

The blue miracle from Bordeaux

Copper compounds combat fungal infestation in agriculture – however, they are not harmless to health.

Botanist Pierre Millardet was a perceptive man. Riding through the vineyards of St. Julien in Bordeaux in October 1882, he was confronted with the sad sight of paltry vines covered in powdery mildew. With one exception: on a plot of land along the road, magnificent leaves and grapes were found. However, the plants were covered with blue powder. The winegrower told Millardet that he had dyed the wine on the street to keep thieves away thanks to the colour and the unpleasant taste. He had accidentally discovered a substance that also kept fungi away. Millardet seized upon the idea and developed the “Bordeaux mixture”. The mixture of slaked lime and copper sulphate was the first successful fungicide.

Back to the present. Millardet’s Bordeaux mixture and other copper compounds are still in great demand as plant protection products against fungal and bacterial infestation in viticulture, arable farming (e.g. potatoes),

vegetable farming (such as tomatoes) and floriculture. Copper is also used in biocidal products against algae, snails and crabs. It is toxic to microorganisms even in small quantities. Copper blocks essential protein molecules, inhibits photosynthesis (energy production from light) in algae and plants, causing cell damage and making cell envelopes permeable.

In Germany, copper compounds are mainly used in fungicides for hops, wine, fruit and potatoes. Copper is indispensable, especially in organic farming. While farmers in integrated and conventional farming can rely on all approved plant protection products, this is not possible in organic farming due to the regulations. Some people may be surprised to learn that there is also “chemical-free” agriculture – using the heavy metal copper, of all things. The reason given for this is that copper is a “natural substance”; it is not an artificial product developed by mankind.



The two faces of a heavy metal

Natural, yes. But harmless? Copper has two faces. As a trace element, it is essential. On the other hand, too much copper can be dangerous. High doses can lead to liver damage. “The kidneys and the blood formation process are also impaired,” reports Dr. Jens Schubert, a copper expert at the BfR who is responsible for the health risk assessment of copper as a plant protection product. It is also being discussed whether the heavy metal used as a pesticide causes antimicrobial resistance. Furthermore, copper compounds accumulate in the soil and can damage soil organisms. Since pure copper is an element, it cannot be broken down.

According to the EU chemicals regulation REACH, a substance is deemed to be concerning if it fulfils the PBT criteria. PBT stands for persistent (non-degradable), bioaccumulative (accumulates in the organism) and toxic (poisonous). Copper compounds such as the “Bordeaux mixture” are persistent and toxic. It is therefore a stated long-term goal to replace them with more harmless substances. Copper is a “substitution candidate” for plant protection in the EU. The Federal Government also presented a strategy for phasing out copper as early as 1998.

“Phasing out” postponed for now

Organic farmers were therefore eagerly looking to Brussels in 2018. The question was whether the approval of the “substitution candidate” should be extended. The decision was made at the end of the year: copper compounds were approved by the EU Commission for use in plant protection products for a further period of seven years. During this period, farms may apply a maximum of 28 kilograms of pure copper per hectare.

Humans ingest copper via food and drinking water. Nuts, cocoa and animal liver are rich in copper. An adult needs one milligram (mg) daily and about 2 mg are supplied. Up to 10 mg a day is safe; prolonged exposure to 30 mg or more is harmful to our health.

“At the moment we do not see any unacceptable health risk to the general population,” says Jens Schubert. “However, we don’t have much headroom; it is possible to exceed the beneficial maximum values.” This applies, for example, to farmers who use copper. The BfR is now working on an overall assessment of copper from the point of view of consumer health protection. Not an easy task, not least because the metal enters the human body via very different paths – not only via the blue grapes of Bordeaux.