

HOW TO PHASE OUT COPPER, PEAT, FOSSIL DERIVED PLASTIC AND CONVENTIONAL FERTILISERS FROM ORGANIC GROWING IN EUROPE?

Webinar arranged by WP3 PLANTS and WP5
SOIL in the Organic-PLUS project: Pathways to
phase-out contentious inputs from organic
agriculture in Europe

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ALTERNATIVES TO Cu AT TABLE OLIVES

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Olives in Greece

- **More than 85% of tree plantations in Greece**
- **Number 1 (olive oil) and 3 (table olives) in Greek agricultural exports**
- **Most olives for olive oil in southern Greece and most for table olives in northern Greece**
- **Table olives are often produced intensively (drip irrigation, yearly pruning, heavy fertilizer and pesticide applications) to produce yearly commercial size fruit**
- **Table olives: >85% exported, around 450 million €**

Organic olives in Greece

- Large surface of olive groves are under organic cultivation
- Mainly for olive oil, cultivated extensively, low productivity
- Some olive groves are cultivated organically for double use, table olives and olive oil (the small size fruit)
- Intensive organic olive groves are increasing
- Need research on new available materials to strengthen plants against abiotic and biotic factors

Table olives: main cvs

	<u>Processed product</u>
•Chondrolia Chalkidikis	>90000 tn
•Konservolea	>55000 tn
•Kalamata	>50000 tn



Differences in climatic conditions per area, Cvs per area

Cu applied and problems

- After questionnaires completed and other studies conducted in Greece:
 - Farmers with intensive cultivation apply around 3 times the Cu quantity allowed per hectare per year (>10 kg Cu/ha/year, allowed 4 kg/ha/yr)
 - In Chalkidiki (relatively new in olive cultivation) the soils and leaves have very high Cu contents
 - Besides the high Cu use, leaf diseases still cause substantial leaf drop

Thus, it was of paramount importance to study alternatives to Cu

Can we find alternatives?

- Not for all uses
- After hail, bacterium *Pseudomonas* may develop to olive knots and Cu is required
- Leaf spot or peacock spot (*Spilocaea oleaginea*) major problem throughout Greece, Cu was (and still is) applied 4-5 times per year, but organic fungicides often used nowadays
- Anthracnose (*Colletotrichum gloeosporioides* and *G. acutatum* lately) in wet areas, major problem after olive fruit fly damage (*Bactrocera oleae*)

Table olive trials in Greece

- During 2019 and 2020.
- cv. Chondrolia Chalkidikis, the main table olive for green Spanish-style cv
- Three farms: at Aerino (A), central Greece, and two farms at western Chalkidiki, one with older trees surrounded by other olive groves (M) and one with younger trees with no other olive trees around (R)
- We almost eliminated Cu applications (farmer applies Cu 4-5 times yearly) and used alternatives to strengthen the plants to reduce disease severity and possibly increase plant productivity.

Alternatives used

Lime sulfur in October

Bordeaux mix foliarly + humic/fulvic soil (March, only in Aerino)

Ca+Si, Kelp extract, aminoacids (April)

Ca+Si, Kelp extract, aminoacids (May)

Ca+Si, Kelp extract, aminoacids (June)

Zeolite foliarly (July)

Zeolite foliarly (late August)

Measurements taken

- ✓ Leaf drop and cause of this loss in April-early May
- ✓ Leaf and fruit characteristics in late June
- ✓ Leaf and fruit characteristics in mid-September with commercial harvest of green olives destined for Spanish-style processing
- ✓ Commercial yield at harvest



Aerino olive grove (A)

- In 2019 limited data, experimental leaves in June more chlorophyll than control, but in September the opposite
- In 2020, experimental leaves in June similar chlorophyll to control, but in September higher than control. Experimental trees lower leaf loss than control. Experimental trees slight reduction of yield, but significant increase in fruit size
- Double pruning: decrease in yield, fruit size improvement, minor leaf loss



Chalkidiki M olive grove

- Heavy soil, olive groves around, 21 years old, 7*7 m off-set
- Major leaf loss in 2019, low in experimental. In 2020, minor leaf loss.





Chalkidiki M olive grove

- In 2019, experimental leaves lower chlorophyll than control, leaves inorganic content in sufficiency levels except Zn (low) and Cu (very high). Experimental leaves higher Ca and lower P and K. Experimental fruit similar quality to control.
- In 2020, experimental leaves similar characteristics to control. Experimental fruit similar to control fruit.

Chalkidiki R olive grove

- Light soil, sloping, no other olive groves around, 11 years old, 6*6.5 m off-set
- Minor leaf loss





Chalkidiki R olive grove

- In 2019, experimental leaves higher chlorophyll than control, experimental fruit similar quality to control fruit.
- In 2020, experimental leaves lower chlorophyll than control, experimental fruit improved quality to control fruit.

Conclusions

- **Biostimulants did not improve leaf characteristics over the summer.**
- **Biostimulants reduced leaf loss due to disease in a wet year (2019) compared to Cu applications**
- **Biostimulants had a positive effect on fruit size, but slightly decreased yield (in Aerino grove)**
- **Biostimulants had no negative effect on fruit size or yield (in Chalkidiki groves)**
- **The biostimulants' combination tried could be used as an alternative to Cu fungicides**