WTFRC APPLE PESTICIDE RESIDUE STUDIES 2011-2017

Since 2011, the Washington Tree Fruit Research Commission has conducted annual field studies to evaluate the harvest residues of numerous insecticides, acaricides, and fungicides commonly used in commercial apple production in WA. In an effort to provide a comprehensive overview of all measured residues, the table below summarizes all results regardless of application rates and timings or supplemental treatments such as overhead cooling, application of sunburn protectants, or simulated packing line washing, scrubbing, and waxing of fruit; values in **bold red font** highlight those residue levels which **exceed current maximum residue levels** (MRLs) in some key export markets. For more details regarding application protocols or results from specific years, please review annual reports of these studies at www.treefruitresearch.com. For more information on MRLs or other regulatory issues, please consult the Northwest Horticultural Council at www.nwhort.org.

STUDY DETAILS

- All trials conducted on 'Pacific' Gala / M.9 Nic.29 trained to central leader/spindle on 3' x 10' spacing
- All applications made with 2 x 25 gal Rears Pak-Blast sprayer calibrated to 100 gal / acre
- All pesticides applied with 8 oz Regulaid / 100 gal water / acre
- Spray protocols each year included both standard (applications made at typical commercial rates and timings) and aggressive (applications made at maximum rates and minimum retreatment and pre-harvest intervals) pesticide programs
- Additional treatments in some years included: application in dilute (200 gal water/acre) vs. concentrated (100 gal water/acre) sprays, application of sunburn suppressants (Raynox or Eclipse), standard overhead cooling practices totaling 11" water applied throughout the trial, and simulated packing line rinsing, washing, scrubbing, and waxing of fruit

MAJOR FINDINGS

- Residues measured for all treatments in all years complied with domestic tolerances set by US EPA
- Most findings in which residues exceeded foreign MRLs occurred in markets which set their tolerances at the limit of quantitation (LOQ), the smallest amount which standard laboratory instruments can accurately measure
- Many residues reported as potentially problematic in earlier reports would now be considered acceptable due to the relaxation of some MRLs in some markets as well as the exclusion of EU standards from this report due to the diminishing relevance of the European market for Washington apples
- Increased residue levels were consistently observed with higher application rates and shorter pre-harvest intervals
- While summer application of carbaryl (i.e. in typical programs against leafhopper) produced residues which could be problematic in many foreign markets, no traces of carbaryl were detected when used only as a chemical thinner at petal fall and 10mm fruitlet size
- Residues of some pesticides were decreased on fruit which received a simulated packing treatment, but results were too inconsistent and unpredictable to consider it a reliable method for reducing residue levels
- Standard sunburn protection programs with Raynox or Eclipse did not significantly affect measured pesticide residues
- Routine application of overhead cooling did not significantly impact pesticide residue levels
- Initial results in 2017 suggest that applications in 100 gal/acre produce higher residues than the same amount/acre of pesticide applied in 200 gal water; these results need to be corroborated by further study, but suggest "rinsing" of fruit with excessive water at 200 gal/acre

Minimum, maximum, and median residues vs. MRLs of pesticides applied to 'Gala'/M.9 Nic. 29 apples near Rock Island, WA. WTFRC 2011-2017.

