berries).
- Vegetables – scatter the bait around the perimeter of vegetable plantings; scatter bait on soil around the plants or between rows.

I use Seduce on my farm.

- We use it at transplant for wireworm control in watermelons; allows plants to get to a size that are not bothered by wireworms.
- Down side is that it has short residual.
- I have wireworm problems near harvest in cantaloupes and the residual is not long enough to provide protection.
- This product works, but in a narrow range of situations.
- Can be used on a wider array of pests than is what is on the label (2ee of FIFRA allows this.)

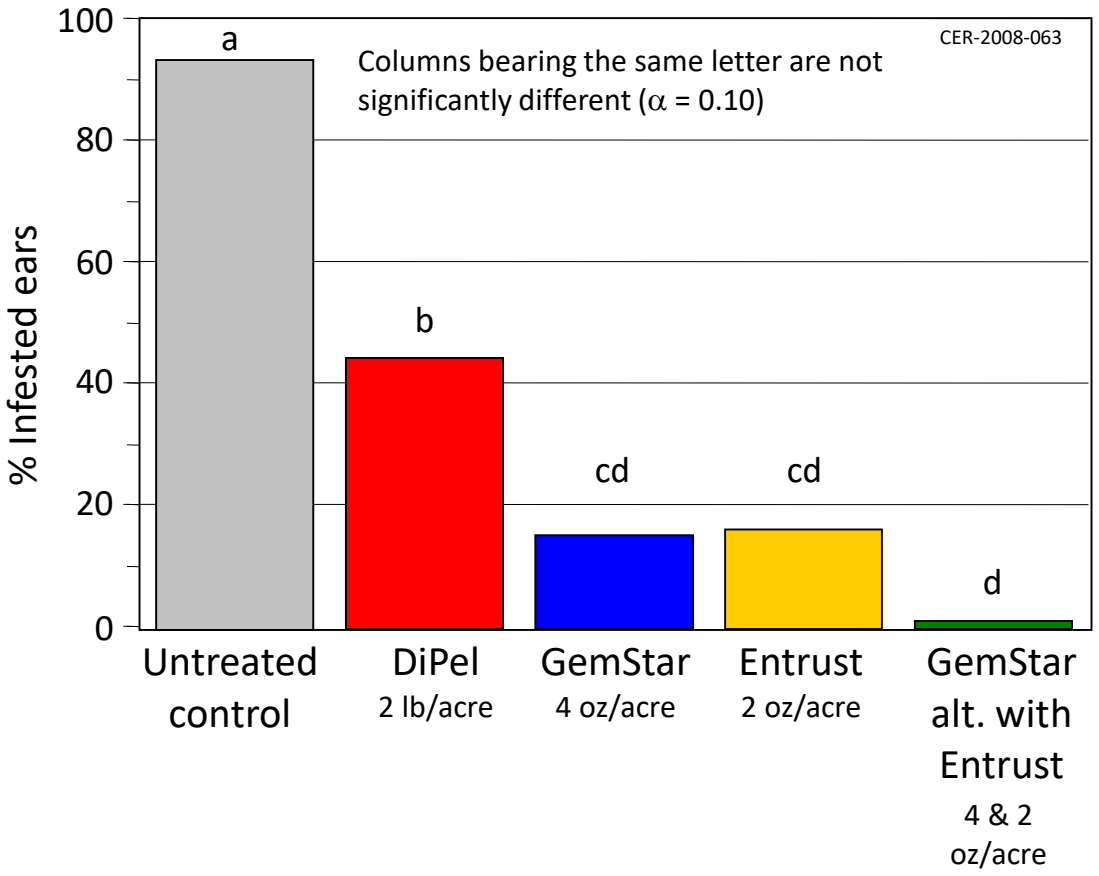
Gemstar (Certis)

- Registered on sweet corn, tomatoes, peppers, leafy and other vegetables. (surprisingly cheap.)
- 4 to 10 oz/acre, air, ground and overhead sprinker, 4 day REI, 0 day PHI.
- Microencapsulated virus that attack only three species of worm pests, most important for WA is corn earworm.
- Has to be ingested, by first and second instar larvae; no adult activity (a weak point, but also true for other organic insecticides.)
- Works better when applied with 5 lbs of sugar/molasses.
- 2 month shelf life, less if exposed to above 90 degrees F.
- The product should be used more than it is.

