

Prochloraz residue removal protocol

Conducted and compiled by: Karlien Muller (Auxano IPM Consulting)

Background motivation

Prochloraz has been used as one of the main post-harvest fungicides in subtropical crops for the control of anthracnose, stem-end rot and *dothiorella/ Colletotrichum* complex in avocado as well as suppression of soft brown rot in mango. The current allowable level is 7.0 ppm for EU export for avocado (Subtrop, PPPL 2023).

Due to recent changes in the residue tolerances of prochloraz in Europe for both Avocado and mango (LOD at 0.03 ppm) implemented from September 2024 onwards, it is crucial to eliminate all residues from packing lines to prevent detection of the active for fruit arriving in the EU after the deadline date. Any fruit with a level of detection of above 0.03 ppm to be rejected leading to major financial implications to the industry (Subtrop presentations, 2024).

According to the MSDS sheet and additional technical information from manufacturers, **the prochloraz molecule is unstable at a pH of 4.0**, hence an **acid wash** is proposed. Care should be to ensure **only plastic and stainless-steel surfaces are washed/wiped with acid to avoid rust reactions**. It is essential that a follow up wash with the ICA product “Skimmer Plus” (formulated to encapsulate and remove residues from surfaces). However thorough washing and scrubbing is required to enable the product to encapsulate residues (ICA citrus postharvest magazine, 2024). A final wash with clean water directly after the acid and skimmer plus (NB not to allow product to dry on the line) to remove residues.

Preliminary results:

Maximum residue level to be **0.03 mg/kg on fruit** – please note that the below results are in **mg/ 5cm² detected from swabs which is much more sensitive to residues**. Further tests to be conducted to determine residue levels on fruit prior to washing – and fruit samples sent over the packing line after washing process, to correlate swab levels to fruit analysis (In process).

Table 1 Initial residue on swabs prior to washing process (pre acid), after acid washing process and after skimmer plus wash and rinse

Packhouse	Location	Result		
		Pre acid (mg)	Post acid (mg)	Post skimmer (mg)
The Fruit Farm Group – Mopani Packers	Fungicide tank	>10	0.0005	0.00024
	Rollers in fungicide app	0.0029	0.0018	0.00012
	Brushes after fungicide app	>10	0.0014	0.0019
	Sorting rollers after fungicide app	0.004	NA	0.000009
	Feeding lines	0.0009	0.0002	0.00028
	Weighingcups/rollers	0.0016	0.001	0.00065
	Final packing belts	0.0004	0.0002	0.0000054

- **Brushes after fungicide application** – brushes are more difficult to wash and penetrate with skimmer plus.
- All brush hairs are not connected to stainless steel roller hence **NB to make sure from your pack line supplier** which surfaces are stainless steel and not.
- **If all components are made from stainless steel** – soak brushes for 15min in pH 4 water.

Use high pressure spray to rinse brushes. Alternatively: Soak brushes in skimmer plus water for an hour – (in big bins or bath) and wash off with high pressure spray (clean water) and dry brushes in sun for a few days (UV breaks down chemical residue). Residues take a drastic reduction but may increase where not properly rinsed with clean water. • Sorting rollers after fungicide application – made from aluminum hence no acid wash and result = NA.

