2014 WTFRC APPLE PESTICIDE RESIDUE STUDY

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

For the fourth consecutive year, the Washington Tree Fruit Research Commission (WTFRC) conducted a trial to evaluate pesticide residues on 'Gala' apples. Sixteen insecticide/acaricides and ten 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. 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. Fruit samples were delivered the day after harvest to Pacific Agricultural Labs (Portland, OR) for chemical analysis.

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 dbh. 'Gala'/M.9 Nic.29, Rock Island, WA. WTFRC 2014.

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*
Penthiopyrad	Fontelis	20	35	0.016	0.017	0.012	0.5	0.5 (many)
Endosulfan*	Thionex 50W	64	35	<0.01	<0.01	<0.01	1	0.05 (UAE)
Methoxyfenozide	Intrepid	16	35	<0.01	<0.01	<0.01	2	1.5 (CAN,TAI)
Acetamiprid	Assail 70WP	3.4	35	0.027	0.025	0.021	1	0.8 (many)
Flubendiamide	Tourismo	16	35	<0.02	<0.02	<0.02	1.5	0.8 (many)
Buprofezin	Tourismo	16	35	<0.01	<0.01	<0.01	3	1 (TAI)
Chlorantraniliprole	Altacor	4.5	35	0.026	0.023	0.022	1.2	0.4 (many)
Diazinon	Diazinon 50W	64	35	<0.01	<0.01	<0.01	0.5	0.3 (many)
Imidacloprid	Nuprid 2SC	6	35	<0.01	<0.01	<0.01	0.5	0.5 (many)
Triflumizole	Procure 480SC	14	35	<0.01	<0.01	<0.01	0.5	0.5 (many)
Spirotetramat	Ultor	14	35	0.013	0.012	<0.01	0.7	0.7 (many)
Fluopyram	Luna Sensation	5.5	35	<0.01	<0.01	<0.01	0.3	0.3 (CAN,MEX)
Trifloxylstrobin	Luna Sensation	5.5	35	<0.01	<0.01	<0.01	0.5	0.5 (CAN,MEX)
Etoxazole	Zeal	2	35	<0.01	<0.01	<0.01	0.2	0.07 (many)
Spirodiclofen	Envidor 2SC	18	35	0.023	0.02	0.018	0.8	0.8 (many)
Myclobutanil	Rally 40WSP	10	35	0.015	0.015	0.013	0.5	0.5 (many)
Emamectin benzoate	Proclaim	4.8	35	<0.01	<0.01	<0.01	0.025	0.02 (many)
Spinetoram	Delegate WG	7	35 & 21	<0.01	<0.01	<0.01	0.2	0.05 (many)
Difenoconazole	Inspire Super	12	28	<0.01	**0.01**	<0.01	1	0.01 (India)
Cyprodinil	Inspire Super	12	28	0.015	0.016	0.021	1.7	0.05 (many)
Flutriafol	Topguard	10	28	0.021	0.023	0.019	0.4	0.2 (Hong Kong)
Bifenazate	Acramite	16	28	0.013	0.014	0.028	0.7	0.2 (China)
Lambda-cyhalothrin	Warrior II	2.56	28	<0.05	<0.05	<0.05	0.3	0.2 (many)
Hexythiazox	Onager	20	28	0.021	0.023	0.026	0.4	0.4 (many)
Pyridaben	Nexter	6.6	28	<0.01	0.01	0.017	0.5	0.5 (many)
Ziram**	Ziram 76DF	96	21	0.52	0.72	0.54	7	3 (India)
Fenpropathrin	Danitol	18	14	0.051	0.047	0.05	5	0.5 (TAI)
Thiophanate-methyl***	Topsin 4.5FL	16	14	0.06	0.052	0.05	2	3 (many)
Pyraclostrobin	Pristine	14	14	0.019	0.023	0.017	1.5	0.5 (many)
Boscalid	Pristine	14	14	0.063	0.059	0.051	3	2 (many)

[1] Top markets for WA apples; 22 Sep 2014. http://www.nwhort.org/AppleMRLs.html

* Endosulfan values reported are sum totals of Endosulfan I, Endosulfan II, and Endosulfan sulfate residues

** 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 with their university extension staff, crop advisors, and warehouses to develop responsible pest control programs.

TRIAL DETAILS

- 7th 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
- Nearly 1" rain recorded during trial, including 0.52" on August 14 (6 days before harvest)
- Overhead cooling settings: 15 min. on/15 min. off from noon to 6PM from start of trial (July 16) to harvest (Aug 20) at a rate of 0.11"/hour for an approx. total of 11.2" 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 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 2014.