GemStar vs. corn earworm in organic sweet corn (2008)

Investigator: Dr. Alan Schreiber, Agric. Development Group

Location: Eltopia, WA



- Randomized complete block design with 4 reps (each 12 x 20 ft.)
- Application via overhead sprinkler chemigation in 0.1" of water.
- Single treatments were applied 5 times, every 5 days.
- Alternating treatment: Gemstar or Entrust applied every 6 days (i.e 12 days between each of 4 applications of the same product)

Control of Potato Psyllid with Organic Products, 2012, RDO Company, sponsor

Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	Potato psyllid Total Adult		Potato psyllid Total Nymph		Potato psyllid Total Egg		Potato psyllid Total Psyllid Number	
16	REAPER	16	fl oz/a	A	0	b	0	c	0	c	0	b
	NIS	0.25	% v/v	A								
	Movento	5.5	fl oz/a	AD								
	MSO	0.5	% v/v	AD								
35	Entrust	1.5	oz wt/a	ABDFHJ	1	b	1.3	bc	3.8	ab	6	b
	Surfact 50	0.5	% v/v	ABDFHJ								
	Sulfur	2	lb/a	ABDFHJ								
36	Entrust	3	oz wt/a	ABDFHJ	0	b	0	c	0.3	bc	0.3	b
	Surfact 50	0.5	% v/v	ABDFHJ								
	Sulfur	2	lb/a	ABDFHJ								
	Azadirect	1	pt/a	ABDFHJ								
37	Azadirect	1.5	pt/a	ABDFHJ	0.3	b	0.8	bc	1	bc	2	b
38	Untreated				11.5	a	8	a	6.5	a	26	a

IR-4 NATIONAL PESTICIDE CLEARANCE BIOPESTICIDE EFFICACY AND PERFORMANCE PROTOCOL 2017 PR. NO.: B00201 DATE: 3/23/2017

PROJECT TITLE:
Mitigation of residues of export concern in blueberry through the utilization of biopesticides for end of season management of Spotted Wing Drosophila (SWD).

1. JUSTIFICATION AND OBJECTIVES: IR4 identified research on SWD as a priority need. The purpose of this efficacy and crop safety trial is to determine the level of SWD control by biopesticides in blueberry to replace conventional pesticides of export concern.

2. IR-4 RESEARCH COORDINATOR: Michael Braverman, Manager, Biopesticide and Organic Support Program, IR4 Project Headquarters, 500 College Road East Suite, 201W, Princeton, NJ 08540,
Phone: (732) 9329575, ext. 4610, FAX: (609) 514-2612, e-mail: braverman@aesop.rutgers.edu

Reducing Pesticide Residues in Raspberries Without Reducing SWD Efficacy.

1. Untreated check
2. Standard – Danitol, (first harvest) Malathion, Mustang Max, Danitol, Malathion Do not use Danitol post harvest.

(7 day retreatment interval moving to 5 day retreatment interval later in the season)

3. Danitol, Malathion, Mustang Max, Grandevo+Jet Ag, Venerate+Jet Ag, Grandevo + Jet Ag
4. Danitol, Malathion, Mustang Max, Venerate+Jet Ag, Grandevo+Jet Ag, Venerate + Jet Ag
5. Delegate, Malathion, Bifenthrin, Grandevo+Jet Ag, Venerate + Jet Ag, Grandevo + Jet Ag
6. Delegate, Malathion, Bifenthrin, Venerate + Jet Ag, Grandevo + Jet Ag, Venerate + Jet Ag
7. Delegate, Malathion, Bifenthrin, Success + Jet Ag, Grandevo + Jet Ag, Success + Jet Ag

Most of my examples have entomological.

There are plenty of examples for diseases; less so for weeds.

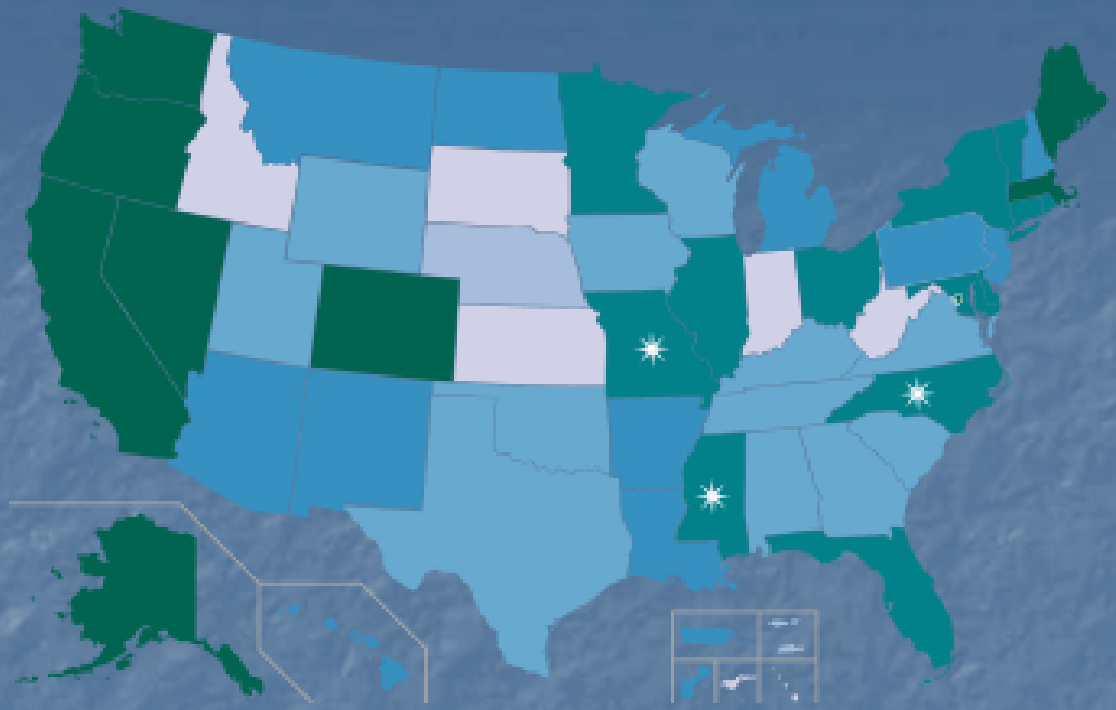
Grape Powdery Mildew Trial in Wine Grapes, 2012, Schreiber

