



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 AUBERGINE GROWING?

AUBERGINE



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 aubergine 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.

Aubergine (also known as eggplant) is a crop widely grown in southern European countries. Cultivation is practised both in open fields and in greenhouses, dependent on the location and time of year. Aubergine yields are threatened by fungal and bacterial diseases which limit both productivity in the field and the shelf life of the crop post-harvest. Fungi and bacteria (powdery mildews, *Phytophthora infestans*, *Botrytis cinerea*, *Verticillium* spp., *Rhizoctonia solani*, *Alternaria solani*, *Xanthomonas* spp.) present in the Mediterranean region may compromise aubergine production in the various countries that they are grown.

In organic aubergine cultivation, pathogens are generally controlled by 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 to its use. The use of copper for crop protection purposes was permitted in the EU up to a maximum of 6 kg/ha/yr of metal Cu until the end of 2018 but from January 2019 this was reduced to 4 kg/ha/yr. According to data collected during interviews with experienced advisors in the first 6 months of the Organic-PLUS project, the previous 6 kg limit was widely accepted by Mediterranean aubergine growers. Many alternative compounds to reduce or replace copper are under development, but few are currently available on the market, and fewer still are in use to any significant extent.

This project has received funding from the European Union's Horizon 2020 impact and innovation programme under grant agreement No. 774340



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

ALTERNATIVES TO COPPER

Low copper grade formulations, with reduced copper content (2-6%), allow a smaller amount of copper to be distributed 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 (BCAs)** with a variety of mechanisms of action against fungal and bacterial pathogens, coupled with the stimulation of plant defences. *Ampelomyces quisqualis*, *Bacillus* spp., *Pseudomonas* spp. and *Trichoderma* spp. are some example of BCAs currently available.
- **Seaweed extracts**, such as *Ascophyllum nodosum* and *Laminaria digitata*. Laminarin extracted from *L. digitata* does not have a direct bactericidal or fungicidal action, but enhances plant resistance to pathogens.
- **Chitosan**, a natural polymer obtained from chitin is reported to be active against a variety of microorganisms. As well as this direct action, plant defence mechanisms are also stimulated.
- **Compost/compost teas:** compost tea, vermicompost, vermicompost tea.
- **Resistant varieties:** some native aubergine varieties can be resistant or moderately resistant to fungal diseases such as early blight (*Alternaria solani*). It is this aspect that Organic-PLUS will be exploring further for aubergines.



ALTERNATIVES TO MINERAL OILS

Mineral oils are rarely applied to aubergines and only for their repellent effect against insects or mites. Alternatives to mineral oils include:

- **Potassium salts of fatty acids**
- **Plant defence stimulators**

ALTERNATIVES TO SULPHUR

Sulphur is applied in organic greenhouses against pests and powdery mildew. It is not selective and has harmful effects on beneficial arthropods. There are alternatives, but these are not currently applied for economic reasons. They include:

- Maltodextrins
- *Ampelomyces quisqualis* (a fungal biocontrol that is a hyperparasite of powdery mildews)

Main goals of Organic-PLUS for aubergine

Organic-PLUS will focus on finding varieties of aubergine with strong resistance to fungal disease. 60 aubergine landraces will be screened for early blight (*Alternaria solani*). Seedlings of the landraces will then be tested for resistance to *Alternaria solani* fungal spores in climate-controlled conditions. After the inoculation stage, resistant or moderately resistant native races will be selected.

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