



LESS COPPER - MORE PROTECTION

Grosafe Chemicals has made significant improvements to its copper fungicide formulation including ease of mixing, handling, application and efficacy. Another result of our research and development programme has been a significant reduction in the amount of applied elemental copper required.

Hortcare® Copper Hydroxide reduces the elemental copper applied, without any compromise in disease protection, mixing, handling or spraying benefits.

Hortcare® Copper Hydroxide gives superior protection against Psa in Kiwifruit and a wide range of diseases in many other fruit and vegetables because of its smaller particle size and improved bioavailability.

Benefits of Hortcare® Copper Hydroxide Use

- **Reduced elemental copper application equals better environmental protection**
- **Fewer problems with spraying and handling**
- **Better protection from fungal diseases and bacterial pathogens**
- **Superior rainfastness and persistence due to its fine particle size**

How does Hortcare® Copper Hydroxide Work?

Copper fungicides inhibit fungal spore germination and mycelial growth. The active agents are free copper ions (Cu^{++}) released from the applied copper. Effective disease control should be the main factor when choosing a copper fungicide. A direct measure of a product's effectiveness is the amount of copper ions it produces, not its metallic copper content alone.

The most effective copper compounds for the prevention of plant diseases are the fixed coppers, particularly copper hydroxide, as crystals of these compounds have the largest surface area for the release of copper ions.

These crystals adhere to the leaf surface and act as ion reservoirs, continuously releasing Cu^{++} ions, forming a protective barrier that prevents infection.

There are two broad categories of copper-based products. Those, which are water soluble such as copper sulphate, and those, which are insoluble in water, such the oxychlorides and hydroxides (Hortcare® Copper Hydroxide 300 WDG). Water-soluble formulations are short lived whereas the



insoluble products release active copper ions over a period of time and are comparatively residual in nature.

The most advanced user-friendly formulations are the more concentrated water dispersible granules, which are also referred to as Dry Flowable Formulations. A granule is literally a compressed powder with additives, which ensure effective dispersion. Contact with water in the spray tank reverses the formulation to a powder and the process can be seen on the following illustration:

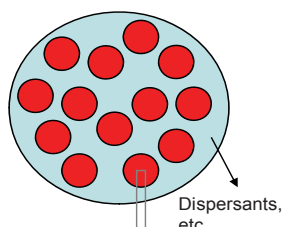
COPPER AVAILABILITY / BIO AVAILABILITY GRANULE ILLUSTRATION

The Starting Point

Granule:

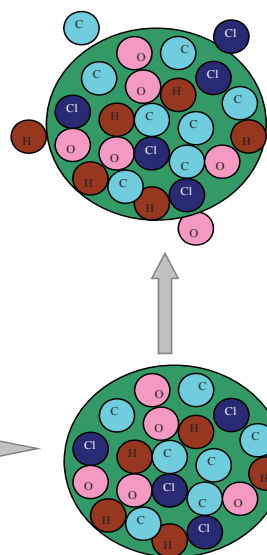
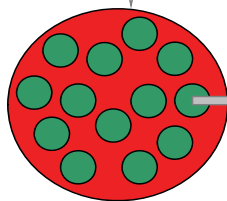
Compressed individual powder particles.

Which disperse on coming into contact with water



Powder Particle:

Comprising molecules of Copper Hydroxide.



Molecule Disintegrating:

(Bioactive)

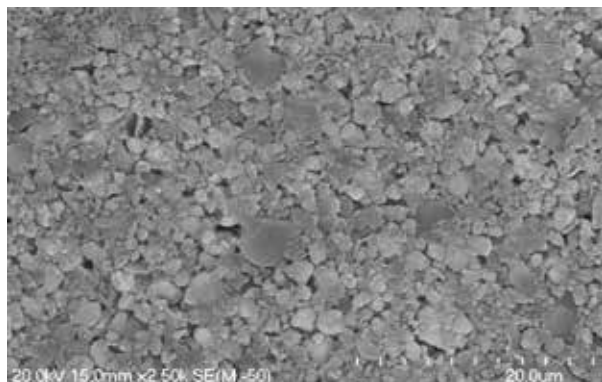
"Active" Copper = copper on the outside of the molecule or atoms of copper breaking free.