Trt	Treatment		Rate	Appl	% Incidence		% Severity	
No.	Name	Rate	Unit	Code	94	17	94	17
1	Untreated				98 a		81 a	
2	Flint	3	oz wt/a	AF	6 c		5 bc	
2	Rally	5	oz wt/a	BG				
2	Quintec	5	fl oz/a	CH				
2	Pristine	10	oz wt/a	D				
2	Endura	4.5	oz wt/a	E				
3	Regalia	16	fl oz/a	ABCEFGH	62 b		19 b	
3	Regalia	2	pt/a	D				
3	NIS	0.25	% v/v	ABCDEFGH				
4	Regalia	16	fl oz/a	ABCEFGH	62 b		19 b	
4	Regalia	2	pt/a	D				
4	Sylgard 309	16	fl oz/100 gal	ABCDEFGH				
5	Regalia	2	qt/a	ACEG	2 c		2 c	
5	Quintec	6	fl oz/a	BDFH				
6	Regalia	2	qt/a	ACEG	6 c		1.7 c	
6	Vivando	12	fl oz/a	BDFH				
7	Regalia	2	qt/a	ABCDEFGH	38 b		18 b	
7	NIS	0.25	% v/v	ABCDEFGH				

Trt No.	Treatment Name	Rate	Rate Unit	July 3, 2014 Incidence	July 3, 2014 Severity	July 15, 2014 Incidence	July 15, 2014 Severity
1	Untreated Check			0.070a	23.3a	0.125a	83.3a
4	REGALIA	4	qt/a	0.055a	13.0a	0.075ab	72.8ab
12	ELEVATE	1.5	lb/a	0.015b	3.8a	0.060bc	24.5abc
21	PROLINE	5	fl oz/a	0.000b	0.0a	0.033bc	36.7abc
3	TAVANO	13	fl oz/a	0.005b	1.3a	0.025bc	37.5abc
16	V-10135	0.38	lb ai/a	0.020b	11.7a	0.025bc	48.0abc
2	PhD	6.2	oz/a	0.015b	16.3a	0.020bc	11.7bc
13	PRISTINE	23	oz/a	0.000b	0.0a	0.020bc	20.5abc
14	IPRODIONE	1	fl oz/a	0.015b	21.3a	0.020bc	16.5bc
15	BRAVO	4	pt/a	0.005b	3.8a	0.020bc	38.8abc
17	PROTEXIO	0.38	lb ai/a	0.015b	6.6a	0.020bc	43.8abc
5	OMEGA	1.25	pt/a	0.020b	4.2a	0.015bc	50.0abc
10	SWITCH	14	oz/a	0.005b	2.5a	0.015bc	35.0abc
11	CAPTAN	2.5	lb/a	0.010b	1.3a	0.015bc	46.3abc
6	MERIVON	5.5	fl oz/a	0.000b	0.0a	0.005bc	15.0bc
7	LUNA SENSATION	5.5	fl oz/a	0.000b	0.0a	0.005bc	25.0abc
8	Luna Tranquility	24	fl oz/a	0.000b	0.0a	0.005bc	2.5c
9	SCALA	18	fl oz/a	0.000b	0.0a	0.000c	0.0c
18	PROTEXIO	0.5	lb ai/a	0.015b	7.5a	0.000c	0.0c
19	PROTEXIO	0.38	lb ai/a	0.005b	18.8a	0.000c	0.0c
19	SWITCH	0.43	lb ai/a				
20	ELEVATE	0.75	lb ai/a	0.000b	0.0a	0.000c	0.0c
20	SWITCH	0.43	lb ai/a				

There is a crop that relies exclusively on biopesticides.

