2016 WTFRC APPLE PESTICIDE RESIDUE STUDY

For the sixth consecutive year, the Washington Tree Fruit Research Commission (WTFRC) conducted a trial to evaluate pesticide residues on 'Gala' apples. Thirteen insecticide/acaricides and seven fungicides were applied using a Rears airblast sprayer according to either an "aggressive" (maximum label rates at minimum retreatment and pre-harvest intervals) or "standard" (typical industry rates and timings) protocol. Products evaluated for the first time in 2016 included Delegate WG and Rimon. Plots from both protocols were divided for one of three additional factorial treatments: 1. Overhead cooling 2. Raynox (Pace Intl.), a waxy sunburn protectant or 3. Eclipse (D & M Chem), a calcium carbonate and boron fertilizer with sunburn protective properties. Raynox and Eclipse were applied according to their respective label specifications. One plot also received the aggressive spray protocol with no additional treatment (control). Fruit samples were delivered the day after harvest to Pacific Agricultural Labs (Sherwood, OR) for chemical analysis.

Visible residues of fruit treated with overhead cooling (L), Raynox (C), and Eclipse (R) at harvest

Measured residues vs. maximum residue levels (MRLs) for uniformly applied STANDARD industry pesticide programs utilizing typical rates, timings, and retreatment intervals on apples with overhead cooling (OHC), Raynox (320 oz/a) or Eclipse (3 gal/a) applied at 35 and 14 days before harvest (dbh). 'Gala'/M.9 Nic.29, Rock Island, WA. WTFRC 2016.

Chemical name	Trade name	Application rate	Application timing(s)	OHC fruit	Raynox treated fruit	Eclipse treated fruit	US MRL[1]	Lowest export MRL[1]
		oz per acre	*dbh*	*ppm*	*ppm*	*ppm*	*ppm*	*ppm*
Spirotetramat	Ultor	14	35	0.035	0.049	0.047	0.7	0.7 (many)
Etoxazole	Zeal	2	35	0.013	0.013	0.018	0.2	0.07 (many)
Spirodiclofen	Envidor 2SC	18	35	0.043	0.052	0.047	0.8	0.8 (many)
Myclobutanil	Rally 40WSP	10	35	0.11	0.11	0.13	0.5	0.5 (many)
Emamectin benzoate	Proclaim	4.8	35	< 0.01	< 0.01	< 0.01	0.025	0.02 (many)
Metrafenone	Vivando	15.4	35	< 0.01	< 0.01	< 0.01	1.5	0.01 (EU, UAE)
Fluxapyroxad	Merivon	5.5	35	0.014	0.022	0.020	0.8	0.8 (CAN,MEX)
Pyraclostrobin	Merivon	5.5	35	0.010	0.011	0.012	1.5	0.5 (many)
Spinetoram	Delegate WG	7	35 & 21	< 0.01	< 0.01	< 0.01	0.2	0.05 (many)
Cyantraniliprole	Exirel	13.5	35 & 21	0.041	0.061	0.076	1.5	0.8 (many)
Spinosad	Entrust	3	35 & 21	0.034	0.024	0.024	0.2	0.1 (many)
Cyflumetofen	Nealta	13.7	35 & 21	0.023	0.022	0.018	0.3	0.3 (CAN,MEX)
Novaluron	Rimon	32	35 & 21	0.10	0.12	0.12	3	2 (CAN,TAI)
Difenoconazole	Inspire Super	12	28	**0.059**	**0.047**	**0.058**	5	0.01 (India)
Cyprodinil	Inspire Super	12	28	**0.097**	**0.082**	**0.095**	1.7	0.05 (VN, INDO)
Flutriafol	Topguard	10	28	0.019	0.024	0.029	0.4	0.2 (Hong Kong)
Bifenazate	Acramite	16	28	0.034	0.052	0.046	0.7	0.2 (China)
Hexythiazox	Onager	20	28	0.054	0.049	0.052	0.4	0.4 (many)
Pyridaben	Nexter	6.6	28	0.029	0.036	0.032	0.5	0.5 (many)
Ziram*	Ziram 76DF	96	21	< 0.1	< 0.1	0.13	7	2.5 (Taiwan)
Fenpropathrin	Danitol	18	14	0.16	0.18	0.17	5	0.5 (Taiwan)
Thiophanate-methyl**	Topsin 4.5FL	16	14	0.126	0.220	0.163	2	3 (many)

[1] Top markets for WA apples with established MRLs; 15 Sep 2016. http://www.nwhort.org/AppleMRLs.html, https://www.globalmrl.com/

* Dithiocarbamate residues cannot be directly measured; total Ziram values are estimates based on analysis of the degradation product CS_2

** Thiophanate-methyl values reported are sum totals of thiophanate-methyl and carbenzadim residues

Results of this lone unreplicated trial are shared for informational purposes only and should not be construed as endorsements of any product, reflections of their efficacy against sunburn, any insect, acarid, or fungal pest, or a guarantee of similar results regarding residues for any user. Apple growers should consult their university extension staff, crop advisors, and warehouses to develop responsible pest control programs.