Molecule:

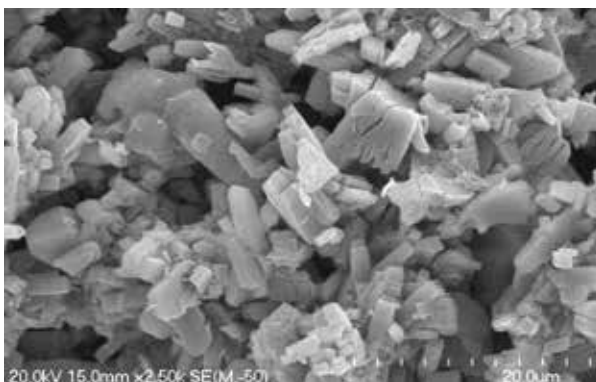
COC
COH

Empirical Formula : $\text{CuO}_6\text{H}_6\text{Cl}_2$
Structural Formula : $3\text{Cu}(\text{OH})_2\text{Cl}_2$
Molecular Mass : 427.12

Hortcare® Copper Hydroxide Crystals compared to other brands



Hortcare® Copper Hydroxide - dried



Other brand Copper Hydroxide - dried

Photos taken by electron microscope under identical test conditions and magnification.

GROSAFE CHEMICALS LTD

20 Jean Batten Drive, Mt Maunganui, 3116
PO Box 14 450, Tauranga 3143, New Zealand

ph: +64 7 572 2662
fax: +64 7 578 6241
freephone: 0800 220002
email: info@grosafe.co.nz
www.grosafe.co.nz

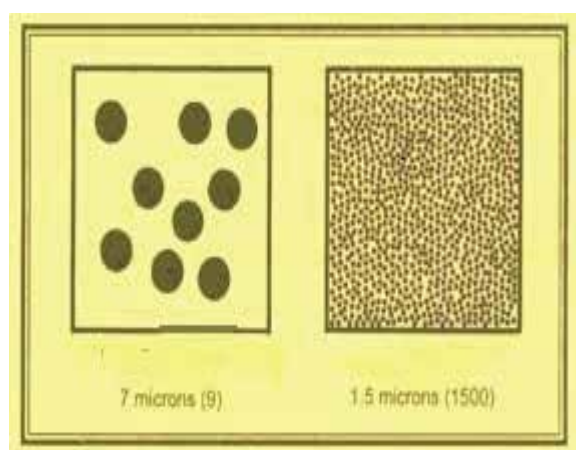




Copper Particle Size Matters

Copper particles of varying size are formed during any copper fungicide manufacturing process; this is problematic as the very large and very small particles are easily dislodged from the leaf. Research conducted by Grosafe Chemicals has shown that copper particles of less than one micron contribute little or no crop protection. **Hortcare® Copper Hydroxide** has a median particle size of 1.711 microns, maximising the amount of fungicide that is retained on the leaf and providing excellent retention after rainfall events.

The smaller the particle size, the better the coverage on the plant surface. This is illustrated by the diagram below:



Hortcare® Copper Hydroxide's average particle size of 1.711 microns has a direct effect on coverage, tenacity of the product and ultimate fungicidal activity and suspension in the spray tank.

