Pathways to phase-out contentious inputs from organic agriculture in Europe

Organic-PLUS is an EU Horizon 2020 project involving 25 partners in 12 countries (EU and non-EU), working to find alternatives to some of the contentious inputs currently permitted in certified organic production, including copper fungicides, mineral oils and sulphur, with a special focus on perennial Mediterranean crops such as citrus and olives, and greenhouse crops like tomato and aubergine

WHAT ARE THE ALTERNATIVES TO CONTENTIOUS INPUTS IN MEDITERRANEAN ORGANIC TOMATO GROWING?

TOMATO



This factsheet provides an overview of some alternative treatments and methods to replace or reduce the use of contentious inputs (namely copper, mineral oils and sulphur) that are used to control diseases and pests in tomato crops. Alternative compounds cannot be considered as one-for-one substitutes of contentious inputs, but they should be integrated within more complex strategies for crop protection. In general, plant health should rely on preventive and indirect care measures in preference to off-farm inputs. The choice of varieties adapted to local conditions, the use of resistant varieties and other general measures which ensure a resilient agricultural system, strongly contribute to reduce dependency on external inputs to control pests and diseases.

Tomato plants are widely cultivated in European countries, for use both as table tomatoes for fresh consumption and for industrial tomato processing (primarily canning).

Cultivation takes place in both the open ground and in greenhouses, based on the location and time of year.

Yields are continually under threat from a range of pathogens and pests which limit productivity in the field and also the shelf life of tomatoes post-harvest. Common and often devastating phytopathogenic fungi and bacteria (powdery mildews, *Phytophthora infestans, Cladosporium* spp., *Botrytis cinerea, Alternaria* spp., *Pseudomonas* spp., *Xanthomonas* spp.) are present across the Mediterranean region and can compromise tomato production.

In organic tomato cultivation, pathogens are generally controlled by the regular spraying of copper-based products. The demonstrated noxious effect of copper on soil microbial communities and other soil fauna has led to regulatory restrictions of its use. Copper for crop protection purposes was permitted at a maximum rate of 6 kg/ha/yr in the EU until the end of 2018, but from January 2019, this was reduced to 4 kg/ha/yr.

According to interviews conducted with experienced advisors as part of the Organic-PLUS project in 2018, the old limit was widely regarded as acceptable among Mediterranean tomato growers.

Many alternative compounds to reduce or replace the use of copper are in development, but few are currently available on the market.

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WHAT ARE THE ALTERNATIVES TO CONTENTIOUS INPUTS IN MEDITERRANEAN ORGANIC TOMATO GROWING?

ALTERNATIVES TO COPPER

Copper use in Mediterranean countries has rarely exceeded the previous limit of 6 kg/ha/year. The greatest use of copper for tomatoes is in greenhouses during the winter season. Alternatives to copper currently include:

Low copper grade formulations, with a reduced copper content (2-6%), result in a smaller amount of copper being applied per hectare.

Natural alternative formulations, applied to replace or reduce copper dosage, used alternately or in combination with copper. Some of them are included in Annex II to Commission Regulation (EC) 889/2008, permitted for plant protection in organic crop production:

- **Plant extracts** with biocidal activity and stimulating effects on plant defences.
- **Inorganic substances**: potassium salts of fatty acids and potassium hydrogen carbonate.
- **Biological control agents**, with a variety of mechanisms of action against fungal and bacterial pathogens and stimulating effects on plant defenses. *Ampelomyces quisqualis*, *Bacillus subtilis, B. amyloliquefaciens, Pseudomonas* spp., *Trichoderma* spp. and *Streptomyces* spp., are examples of BCAs currently available to growers.
- **Seaweed extracts** such as *Ascophyllum nodosum* and *Laminaria digitata.* Laminarin extracted from *L. digitata* does not have a direct bactericidal or fungicidal activity, but enhances the plants' resistance to pathogens.
- **Chitosan**, a natural polymer obtained from chitin, is reported to be active against a variety of microorganisms. It has an effective direct action but also stimulates plants' defence mechanisms.
- **Herbal preparations**, including decoctions of nettle (*Urtica dioica*) and horsetail (*Equisetum* ssp.).

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ALTERNATIVES TO MINERAL OILS

Mineral oils are occasionally applied to tomatoes to repel insects and mites. The maximum dose is 10-13 litres/ha/year. Alternatives include:

- **Organic oils (e.g. rapeseed)**
- **Plant defence stimulators**
- **Diatomaceous earth**
- **Potassium salts of fatty acids**
- **Biological controls**

ALTERNATIVES TO SULPHUR

Sulphur is applied in organic greenhouses against pests and powdery mildews. Its use can move from 2 kg/ha/year to, in the rare and highest case, 95 kg/ha/year depending on the production system and the incidence of pests/diseases. It is not selective and has harmful effects on beneficial arthropods. Alternatives, not widely applied for economical reasons, are essentially represented by:

- **Maltodextrins**
- **Potassium hydrogen carbonate**
- ***Ampelomyces quisqualis***

Main goals of Organic-PLUS in relation to tomato

Based on practitioners experience, ten different available-to-growers formulations alternative to copper will be screened in the lab for their efficacy against pathogenic tomato strains of *Botrytis cinerea* and *Fulvia fulva*. The effective formulations will be checked for persistence of their effect. The best selected alternative will be tested out in three demonstrative trials carried out in Mediterranean greenhouses.