A TOOLBOX OF STRATEGIES TO ALLOW SUCCESSFUL REDUCTION IN COPPER PPP APPLICATIONS ALIGNED WITH THE EUROPEAN GREEN DEAL

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Background and Aims

Currently copper is approved as a fungicide for more than 50 different diseases in viticulture, horticulture, hops, market garden and arable crops. Although copper formulations have been used for more than 100 years, there are no reported resistances which makes it a very important tool in pest management systems for conventional farming and, particularly, for organic farming.

The maximum copper quantity allowed in plant protection has been successively restricted in Europe over the years. In 2001, an EU limit of 8 kg/ha/yr was set. In January 2006, this value was reduced to 6 kg/ha/yr. The current amount of permitted copper use in the EU (as of 2019) is 4 kg Cu/ha/yr counted as an average over a 7-year period (i.e., a maximum 28 kg C/ha over 7 years). It is worth noting that despite significant reductions in copper application limits in recent years, historical rates were much higher. For example, in Germany application rates of 20 to 30 kg/ha/yr, and occasionally even 80 or more kg/ha/yr, of copper pesticides were used in conventional farming[1].

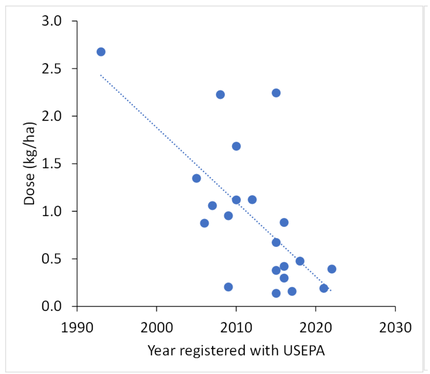
The European Green Deal aims to reduce the use of pesticides in agriculture by half by 2030 whilst also targeting an increase in organic production to 25% of agricultural land. This proposed reduction on pesticide use presents a challenge for growers. This is particularly severe for organic growers, who are prohibited from using synthetic pesticides and rely heavily on copper-based products. Therefore, the European Green Deal has increased interest in identifying strategies to limit pesticide inputs in agriculture. This study presents a range of strategies that can be used to reduce pesticide inputs and transport in the environment whilst maintaining effectiveness to control pests and disease. These options are generally applicable to all pesticide use, including copper.

A toolbox approach to reducing pesticide inputs and transport in the environment

Reducing inputs

Reduction of pesticide use in agriculture can be achieved either by reducing the dose per application or by decreasing the numbers of sprays per season. A range of strategies can be used to achieve this objective, many of which have been demonstrated in the field.

Improved Active or Formulation

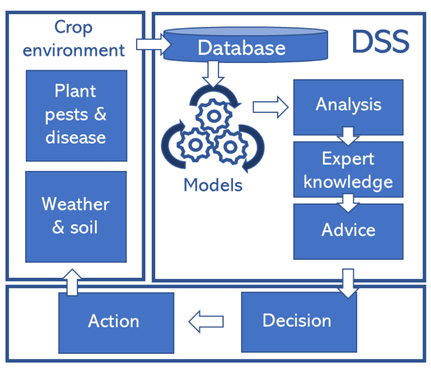


Recommended application dose for grapes and vines of Copper-based fungicides and the year they were registered for use in the US with the US-EPA

- Innovative formulation technologies with reduced dosage requirements are being developed continually.
- Examples with copper include micronisation, microencapsulation, complexation or formulation with adjuvants.
- Substantial reductions in copper dose have been achieved through improved formulation.

Improved application strategies

- Decision support systems (DSS) can be used to minimise the frequency of applications during the growing season.
- A decision to spray (and how much to spray) is based on the calculated risk.
- A recent study showed the median number of pesticide sprays applied with DSSs was 43% lower compared to standard calendar-based strategies[2].



- Optimised spraying technology and spray parameters (volume rates, dose, pressure, forward speed, etc) can also reduce pesticide inputs.
- An app-based tool, DOSAVIÑA, showed that fungicide use could be reduced by at least 20% using optimized spray parameters[3].

Precision Agriculture

- Allows more precise and targeted treatments based on variability observed in the field, that may ultimately lead to lower pesticide inputs.
- Early studies in viticulture have shown a 25 – 50% reduction in fungicide use[4].

Minimising transport to receptors

Approaches to limit pesticide transport to receptors (i.e., surface water) are established in agriculture and can be applied to copper. Most copper exported off the field is bound to suspended particulate matter (SPM) and will be driven by rain-based erosion and surface runoff.

Reduction of copper in runoff leaving the field

- Transport of Cu from fields to surface water occurs mainly via runoff after precipitation.
- The use of cover crops is widely considered as an effective agricultural conservation measure, reducing runoff and erosion processes.
- *In-situ* immobilisation with biochar is a means of reducing the dissolved and mobile forms of copper in soil and limits their transport in runoff.
- Other strategies include the use of mulches, reducing the depth and frequency of tillage and the use of terracing on sloping terrain.

Interception of copper in runoff

- Limiting the transport of copper to surface waters may be achieved using buffer zones and sediment interception strategies.
- There are many different options for reducing copper transport to water bodies, including buffer zones (a), grassed waterways and swales (b), sediment traps and infiltration trenches (c), retention ponds (d), woodland shelter belts (e) and constructed wetlands (f).

Conclusions

- A range of strategies to reduce pesticide use continue to develop as societal and regulatory pressures (i.e., European Green Deal) call for reductions in agriculture. Considering significant reductions in copper use in agriculture in recent times, any further reductions will need to be carefully investigated as part of this overall effort to optimize pesticide use while limiting transport to receptors.

References

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