

# Frequently asked questions- copper

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Frequently asked questions:

## 1. Does copper accumulate in soil?

The question of copper accumulation in soil is complex. Copper is present in two forms in soil:

- Bound copper - Copper ions tightly bind to organic matter and are not available to either plants or microorganisms
- Bioavailable copper – Copper ions are available for uptake by microorganisms and plants and can be toxic in high concentrations.

The bioavailability of copper decreases when copper is tightly bound to soil particles, in particular clay, and organic matter at pH levels greater than 6.0. Conversely, the concentration of bioavailable copper increases in soils with less soil particles, less organic matter and which have lower pH levels (e.g. a sandy, acidic soil). The increased presence of bioavailable copper increases the potential of environmental toxicity.

When copper fungicides are applied, most of the copper accumulates in the top soil layers, as mulch high in organic matter and high soil pH levels promotes the retention of copper (bound copper). There is very little movement of copper (bioavailable copper), either through the soil or by uptake into the plant.

Copper accumulation in New Zealand soils depends on soil type and is therefore **site specific**. Research indicates there is no obvious correlation between the number of copper applications or the amount of copper added and soil copper levels. That is orchards which apply more copper do not necessarily have higher soil copper levels, and vice versa.

## 2. What is the impact of copper fungicide application on human health?

The National Environmental Standard Soil Contaminants for Human Health is non-limited for copper. That is, the amount of copper in our environment is not currently considered to be now or in the future, harmful to human health.

## 3. What is the impact of copper fungicide application on soil health?

Biological activity (e.g. nutrient cycling and microbial functions) is essential for healthy plant function. If the total copper concentration in orchard soil is too high, then adverse effects on productivity may be occurring.

Growers who are concerned about their soil health, are encouraged to assess the health and yield of tree, and consider having the microbial activity of soil tested. The following tests are available:

- Microbial function test -Landcare Research, Palmerston North.

Tests cannot be done on individual soil samples and must be sent in a group of at least ten. The following tests should be requested as an indication of microbial health:

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- Anaerobic mineralisable nitrogen
- Soil basal respiration
- Microbial biomass carbon
- Microbial biomass nitrogen
- Microbe Wise soil test – Linnaeus laboratory, Gisborne

The Microbe Wise test can identify and quantify the biomass of 10 different groups of microbes in a soil. The test uses molecular markers unique to each different species of microbe to accurately measure what and how many microbes there are in the soil.

- Microbial assessment – Soil Foodweb, Waihi

A 'direct count' system of assessing soils biological components. These results can indicate your total levels of bacteria and fungi; the percentage of these organisms that are working and doing the job; the diversity of fungi; nutrient cycling capabilities and fungal-bacterial ratios.

- Hot water extractable carbon test – Hills laboratory, Hamilton

A measure of the more labile soil carbon fraction, which has been shown to be sensitive to subtle changes in soil quality. The test is highly correlated with microbial biomass carbon.

### **4. What is the impact of copper fungicide application on avocado trees?**

There is no information regarding the tolerance of avocado trees to increased copper concentrations in the soil. Studies on other species of trees have shown variation in copper tolerance between species, within species and between levels of maturity.

Growers who are concerned about their tree health are encouraged to test soil and leaf nutrient levels.

### **5. What is the impact of copper fungicide application on the environment and future land use?**

If land development is proposed within an avocado orchard property (e.g. subdivision, soil disturbance or land use change), Council (District or City) may require the proposed activity to be assessed against the provisions of the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NESCS), a consistent set of national planning controls and soil contaminant values.

Soil contaminant standards have been derived for five different land use scenarios:

- rural residential
- residential high density
- residential
- recreational
- commercial

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Soil sampling, analysis and reporting may be required and requested before the development can proceed.

The NESCS is associated with the protection of human health. In relation to human health, the NES soil contaminant standard for copper is non limiting, however, if the level is greatly elevated, environmental concerns may arise. Impacts on ecological receptors are regulated by Regional Councils. As the environmental setting for every orchard is unique, test results exceeding the total copper concentration guideline set by a Regional Council does not necessarily mean remedial work will need to be undertaken (Table 1). Exceedance of the Regional Council copper guideline generally means that a resource consent for discharging contaminants to land and/or water will be required for the piece of land in question. The Regional Council will assess all the relevant information and make a decision on the environmental sensitivity of the land to copper.

All current soil contaminant standards and guidelines are continually reviewed and can change (become more or less stringent) as new science, toxicity or eco-toxicity information becomes available.

Regional Council	Total Soil Copper Guideline Value (ppm)
Bay of Plenty	325
Auckland	325

Table 1. Regional Council total soil copper guideline values as of November 2017.

### 6. What is the impact of copper fungicide application and copper levels in fruit?

Copper is an essential trace element that is vital to the health of all living things (humans, plants, animals, and microorganisms).

Copper fungicides applied to avocados are *protectant* and not systemic. At harvest, the majority of residual active copper on the fruit is removed during the water blasting process and any copper remaining on the skin is not consumed.

### 7. How do I know how much copper is in my soil?

There are two soil tests available for copper:

- Total soil copper – measures accumulated levels of copper and reflects previous copper use history of the site.
- Extractable copper – measures the amount of copper *potentially* available for release to the soil/plant.

Standard soil tests list copper levels as milligrams per kilogram (mg/kg) which is the same as parts per million (ppm).

For interpretation of copper results please refer to '*Interpreting soil tests: Copper (Cu)*'. Avoscene, March 2015, pgs. 34-36.

<https://industry.nzavocado.co.nz/news-events/avoscene/>

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### 8. What do I do if I am concerned about copper accumulation in my soil?

- i) If extractable copper soil analysis levels (Mehlich 3) are in the high range (20-80ppm) then growers are encouraged to undertake a total copper soil test.

NZ Avocado will pay for the total copper soil testing if growers share results for industry wide monitoring.

- ii) NZ Avocado suggests the following monitoring program:

Total copper soil level (ppm)	Monitor
80	5 years
80-190	3 years
190>	Every year

If growers are concerned about total copper levels or total copper accumulation rates in soil, please contact NZ Avocado and we will work through the process with you.