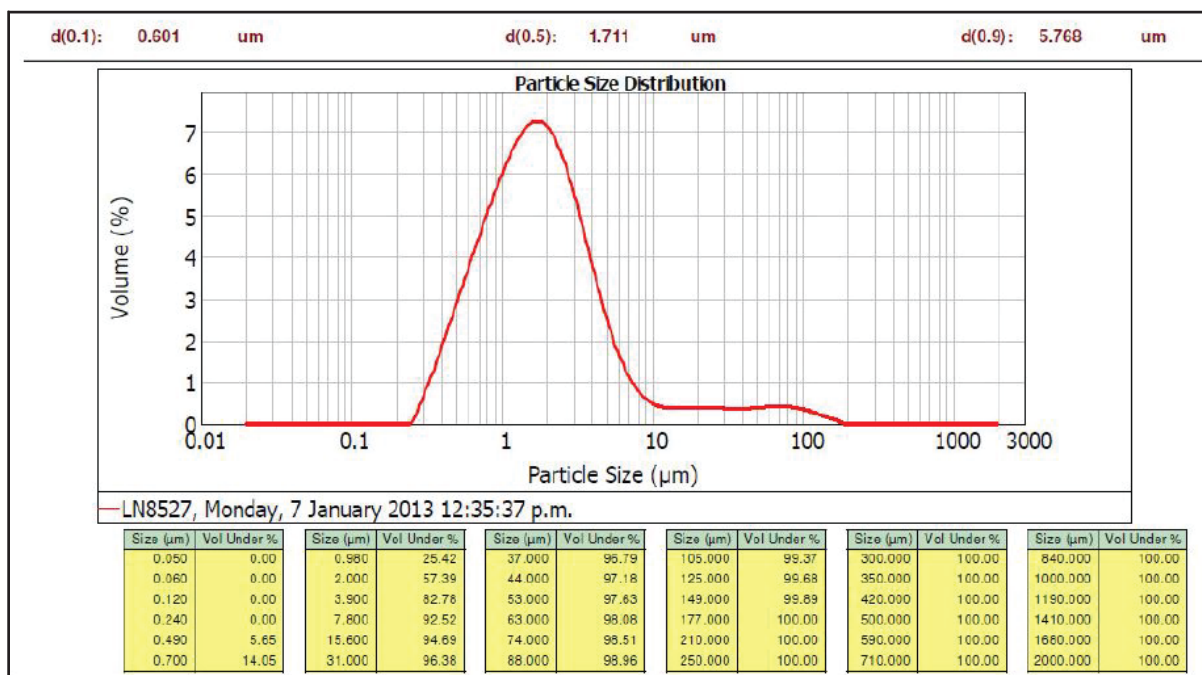
This is **the** single most important factor in terms of fungicidal activity. Formulations containing say 1 micron vs 2 microns, have a coverage factor of 10 times the number of particles and not twice the number of particles as one would first think.

Improved Persistence

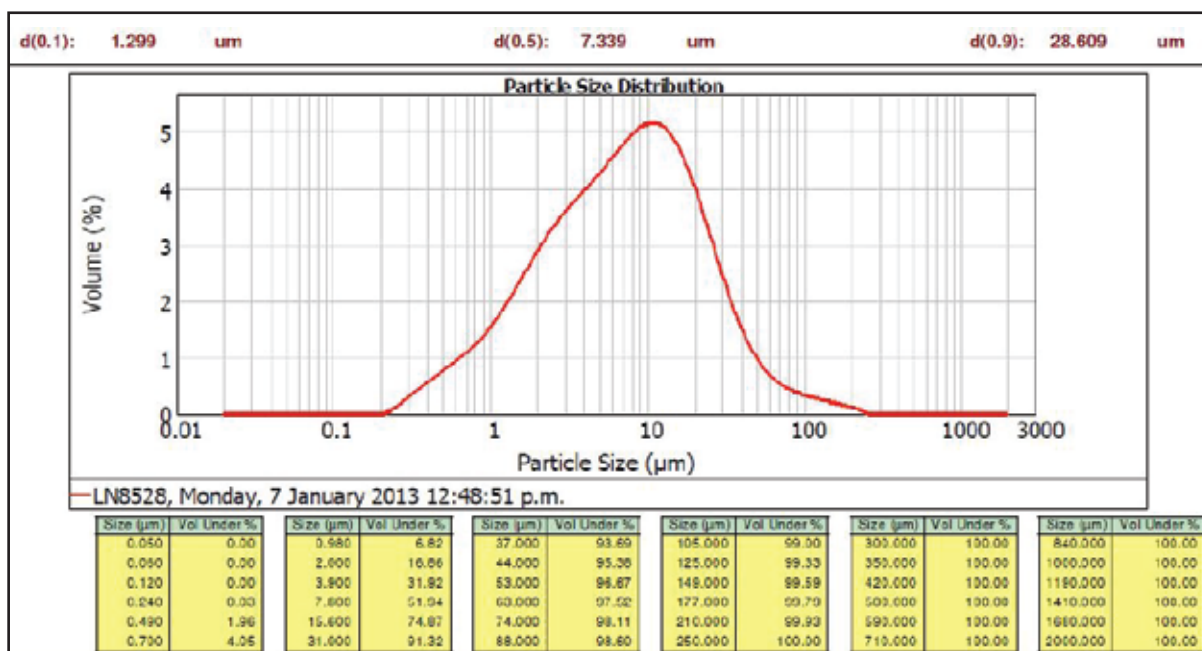
Although **Hortcare® Copper Hydroxide** has a more even particle size, some small copper crystals still inevitably occur. To retain more of these on the leaf surface and thus increase the level of bio-available Cu^{++} ions for disease prevention, Grosafe Chemicals has developed an improved formulation with a smaller micron sized particle. Small particles form copper complexes which are retained on the sprayed surface to provide an added source of copper ions for increased pathogen control.