Cannabis



Cannabis laws in the United States

- Jurisdiction with legalized cannabis.
- Jurisdiction with both medical and decriminalization laws.2 Marked states have only legal non-psychoactive medical cannabis.
- Jurisdiction with legal psychoactive medical cannabis.
- Jurisdiction with legal non-psychoactive medical cannabis.
- Jurisdiction with decriminalized cannabis possession laws.
- Jurisdiction with cannabis prohibition.

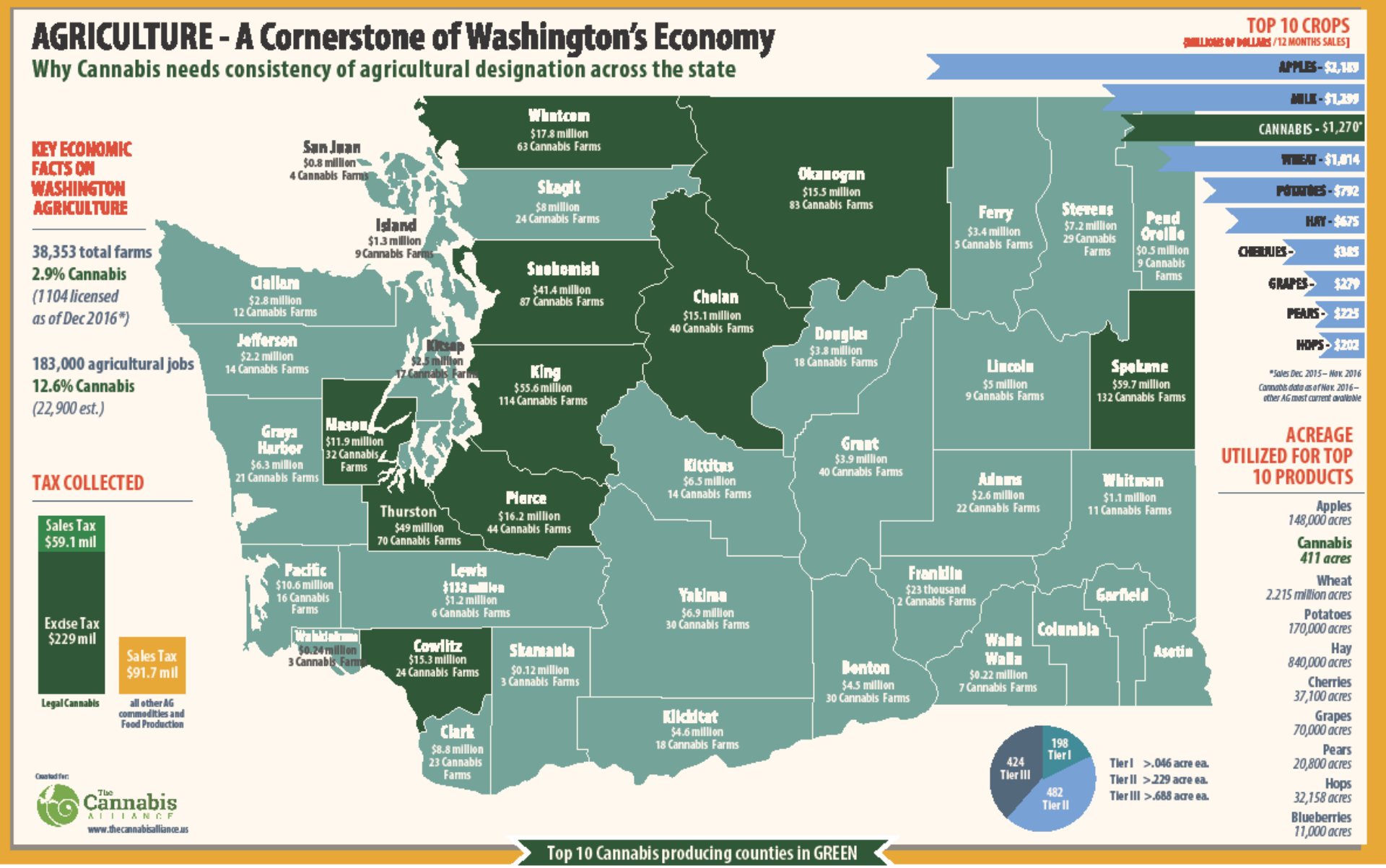
Cannabis remains a Schedule I substance under federal law.
Some cities and Indian Reservations have legalization policies separate from their surrounding states. Cannabis is illegal in all Federal enclaves.

How much is cannabis worth?

- One of the most valuable crops in Washington is blueberries. Worth about $15,000 an acre in 2014.
- Tier 2 Operation. Outdoors. Eastern Washington.
- 600 plants. Planted in May, harvested in October.
- 2,000 pounds of dried product; $400 a pound.
- $800,000 for 10,000 square feet.
- Hundreds of times more valuable than blueberries.
- After processing, double to triple the value.
- The value of this crop fundamentally changes the pest management equation.
- You cannot tolerate any losses from pests.