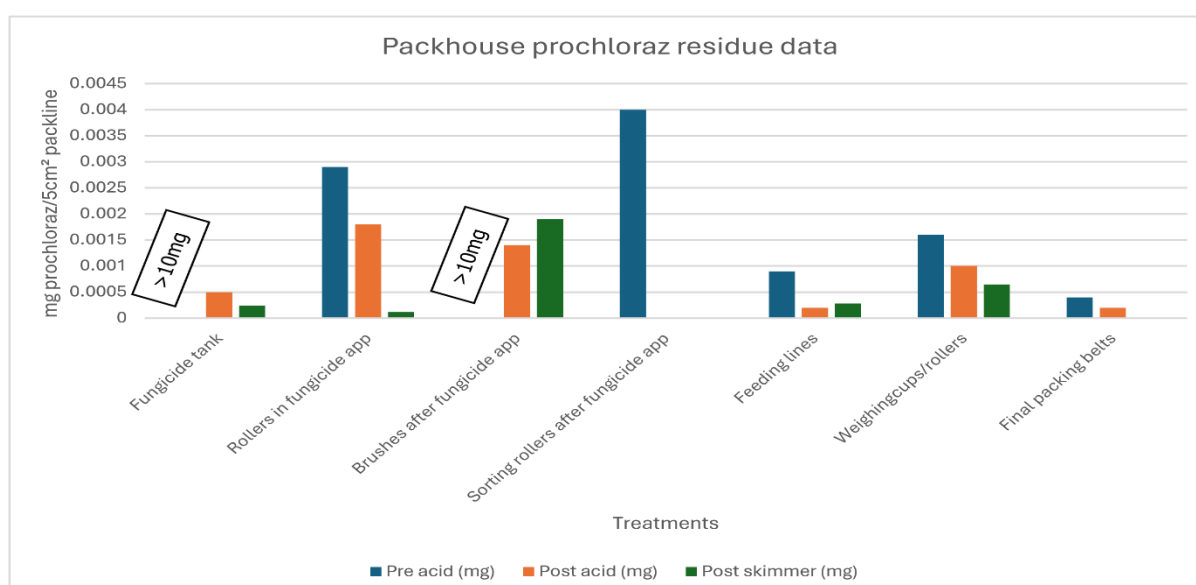


Figure 1. Results from table, summarized in graph format. Note: initial result (>10mg) from fungicide tank and brushes not indicated on graph as the value difference is too great to optimally represent results. All residues are below the allowable 0.03mg residue – BUT: This is per swab and per 5cm².

Procedure:

Acid wash:(NB!!!! ONLY PLASTIC AND STAINLESS-STEEL SURFACES AND COMPONENTS as it will induce rusting process on other materials such as aluminum and iron!!)

1. Ensure people wear PPE – rubber gloves and respiration mask
2. Use/spray anti rust products on bolts and nuts/chains etc close to surfaces being washed with acid to reduce the risk of rusting.
3. Use clean 20L paint buckets or similar containers, fill with 15L of water
4. Initial wash (to remove dust/wax/soap/etc) on pack line – wash with normal soap and water – this allows acid wash water and skimmer plus water to stay cleaner for longer and lower change rate of washing water.
5. Use a calibrated pH meter (pH strips not as accurate)
6. Add small volume of HCL/ pool acid to water (+- 2ml to 3ml acid per 15L water will give a water pH of between 3.0 and 4.0. Do not go below pH 2.0) Use a syringe to draw up 2ml.
7. Test to ensure that pH is optimal!!
8. If fungicide tank and fungicide rollers are stainless steel – remove from pack line and use soft brushes to scrub and wash with acid water, and rinse with clean water immediately after acid wash (without letting the surface dry, as this allows residues to stick onto surface area). Rollers needs to be removed and washed separately so that acid wash do not get into contact with bolts and nuts or chains etc. made from other materials.
9. Wet the new cloths in the acid water, remove excess water and wash/wipe plastic belts or surfaces.
10. Immediately after acid wash, follow up with a **NEW** cloth dipped in clean water and rinse section washed before it dries off.
11. Use one set of cloths for fungicide tank and rollers – having high concentrations of prochloraz. (The active sticks to the cloth and deposit to other surfaces). **OR** start from least levels of possible active (final packing belts) and wash backwards to end at fungicide tank.

Skimmer plus wash:

1. Mix a 20% skimmer plus solution in 20L buckets
2. Use **brushes and sponges to scrub all surfaces** of the pack line – from final packing belts to fungicide tank – (low concentration of residues to higher concentration residues) (better to remove rollers/cups/donuts etc).
3. Pressure and proper scrubbing are NB for the efficacy of this product as it encapsulates the remaining residues on the line.
4. Immediately after the skimmer plus wash (while the surface is still wet) rinse with clean water so that encapsulated residues are removed from the pack line and do not dry on the surface.
5. **All surfaces can be washed** – give special attention to aluminum and other surfaces not washed with acid as these surface prochloraz levels will still be present at higher concentrations.
6. Change skimmer plus water regularly.

If you want to determine the levels of residue still present on selected areas of the pack line: swab by using the following protocol.

1. Use normal cotton earbuds.
2. Use 3 earbuds per section, dip the cotton ends in a 20% skimmer plus solution
3. Swab on a +- 5cm surface area with both sides of the cotton earbud on the sections from chemical application point onwards
4. Mark clearly the location of the swab for reference
5. Place in small zip lock bag (each area separate zip lock bag)
6. Mark to test for postharvest chemicals – prochloraz and send to **HORTEC** (as they are familiar with the protocol)

Proposed areas to swab:

- a. Fungicide tank
- b. Rollers in fungicide application tunnel
- c. Brushes after fungicide application
- d. Donuts after fungicide application

- e. Belts after fungicide application
- f. Feeding lines
- g. Feeding brushes
- h. Weighing cups/rollers
- i. Final packing belts/ packing bins

NB Employees to wear PPE (arm length rubber gloves, eye protection and face mask/respirator during acid wash) Please note that following this protocol is a guideline and a document pointing out the risks and reasoning behind the protocol. It is the responsibility of every pack house to ensure they optimize their risk management and results. SAAGA or Auxano IPM Consulting will not be held responsible or liable for any damages or lack of results from following this protocol.***

Any questions/guidance in the process contact:

Auxano IPM Consulting

Karlien Muller: 084 626 0540

muller.karlien@gmail.com