Chemical name	Trade name	# of years evaluated	# of samples analyzed	Minimum residue	Maximum residue	Median residue	US MRL[1]	Lowest export MRL[1]
				ppm	*ppm*	*ppm*	*ppm*	*ppm*
Acetamiprid	Assail 70WP	4	32	<0.01	0.16	0.030	1	0.8 (many)
Bifenazate	Acramite	5	60	<0.01	**2.8**	0.025	0.7	0.2 (China)
Boscalid	Pristine	4	32	0.049	0.86	0.130	3	2 (many)
Buprofezin	Tourismo	4	42	<0.01	0.24	0.022	3	1 (Taiwan)
Captan	Captec 4L	2	8	0.15	1.1	0.555	25	5 (Canada)
Carbaryl (summer)	Carbaryl 4L	1	4	**0.62**	**3.10**	**1.355**	12	0.01 (SAU,UAE)
Carbaryl (thinning)	Carbaryl 4L	2	16	<0.01	<0.01	<0.01	12	0.01 (SAU,UAE)
Chlorantraniliprole	Altacor	4	32	<0.01	0.18	0.031	1.2	0.4 (many)
Cyantraniliprole	Exirel	3	36	0.021	0.6	0.051	1.5	0.8 (many)
Cyflumetofen	Nealta	3	36	<0.01	0.079	0.023	0.3	0.3 (Canada)
Cyprodinil	Inspire Super	7	68	<0.01	**0.15**	0.030	1.7	0.05 (IDN)
Diazinon	Diazinon 50W	4	32	<0.01	0.12	0.033	0.5	0.3 (many)
Difenoconazole	Inspire Super	7	68	<0.01	0.081	0.014	5	0.5 (China)
Emamectin benzoate	Proclaim	3	40	<0.01	<0.01	<0.01	0.025	0.02 (many)
Endosulfan*	Thionex 50W	4	32	<0.01	0.99	<0.01	na	na
Etoxazole	Zeal	5	60	<0.01	0.059	0.014	0.2	0.07 (many)
Fenpropathrin	Danitol	7	68	<0.01	**0.54**	**0.135**	5	0.01 (SAU,UAE)
Flubendiamide	Tourismo	4	42	<0.01	0.31	0.040	1.5	0.8 (many)
Fluopyram	Luna Sensation	3	38	<0.01	0.083	<0.01	0.8	0.5 (many)
Flutriafol	Topguard	6	64	<0.01	0.13	0.028	0.4	0.2 (Hong Kong)
Fluxapyroxad	Merivon	3	36	0.01	**0.24**	0.040	0.8	0.05 (India)
Formetanate	Carzol SP	1	4	<0.01	<0.01	<0.01	na	na
Hexythiazox	Onager	3	40	0.012	0.089	0.022	0.4	0.4 (many)
Imidacloprid	Nuprid 2SC	4	32	<0.01	0.053	<0.01	0.5	0.5 (many)
Lambda-cyhalothrin	Warrior II	4	42	<0.01	<0.01	<0.01	0.3	0.2 (many)
Methoxyfenozide	Intrepid	4	32	<0.01	0.21	0.030	2	1.5 (CAN,TAI)
Metrafenone	Vivando	2	28	<0.01	<0.01	<0.01	1.5	0.01 (EU)
Myclobutanil	Rally 40WSP	3	40	<0.01	**0.16**	**0.029**	0.5	0.01 (India)
Novaluron	Rimon	2	22	0.09	0.63	0.380	3	2 (CAN,TAI)
Penthiopyrad	Fontelis	3	38	<0.01	0.034	0.015	0.5	0.4 (many)
Pyraclostrobin	Pristine	7	68	<0.01	0.45	0.043	1.5	0.5 (many)
Pyridaben	Nexter	3	40	<0.01	0.044	0.029	0.75	0.5 (many)
Spinetoram	Delegate WG	5	46	<0.01	0.045	<0.01	0.2	0.05 (many)
Spinosad	Entrust	3	36	<0.01	0.075	0.028	0.2	0.1 (many)
Spirodiclofen	Envidor 2SC	4	52	<0.01	0.35	0.042	0.8	0.5 (China)
Spirotetramat	Ultor	4	52	<0.01	0.19	0.020	0.7	0.7 (many)
Thiophanate-methyl**	Topsin 4.5FL	7	68	<0.01	2.86	0.100	2	3 (many)
Trifloxylstrobin	Luna Sensation	5	46	<0.01	0.033	<0.01	0.5	0.5 (Canada)
Triflumizole	Procure 480SC	5	46	<0.01	0.049	<0.01	0.5	0.5 (many)
Ziram***	Ziram 76DF	7	68	<0.01	**7.4**	0.540	7	2.5 (Taiwan)

[1] Top markets for WA apples; 7 March 2018. http://www.nwhort.org/AppleMRLs.html, https://globalmrl.com

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

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

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

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Results of these unreplicated trials are shared for informational purposes only and should not be construed as endorsements of any product, reflections of their efficacy against 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.