AGRICULTURE - A Cornerstone of Washington's Economy

Why Cannabis needs consistency of agricultural designation across the state



Washington Cannabis Pests

- Two-spotted spider mite
- Hemp russet mite and a broad mite
- Aphids, root and foliar
- Fungus gnats
- Thrips
- Whitefly
- Leafminer
- Other pests, such as worms
- Powdery mildew
- Botrytis (bud rot)
- Pythium (marijuana root rot)
- More pest species will come
- Abiotic problems that confound figuring out what pest problem you might have.

Hemp russet mite – a new pest to me


LIFETIME

Tri-Cities HRM Infestation

First time medical grower. Seemed to do everything right but got HRM.

The grower tried removing infected leaves; removed
Severely infected plants, nothing worked, probably
came with seed or from the grower next door.

All Washington ag commodities (except one) are supported by research and extension activities

- Interpretation of federal law precludes all of the traditional sources of research and extension.
- Land Grant institutions, USDA, IR-4, etc.
- Cannabis suffers from a wide variety of insect, diseases and other pests, as does every other crop.
- Like every other grower, cannabis growers desire to control pests on their crops.
- Due to the potential high value of cannabis, growers have extraordinary motivation to control pests.
- Unlike every other crop, it is illegal to federally register a pesticide on cannabis.

Cannabis Pest Management Challenges

- It is illegal to register a pesticide on cannabis at least at the Federal level. We are pursuing 24c registrations.
- It is not possible to certify cannabis as organic; you cannot claim your cannabis is organic-certainly not certified organic. If it is not certified organic, then saying it is “organic” means nothing.
- No pesticide applicator or worker protection training is permitted by the usual mechanisms.
- None of the traditional sources of ag research and extension is allowed.
- As a result, growers are left to figure out how best to control pests... many of which may be new to cannabis or growing cannabis by new methods or on larger scale than they have traditionally.

As a result the cannabis industry faces some tremendous problems.

- Illegal pesticide residues.
- High pesticide residues.
- Several pesticides concentrate in concentrated cannabis to stunningly high levels.
- Consumer risk issues
- Worker protection issues.
- Applicator exposure issues
- Growers are left to each other, the internet and sometimes unscrupulous companies for information.
- Cannabis pest management is a mess and growers need help.

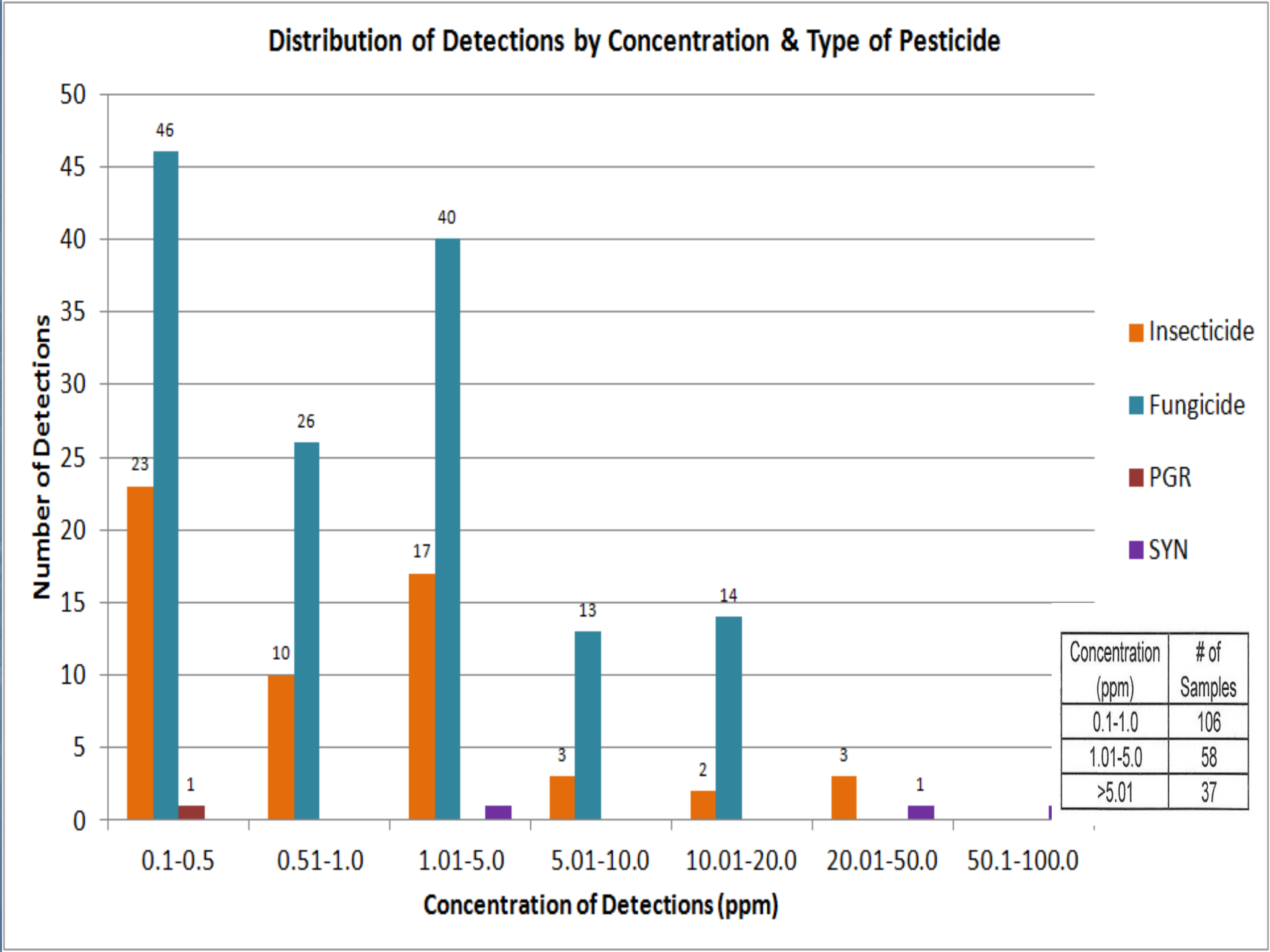
In the past year, Washington started testing for pesticide residues.