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*
Penthiopyrad	Fontelis	20	35 & 28	0.032	0.034	0.02	0.5	0.5 (many)
Endosulfan*	Thionex 50W	64	35 & 21	<0.01	<0.01	<0.01	1	0.05 (UAE)
Diazinon	Diazinon 50W	64	35 & 21	0.072	0.051	0.043	0.5	0.3 (many)
Hexythiazox	Onager	24	28	0.028	0.024	0.024	0.4	0.4 (many)
Pyridaben	Nexter	10.67	28	0.044	0.029	0.014	0.5	0.5 (many)
Lambda-cyhalothrin	Warrior II	2.56	28 & 21	<0.05	<0.05	<0.05	0.3	0.2 (many)
Methoxyfenozide	Intrepid	16	28 & 14	<0.01	<0.01	<0.01	2	1.5 (CAN,TAI)
Flutriafol	Topguard	12	28 & 14	0.053	0.05	0.044	0.4	0.2 (Hong Kong)
Fenpropathrin	Danitol	21.3	28 & 14	0.16	0.13	0.14	5	0.5 (TAI)
Triflumizole	Procure 480SC	16	21 & 14	<0.01	<0.01	<0.01	0.5	0.5 (many)
Difenoconazole	Inspire Super	12	21 & 14	**0.024**	**0.02**	**0.02**	1	0.01 (India)
Cyprodinil	Inspire Super	12	21 & 14	0.043	0.036	0.029	1.7	0.05 (many)
Flubendiamide	Tourismo	17	21 & 14	0.047	0.042	0.05	1.5	0.8 (many)
Buprofezin	Tourismo	17	21 & 14	0.027	0.24	0.022	3	1 (TAI)
Fluopyram	Luna Sensation	5.8	21 & 14	<0.01	<0.01	<0.01	0.3	0.3 (CAN,MEX)
Trifloxylstrobin	Luna Sensation	5.8	21 & 14	<0.01	<0.01	<0.01	0.5	0.5 (CAN, MEX)
Emamectin benzoate	Proclaim	4.8	21 & 14	<0.01	<0.01	<0.01	0.025	0.02 (many)
Myclobutanil	Rally 40WSP	10	21 & 14	0.036	0.033	0.031	0.5	0.5 (many)
Acetamiprid	Assail 70WP	3.4	21 & 7	0.036	0.04	0.032	1	0.8 (many)
Spirotetramat	Ultor	14	21 & 7	0.018	0.02	0.014	0.7	0.7 (many)
Imidacloprid	Nuprid 2SC	6.4	21 & 7	<0.01	<0.01	<0.01	0.5	0.5 (many)
Etoxazole	Zeal	3	14	0.026	0.025	0.03	0.2	0.07 (many)
Ziram**	Ziram 76DF	128	14	0.7	0.98	1.25	7	3 (India)
Spinetoram	Delegate WG	7	14 & 7	<0.01	<0.01	<0.01	0.2	0.05 (many)
Chlorantraniliprole	Altacor	4.5	14 & 5	0.033	0.032	0.032	1.2	0.4 (many)
Spirodiclofen	Envidor 2SC	18	7	0.024	0.017	0.02	0.8	0.8 (many)
Bifenazate	Acramite	16	7	<0.01	<0.01	<0.01	0.7	0.2 (China)
Thiophanate-methyl***	Topsin 4.5FL	20	7 & 1	0.212	0.154	0.177	2	3 (many)
Pyraclostrobin	Pristine	18.5	7 & 1	0.061	0.052	0.053	1.5	0.5 (many)
Boscalid	Pristine	18.5	7 & 1	0.14	0.13	0.13	3	2 (many)

[1] Top markets for WA apples; 22 Sep 2014. http://www.nwhort.org/AppleMRLs.html

* Endosulfan values reported are sum totals of Endosulfan I, Endosulfan II, and Endosulfan sulfate residues

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CONCLUSIONS

Across all treatment combinations, residues for all pesticides tested were well below US tolerance levels, and only residues of **difenconazole** exceeded an important export market MRL. This low incidence of potentially problematic residues is likely due to: 1. Generally lower residue levels than previous years, perhaps due to relatively greater environmental degradation from wind and light in 2014, 2. Recent relaxation of MRLs in some foreign markets, and 3. The exclusion of European Union MRLs from this report due to the diminishing relevance of that market for Washington apples. Residue levels were generally comparable between fruit treated with Raynox, Eclipse, or overhead cooling. 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.

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

WASHINGTON TREE FRUIT RESEARCH COMMISSION