Hortcare® Copper Hydroxide 300 WDG



Other Comparative Copper Hydroxide



GROSAFE CHEMICALS LTD
20 Jean Batten Drive, Mt Maunganui, 3116
PO Box 14 450, Tauranga 3143, New Zealand

ph: +64 7 572 2662
fax: +64 7 578 6241
freephone: 0800 220002
email: info@grosafe.co.nz
www.grosafe.co.nz

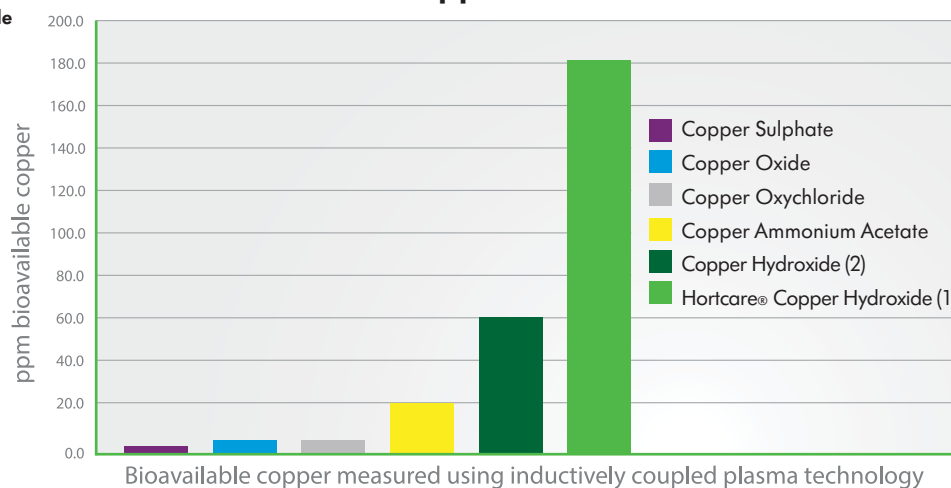




Available copper for disease control

Hortcare® Copper Hydroxide

formulation produces more copper ions for disease control than most other copper formulations.



Problem Free Spraying

Hortcare® Copper Hydroxide brings benefits to the application process.

The unique spray dried dry flowable formulation:

- Mixes well - superior dispersion and suspension
- Easily passes through filters and nozzels
- Easy to measure and handle - pours like a liquid
- Has low dust levels
- Is low foaming

Superior Dispersion and Suspension Properties

Hortcare® Copper Hydroxide has superior bulk wetting qualities, dispersing completely when added to the spray tank. With high suspension levels, the particles remain suspended for longer, resulting in superior mixing, better compatibility and easier spraying.

To ensure best results when mixing with other insecticides, fungicides and foliar fertilisers, ensure you follow the correct mixing instructions and DO NOT pre-mix with water before adding to the tank.

Sprays that contain Hortcare® Copper Hydroxide should be used within three hours of mixing, however the content will remain stable and re-suspend easily if left standing.

GROSAFE CHEMICALS LTD

20 Jean Batten Drive, Mt Maunganui, 3116
PO Box 14 450, Tauranga 3143, New Zealand

ph: +64 7 572 2662
fax: +64 7 578 6241
freephone: 0800 220002
email: info@grosafe.co.nz
www.grosafe.co.nz





Easy Handling and Measuring

Hortcare® Copper Hydroxide is formulated as a dry free flowing granule. There is no sticking or lumpiness as there can be with wettable powders. Spillages can be easily handled by sweeping and recovery.

Hortcare® Copper Hydroxide Fungicide can be measured volumetrically. Use the table as a guide. Pour slowly into a dry measuring jug or measuring cylinder.

Hortcare® Copper Hydroxide

50g	=	48 ml
100g	=	96 ml
150g	=	144 ml
200g	=	192 ml
250g	=	240 ml
300g	=	288 ml
500g	=	480 ml
1000g	=	960 ml

Low Dust Levels

With the constant improvement of our formulation **Hortcare® Copper Hydroxide** has become virtually dust free. This is a big plus for workers and the environment.