- A large number of lots tested positive.
- Scandal.
- Some of the biggest, best known growers and brands were testing positive.
- “Organic” and “all natural” brands tested positive.
- There was a temporary shortage of product because no one could get “clean” product.

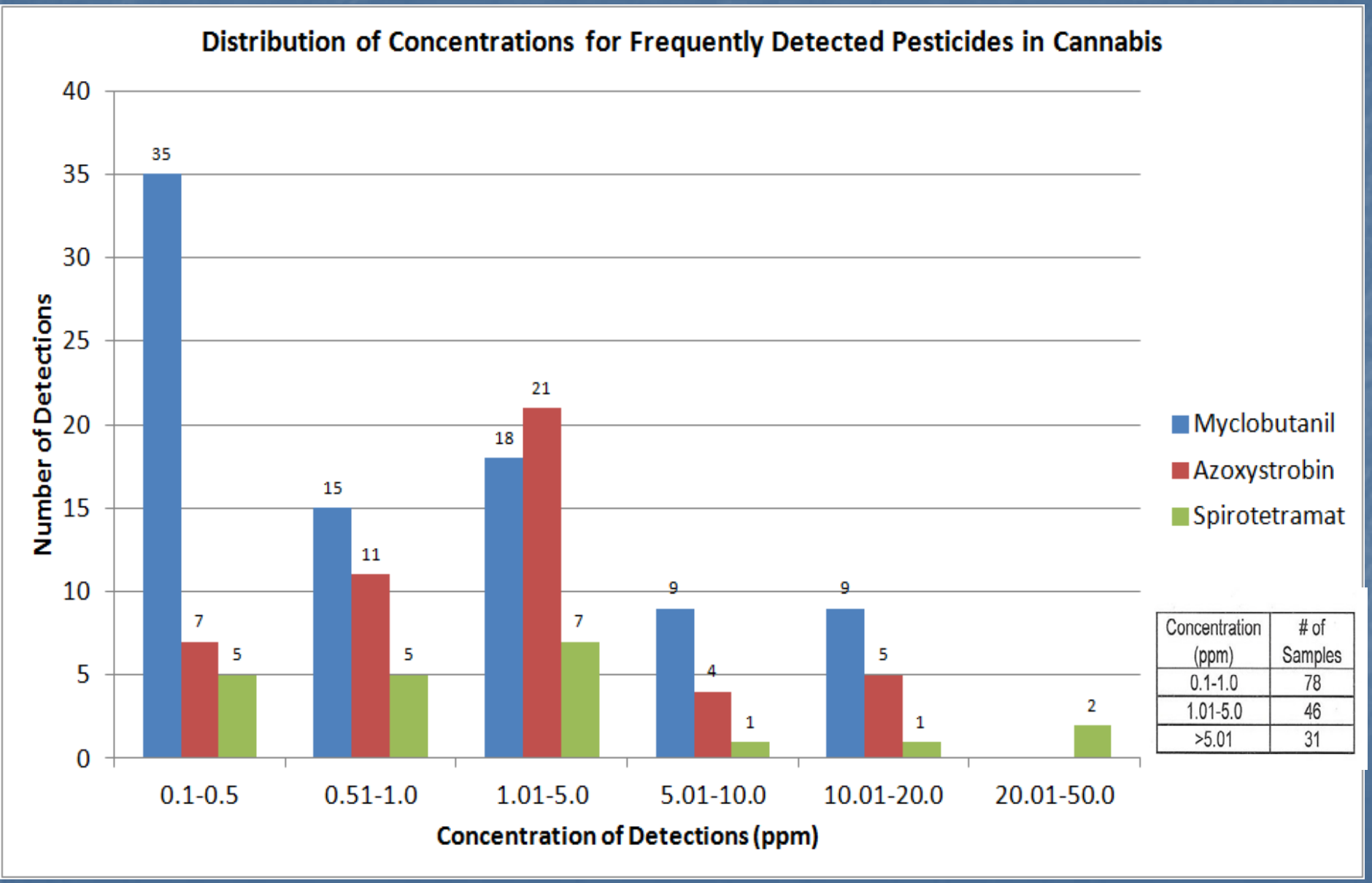
More Products on Shelves at Recreational Marijuana Stores Have Tested Positive for Sketchy Pesticides by Tobias Coughlin-Bogue • Mar 17, 2016 at 6:28 pm

