WHAT ARE THE ALTERNATIVES TO CONTENTIOUS INPUTS IN ORGANIC POTATO CROPS?

This factsheet provides an overview of some alternative treatments and methods to replace or reduce the use of contentious inputs (namely copper and mineral oils, as sulphur is not used in organic potato production) that are used to control diseases and pests in potato crops. Alternative compounds cannot be considered as one-for-one substitutes of contentious inputs, but 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.

Potato is cultivated in most European countries, for use for fresh consumption, for processed food products (French fries, crisps, dehydrated mashed potatoes...) and as a source of high-quality starch for a wide range of industrial purposes. Since potato is vegetatively propagated, seed tuber production is a specific specialty crop, with high sanitary requirements. Potato is primarily an open-field crop, although early potatoes, planted and harvested very early in the season, are often grown under plastic covers for part of their cycle. Potato yields are compromised by a range of pathogens and pests which limit productivity in the field and can affect tuber quality. Among the most problematic are late blight (caused by Phytophthora infestans), early blight (caused by Alternaria spp.), and several viruses transmitted by insects.

Pathogens are generally controlled in organic potato crops through repeated sprays 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, reduced to 4 kg/ha/yr from January 2019. Several northern European countries have, however, banned copper use entirely. According to interviews conducted with experienced advisors as part of the Organic-PLUS project in 2018, the old limit was widely regarded as acceptable by European potato growers, while the new one may cause shortcomings under severe infections. Many alternatives to reduce or replace copper are under development, but few are currently available on the market.

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

Organic-PLUS (O+) 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.

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ALTERNATIVES TO COPPER

The main use of copper in potatoes is against late blight. Alternatives to copper currently include:

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, and herbal preparations including decoctions (heated extracts) of nettle (*Urtica dioica*) and horsetail (*Equisetum* spp.);
- Biological control agents, with a variety of mechanisms of action against fungal and bacterial pathogens and stimulating effects on plant defenses. *Bacillus subtilis*, *B. amyloliquefaciens*, *Pseudomonas* spp., *Trichoderma* spp., *Pythium oligandrum* and *Streptomyces* spp., are examples of BCAs currently available to growers;
- Plant defense stimulators, such as seaweed extracts, silicates or chitosan, a natural polymer obtained from chitin and reported to be active against a variety of microorganisms.

A number of resistant cultivars are available, for all market segments. Their resistance comes from different physiological mechanisms which can be highly effective in a wide range of environments.

ALTERNATIVES TO MINERAL OILS

Mineral oils, if used, are applied to seed potato crops to repel insects and therefore avoid virus transmission.

Alternatives include:

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

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SYSTEM SOLUTIONS

Individual alternatives listed above have often demonstrated only partial efficacy when used individually as substitution for copper sprays. Therefore, their performance needs to be supplemented with agronomic good practices to allow for satisfactory copper-free management in integrated pest management systems. Among these best practices are:

- **Crop rotations of at least three years, and preferably four or five**, to control soil-borne pests and diseases and manage volunteers;
- Sanitation, through the use of certified seed tubers and the management of refuse piles next to the fields, to limit primary inoculum within or close to the production fields;

The use of Decision Support Systems, predicting the risk of infection according to local weather and to host resistance, for optimal timing of in-field applications. These systems can now be refined to take into account the pathogenicity characteristics of local pathogen populations and the modes of action of biocontrol solutions currently being developed.

Main goals of Organic-PLUS in relation to potato

Based on practitioners experience, O+ will concentrate on designing and testing new, effective alternative systems for organic potato protection based on a combination of host resistance, biocontrol and forecasting models. It will also develop specific knowledge regarding the joint control of late blight and early blight, since simulations based on future climate scenarios predict a shift towards increased occurrence of the latter disease in Europe between now and the end of the century.

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