International standard assessment of dustiness		
Category	Dust gravimetric collection (mg)	Interpretation
1	0 - 12	Nearly dust free
2	12 - 30	Essentially non dust
3	> 30	Dusty

A 30g sample is allowed to fall under standard conditions in a chamber releasing dust.

Dust is collected on a filter paper placed on a glass sided filter box.

The filter paper is re-weighed, the difference in weights is defined as the "collected dust".

Hortcare® Copper Hydroxide has a dust rating of 2.5mg.

Low Foaming

Unlike some other copper formulations **Hortcare® Copper Hydroxide** has very low foaming properties during mixing and application, resulting in easier handling.

Mixing Directions

Hortcare® Copper Hydroxide is not water soluble, it is water dispersible and therefore must have direct contact with water to disperse. Always pour **Hortcare® Copper Hydroxide** slowly into water while stirring. No additional surfactants are required. Fill spray tank half full with water. Pour the correct quantity of **Hortcare® Copper Hydroxide** slowly into the tank while hydraulic or mechanical agitation is operating and continue to fill with water. Spreaders, stickers, insecticides and nutrients

GROSAFE CHEMICALS LTD

20 Jean Batten Drive, Mt Maunganui, 3116
PO Box 14 450, Tauranga 3143, New Zealand

ph: +64 7 572 2662
fax: +64 7 578 6241
freephone: 0800 220002
email: info@grosafe.co.nz
www.grosafe.co.nz





etc should be added last, only after the **Hortcare® Copper Hydroxide** has been thoroughly mixed. **Observe all precautions and limitations on the labels of all other products used in mixtures.**

Add Products in the Following Order

1. Water soluble bags (WSB)
2. Water soluble granules (SG)
3. Water dispersible granules (WG, XP, DF) **Hortcare® Copper Hydroxide**
4. Wettable powders (WP)
5. Water-based suspension concentrates (aqueous flowable) (SC)
6. Water-soluble concentrates
7. Suspo-emulsions (SE)
8. Oil-based suspension concentrates (OD)
9. Emulsifiable concentrates (EC)
10. Surfactants, oils, adjuvants
11. Soluble fertilizers
12. Drift retardants

Surfactants

Hortcare® Copper Hydroxide does not require the use of a wetting agent or spreader/sticker, although one may be used if required when tank-mixing with other products. If using a surfactant always add it to the spray tank as per the above order and use the lowest recommended rate. Grosafe recommends **Aquaspread®** if adding a surfactant to **Hortcare® Copper Hydroxide**.

Compatibility

Hortcare® Copper Hydroxide is compatible with most commonly used fungicides & insecticides as a tank mix. DO NOT MIX with diazinon or with strongly alkaline or acidic materials. If compatibility is in question, use a compatibility jar test before mixing a whole tank. For further information, consult your supplier.

Crop Safety

Hortcare® Copper Hydroxide should not be applied in a spray solution having a pH of less than 6.5 as phytotoxicity may occur. When applying **Hortcare® Copper Hydroxide** in a spray solution



which has a pH greater than 9.0 it may result in decreased disease control levels. Environmental conditions, may affect the performance of **Hortcare® Copper Hydroxide**, such as extended periods of wet weather, which alter the pH of the leaf surface, this may result in possible phytotoxicity or diminished performance.

Fungicide Resistance Warning

Hortcare® Copper Hydroxide is part of the Inorganic group of fungicides. For resistance management purposes the product is a Group M1 fungicide. Some naturally occurring individual fungi resistant to Group M1 fungicides may exist through normal genetic variability. The resistant individuals can eventually become dominant in the fungal population if M1 fungicides are used repeatedly. Resistant fungi will not be controlled by this product or any other Group M1 fungicide, thus resulting in a reduction in efficacy and possible yield loss. The occurrence of resistant fungi is difficult to detect prior to use, hence Grosafe accepts no liability for any losses that may result from the failure of this product to control resistant fungal populations.

Directions For Use

Restraints:

- DO NOT apply when temperatures exceed 35°C
- DO NOT apply when slow drying conditions prevail
- DO NOT apply to copper-shy crops or cultivars
- DO NOT apply if it is likely to rain before the spray is dry
- DO NOT apply to wet crops
- DO NOT apply in spray solutions having a pH of less than 6.5 as phytotoxicity may occur.