Washington State Fines Two Marijuana Growers For Using Prohibited Pesticides

by Tobias Coughlin-Bogue • Feb 11, 2016 at 1:56 pm


Distribution of Detections by Concentration & Type of Pesticide
Number of Detections
50
45
40
35
30
25
20
15
10
5
0
46
23
1
26
10
40
17
13
3
14
2
3
1
0.1-0.5
0.51-1.0
1.01-5.0
5.01-10.0
10.01-20.0
20.01-50.0
50.1-100.0
Concentration of Detections (ppm)
Insecticide
Fungicide
PGR
SYN
Concentration (ppm)
# of Samples
0.1-1.0
106
1.01-5.0
58
>5.01
37

Distributions of Frequently Detected Analytes



Concentration (ppm)	# of Samples
0.1-1.0	78
1.01-5.0	46
>5.01	31

Cannabis Safety Institute White Paper

www.cannabissafetyinstitute.org

- OG Analytical in Eugene, OR
- Tested samples from Oct - Dec 2014
- 389 flowers
- 154 concentrates
- Tested for 65 compounds
- Detected 24 different residues
- 29% of flowers and 55% of concentrates had detectable residues

Some of the highest residues detected in study period:

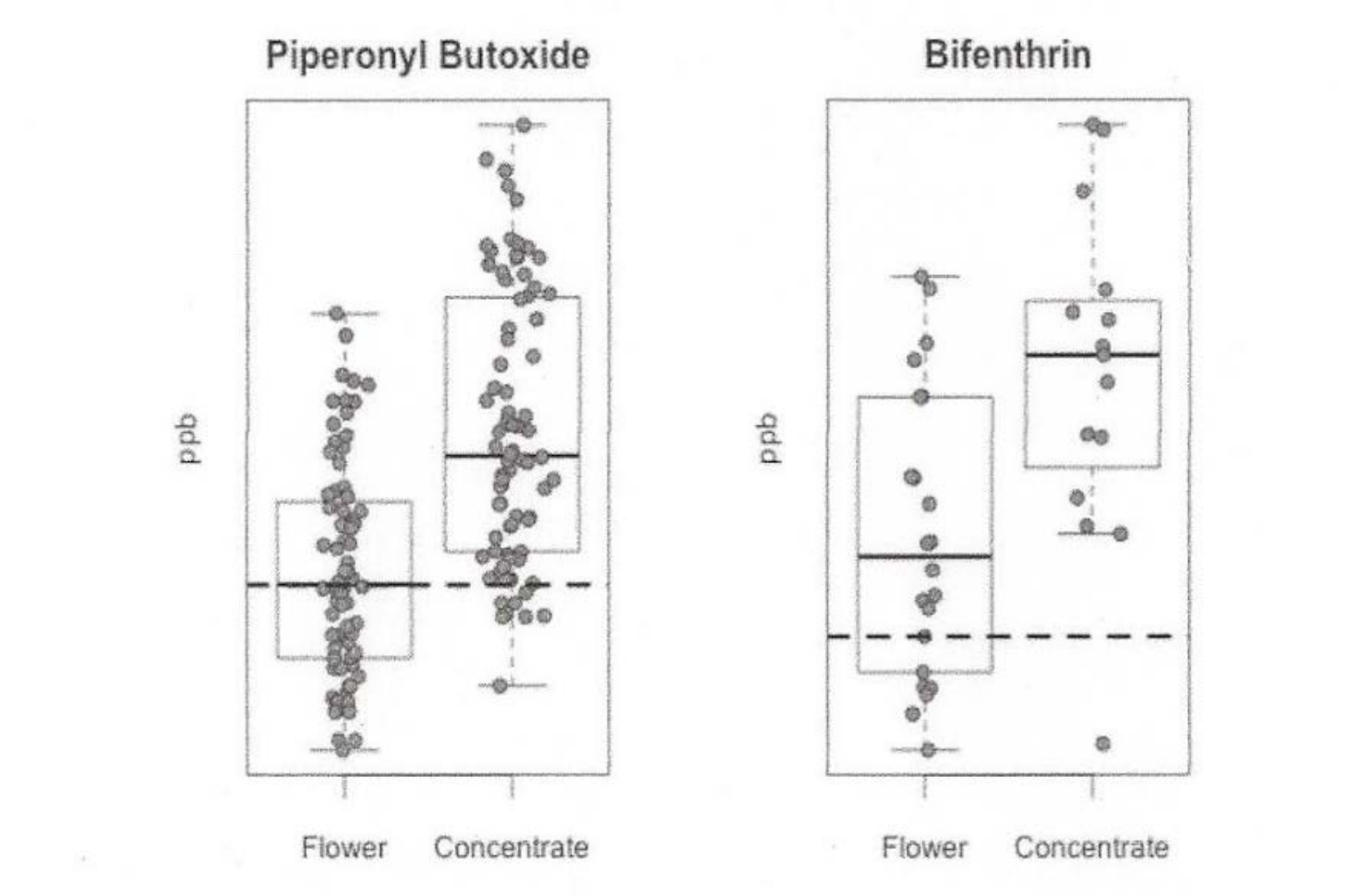
FLOWERS

Analyte	Amount Detected (ppm)
Imidacloprid	64.0
Piperonyl Butoxide	22.7
Dichlorvos	8.06
Myclobutanil	8.04
Bifenthrin	5.62

CONCENTRATES

Analyte	Amount Detected (ppm)
Carbaryl	415
Piperonyl Butoxide	407
Myclobutanil	392

Residues will concentrate in concentrates!



Flowers			Concentrates		
Matrix	Pesticide	Conc (ppb)	Matrix	Pesticide	Conc (ppb)
Flower	Imidacloprid	64,000	Concentrate	Carbaryl	415,000
Flower	Azadirachtin	36,000	Concentrate	PBO	407,000
Flower	PBO	2,700			
			Concentrate	Myclobutanil	392,000
Flower	Azadirachtin	16,700	Concentrate	PBO	220,000
Flower	Imidacloprid	15,300	Concentrate	PBO	180,000
Flower	Azadirachtin	14,274	Concentrate	Myclobutanil	160,000
Flower	PBO	13,500	Concentrate	PBO	137,000
Flower	Azadirachtin	13,200	Concentrate	Azadirachtin	123,000
Flower	Azadirachtin	11,450	Concentrate	Myclobutanil	110,000
Flower	Azadirachtin	11,300	Concentrate	PBO	106,700
Flower	PBO	9,040	Concentraate	Chlorfenapyr	100,000
Flower	Dichlorvos	8,058	Concentrate	Myclobutanil	64,310
