Impact of Agrochemical Spray Formulation Type on the Epidermal Integrity of Table Grapes: Microcracking and Russeting

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The Hidden Cost of Crop Protection

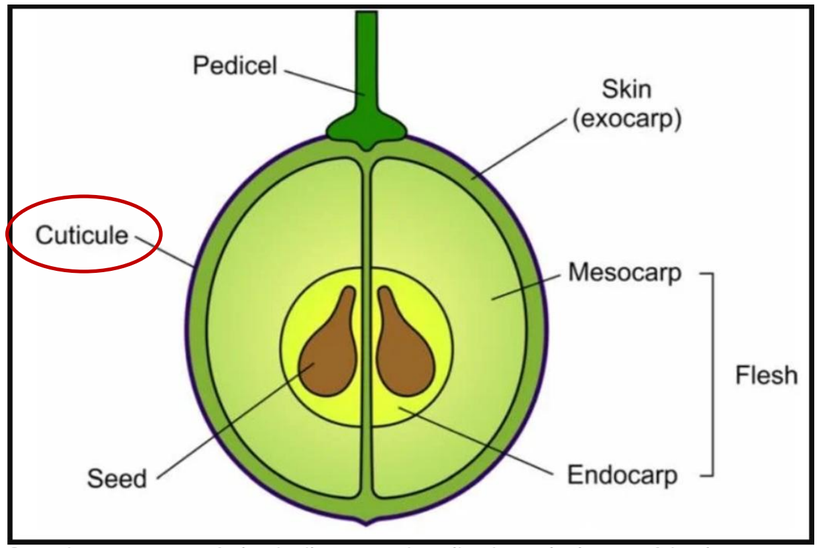
Growers spray vineyards to protect grapes from disease and pests

Grape berry:

outer skin = cuticle
barrier against fungal infection and water loss

Barrier breaks down:

russetting,
microcracks
increased disease susceptibility



Grape berry structure. A simple diagram to describe the main tissues of the ripe grapevine berry. Diagram from (Conde et al., 2007).

Problem:

Growers focus on whether the active ingredient in their fungicide works
They ignore or are not fully informed about what the formulation vehicle does to the fruit

Formulation:

liquid carrier that delivers the active ingredient
harsh or gentle

This research reveals a **critical oversight in spray management**

Why Formulation Matters More Than You Think

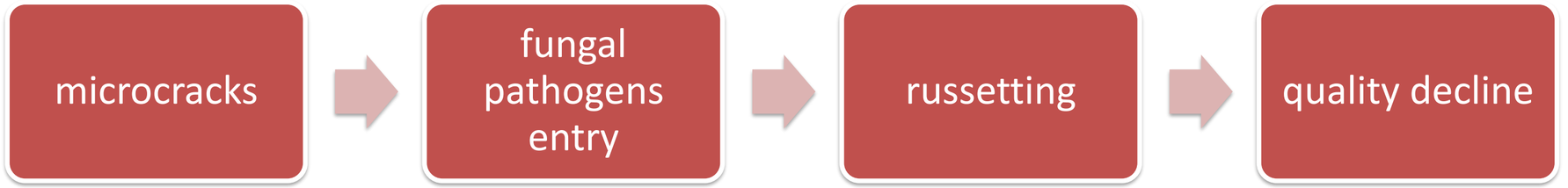
The active molecules in modern fungicides and insecticides are structurally neutral to the grape cuticle

They don’t intend to damage the skin. But the formulation vehicle is different

Emulsifiable Concentrate formulations, or **EC formulations**:

harsh organic solvents

strip the epicuticular **waxes** from the berry skin



Applying EC formulations during critical growth stages, namely bloom, pea size, and veraison, the berry skin is developing and most vulnerable

What the Field Trial Revealed

- One full production season tested
- Three distinct South African grape regions:
  - Bergriver Valley
  - Hex River Valley
  - Northern Cape
- Single red seedless cultivar (eliminate genetic variables)
- Three spray programs compared

What the Field Trial Revealed

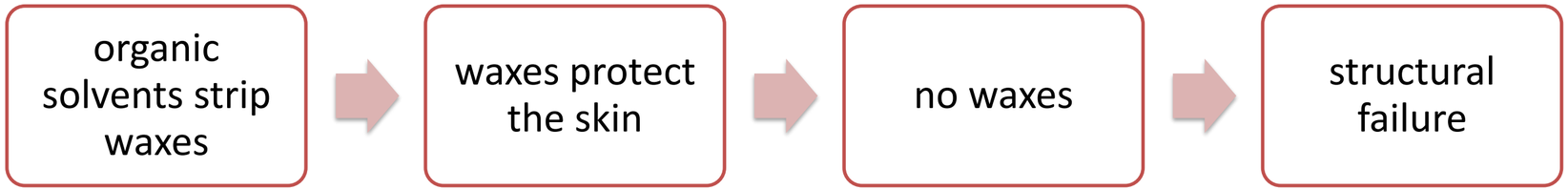
Key difference:

One program used EC formulations exclusively during critical developmental stages

The other programs used alternative formulations

One program applied EC formulations at bloom, pea size, and veraison and saw significantly higher incidence of epicuticular microcracking and russetting

The mechanism is straightforward:



The data proves what science already tells us:

Formulation vehicle matters as much as active ingredient

How to Protect Your Fruit and Your Profits

Switch formulations at critical times

Here's what to revise immediately:

- Audit your current spray program and identify which products use EC formulations
- Focus your changes on the three critical growth stages
- Lower microcracking reduces post-harvest decay and extends shelf life
- Keep more fruit marketable longer

The math is simple:

Spend slightly more on formulation, earn significantly more on fruit quality

Next Steps and Future Directions

This research is compelling but incomplete, a second production season is essential before drawing final conclusions

The results apply specifically to red seedless cultivars. Other cultivars may respond differently.

Here's how to move **forward**:

- Apply this formulation principle to your own vineyards in the next season.
- Document russetting and microcracking incidence in treated blocks.
- Compare results to your historical quality data.
- Track packhouse grades and pricing premiums.

Work with your agrochemical supplier to confirm formulation types in your current products.

The research direction is clear:

Formulation vehicle influences fruit quality as much as the active ingredient

TopFruit

Thank you