TRIAL DETAILS

- 9th leaf 'Pacific' Gala / M.9 Nic.29 trained to central leader/spindle on 3' x 10' spacing
- 2 x 25 gal Rears Pak-Blast sprayer calibrated to 100 gal / acre
- All pesticides applied with 8 oz Regulaid / 100 gal water / acre
- 0.22 total inches precipitation recorded during trial: 0.06" on July 17, 0.12" on July 18, 0.02" on July 22, & 0.02" on Aug 8
- Overhead cooling settings: 15 min. on/15 min. off from noon to 6PM from start of trial (July 13) to harvest (Aug 17) at a rate of 0.11"/hour for an approx. total of 11" of water applied throughout the study

Measured residues vs. maximum residue levels (MRLs) for uniformly applied AGGRESSIVE pesticide programs utilizing maximum rates, and minimum preharvest and retreatment intervals on apples with no additional treatment (Control), overhead cooling (OHC), Raynox (320 oz/a) or Eclipse (3 gal/a) applied at 35 and 14 dbh. 'Gala'/M.9 Nic.29, Rock Island, WA. WTFRC 2016.

Chemical name	Trade name	Application rate	Application timing(s)	Control fruit	OHC fruit	Raynox treated fruit	Eclipse treated fruit	US MRL[1]	Lowest export MRL[1]
		oz per acre	*dbh*	*ppm*	*ppm*	*ppm*	*ppm*	*ppm*	*ppm*
Hexythiazox	Onager	24	28	0.089	0.063	0.077	0.059	0.4	0.4 (many)
Pyridaben	Nexter	10.67	28	0.038	0.035	0.040	0.037	0.5	0.5 (many)
Flutriafol	Topguard	12	28 & 14	0.13	0.059	0.096	0.095	0.4	0.2 (Hong Kong)
Fenpropathrin	Danitol	21.3	28 & 14	**0.54**	0.39	**0.51**	0.38	5	0.5 (Taiwan)
Novaluron	Rimon	50	28 & 14	0.63	0.47	0.54	0.52	3	2 (CAN,TAI)
Difenoconazole	Inspire Super	12	21 & 14	**0.05**	**0.026**	**0.037**	**0.042**	5	0.01 (India)
Cyprodinil	Inspire Super	12	21 & 14	**0.083**	**0.059**	**0.062**	**0.061**	1.7	0.05 (VN, INDO)
Emamectin benzoate	Proclaim	4.8	21 & 14	< 0.01	< 0.01	< 0.01	< 0.01	0.025	0.02 (many)
Myclobutanil	Rally 40WSP	10	21 & 14	0.14	0.075	0.12	0.16	0.5	0.5 (many)
Spirotetramat	Ultor	14	21 & 7	0.100	0.047	0.076	0.087	0.7	0.7 (many)
Cyflumetofen	Nealta	13.7	21 & 7	0.079	0.054	0.068	0.055	0.3	0.3 (CAN,MEX)
Spinosad	Entrust	3	21 & 7	0.075	0.062	0.065	0.061	0.2	0.1 (many)
Etoxazole	Zeal	3	14	0.059	0.039	0.041	0.052	0.2	0.07 (many)
Ziram*	Ziram 76DF	128	14	2.4	0.85	1.5	1.5	7	2.5 (Taiwan)
Metrafenone	Vivando	15.4	14 & 7	< 0.01	< 0.01	< 0.01	< 0.01	1.5	0.01 (EU, UAE)
Spinetoram	Delegate WG	7	14 & 7	0.043	0.023	0.034	0.025	0.2	0.05 (many)
Cyantraniliprole	Exirel	20.5	14 & 5	0.60	0.34	0.55	0.49	1.5	0.8 (many)
Spirodiclofen	Envidor 2SC	18	7	0.19	0.16	0.18	0.15	0.8	0.8 (many)
Bifenazate	Acramite	16	7	0.065	0.036	0.038	0.040	0.7	0.2 (China)
Thiophanate-methyl**	Topsin 4.5FL	20	7 & 1	0.83	0.45	0.83	0.65	2	3 (many)
Pyraclostrobin	Merivon	5.5	7 & 1	0.18	0.14	0.18	0.15	1.5	0.5 (many)
Fluxapyroxad	Merivon	5.5	7 & 1	0.24	0.16	0.22	0.20	0.8	0.8 (CAN,MEX)

[1] Top markets for WA apples with established MRLs; 15 Sep 2016. http://www.nwhort.org/AppleMRLs.html, https://www.globalmrl.com/

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CONCLUSIONS

As we have seen consistently throughout these studies, pesticide residues from all treatments were safely below the maximum tolerances set by the US Evironmental Protection Agency for domestic apples. Our results suggest that growers hoping to export their apples to India, Vietnam, or Indonesia should avoid use of Inspire Super because those markets set such conservative standards for residues of cyprodinil and/or difenoconazole. Further, aggressive use of Danitol could be problematic for apples being shipped to Taiwan. After three years of comparing overhead cooling, Raynox, and Eclipse, the effects of these sunburn management strategies on pesticide residues remain unclear; while overhead cooling sometimes reduces the persistence of some chemical residues, our results have been far too inconsistent to draw any broad conclusions. Reports from previous pesticide residue studies on apple and cherry which provide a broader context for these results are available on the WTFRC website at www.treefruitresearch.com. For more resources on MRLs, visit the Northwest Horticultural Council website, www.nwhort.org.

WASHINGTON TREE FRUIT RESEARCH COMMISSION

For more information, contact Tory Schmidt (509) 669-3903 or email tory@treefruitresearch.com