Flower	Myclobutanil	8,039	Concentrate	PBO	52,000
Flower	Azadirachtin	7,200	Concentrate	PBO	48,160
Flower	Bifenthrin	5,621	Concentrate	PBO	46,440
Flower	Bifenthrin	4,925	Concentrate	PBO	44,500
Flower	PBO	4,450	Concentrate	Myclobutanil	43,600

The legal cannabis industry has had to very quickly shift from using whatever it wanted to regardless of the label to using only a subset of biopesticides.

- Products considered “not illegal” to use on cannabis must be exempt from tolerances and labels must contain label language that does not preclude use on cannabis.
- In Washington, the WSDA “approved” list contains almost 300 products over about 80 active ingredients.
- For example, spinosad is not allowed, but pyrethrin, azadiraction, Regalia are allowed.
- There is something to be learned from the cannabis experience.
- There is tremendous pressure to achieve a high level of control of a wide array of pests without the use of conventional pesticides.

The techniques being widely adopted by the cannabis industry might be familiar to some you.

- Scouting, scouting, scouting. Early detection.
- Proper identification of the pest species.
- Prophylactic releases of beneficial organisms.
- Innudative releases of beneficial organisms in rescue situations.
- Hygienic practices to disrupt pest life cycles such as reducing humidity, keeping growing areas clean, sanitation, preventing contamination, etc.
- Early application of products before thresholds are high.
- Tank mixes, correct rates, good coverage, surfactants.

For lack of access to better products, biopesticides have become the backbone of cannabis pest management programs.

I foresee cannabis as having some of the most advance integrated pest management programs in the U.S. based on heavily reliance on biopesticides. There is something for us to learn from this cannabis growers.


September, 2017


May, 201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