Extended Practice Abstract Nº 12

Integrated smart system for olive anthracnose management using predictive models and targeted IPM treatments

Challenge

The GleoControl project operates primarily in Western Greece, where climatic conditions such as increased humidity favour the spread of anthracnose. The project includes extensive sampling from various regions and microenvironments to tailor disease management solutions.

The project addresses the growing threat of olive anthracnose, a disease intensified by climate change factors such as rising humidity and temperature fluctuations.

Solution

The GleoControl project develops integrated pest management (IPM) by combining chemical and biological treatments, resistant olive cultivars and predictive modelling combining meteorological data with disease patterns to optimize treatment timing.

Benefits

GleoControl will equip farmers with an eco-friendly solution combining a weather-based predictive model with strategic rotation of biological and chemical treatments.

Applicability box

Theme

1. Pest management
2. Adaptive management
3. Climate change adaptation
4. Digital technologies

Application time

The GleoControl practice is primarily applied during high-risk periods in spring (flowering), late summer (fruit setting) and autumn (ripening). Adjustments are made based on real-time weather conditions and disease risk indicators throughout the cultivation cycle.

Required implementation time

Implementing the GleoControl practice requires ongoing monitoring throughout the cultivation season, with treatment applications typically taking a few hours per treatment. Each intervention is conducted only as needed based on predictive model alerts, minimizing total treatment time across the year.

Period of impact

The GleoControl practice is expected to have an impact throughout the cultivation season, with cumulative benefits evident in crop yield and olive oil as well as table olive quality by harvest time.

Equipment

Standard spraying equipment is needed for treatment applications, in addition to weather stations with access to meteorological data and a decision support system with a prediction model application.

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Practical recommendation

• Monitor meteorological data

Regularly check meteorological data through the predictive model to identify high-risk periods for anthracnose outbreaks, focusing on humidity, temperature and rainfall.

• Assess crop condition and growth stage

Evaluate the olive crop's growth stage and overall plant health, as disease susceptibility varies; prioritise stages such as flowering and ripening.

• Implement IPM programs for disease control

Apply targeted treatments only when the model indicates favourable conditions for the disease. Alternate between fungicides with different active substances and mode of action to minimise pathogen resistance (Figure 1).

• Use biological plant protection products

Integrate biological fungicides where possible, especially during pre-harvest stages, to reduce chemical residues and protect the environment.

• Monitor IPM programme effectiveness

Continuously assess the treatment impact on disease severity and adjust methods as needed.

Months	T (◦C)	RH(%)	Max.no. of applications	Suggested PPPs that showed high efficacy in all the experimental procedures
April	Mild (14-25◦C)	-	1	Synthetic PPPs (e.g. Priori Top®, Ortiva top®, Insignia®), Copper compounds, bioPPPs
May			1	
August	Low (<30◦C)	mild/ high	1	Synthetic PPPs (e.g. Score®), Copper compounds, bioPPPs
September	Mild (14-25◦C)	mild/ high	1 or 2	Copper compounds, Synthetic PPPs (e.g. Syllit®, Score®), bioPPPs
October (ripening)	High (>10-14◦C)	mild/ high	1 or 2	bioPPPs
November (ripening)	High (>10-14◦C)	mild/ high	1 or 2	bioPPPs

Figure 1. *IPM programmes. The treatment schedule outlines targeted applications aligned with meteorological data, ensuring sprays are used only when disease risk is high, optimising crop protection and minimising environmental impact.*

Further information

Videos: https://www.youtube.com/watch?v=DQs9WcMXON0&t=3s

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Simplified cost/benefit analysis

Integrated smart management system for olive anthracnose

Introduction – presentation of ex-ante and ex-post situation

Climate change has intensified the prevalence of olive anthracnose in the Mediterranean Basin, with increased humidity and temperature fluctuations creating optimal conditions for the disease to spread. In the ex-ante situation, farmers rely on conventional pesticide applications based on fixed schedules without considering weather predictions, often leading to the excessive and untimely use of chemicals. This management not only risks environmental degradation but also affects the quality of the produced olives, as excessive pesticide use may result in harmful residues when/if applied near harvest. Furthermore, there is the added risk that without knowing the right application timing, farmers might delay applications, potentially allowing the disease to spread quickly, causing significant crop damage.
In the ex-post scenario, the GleoControl project incorporates: 1) meteorological data with a predictive model so that treatments are applied only when necessary, reducing pesticide application frequency and enabling precise, timely intervention for a more effective disease management; 2) optimal use of efficient biological and chemical plant protection products; and 3) use of either tolerant or resistant olives cultivars to anthracnose disease.

Economical costs and benefits

The economic context of this analysis focuses on olive growing in the Mediterranean region, where olive anthracnose is a notable challenge, causing reduced yields and a decline in olive oil quality. The GleoControl project applies integrated pest management (IPM) management, including weather-based predictive models and strategic pesticide rotation, to help reduce crop losses and improve economic outcomes for farmers. It is important to note that there are no specific economic data records available for Greece, nor does the GleoControl project aim to gather such economic data. Instead, this context is based on findings from existing literature on similar IPM applications in the Mediterranean, which demonstrate improvements in crop protection, optimised treatment timing, reduced chemical input and the resultant benefits for product quality.

Legend

Estimated indicator

Measured indicator

	Ex-ante	Ex-post
Variable costs		
Yield losses	€300 million worth of product losses yearly [1]	€120–240 million worth of product losses yearly [2]
COMPARISON	Global reduction of 20% of the cost:  Reduction in total costs due to efficient pesticide use, which generates economic and ecological benefits for farmers by reducing losses	

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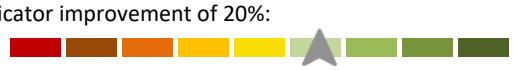
Environmental costs and benefits

Energy	Indicator improvement of 20%: 
Improvement due to lower fuel consumption due to fewer pesticide applications. This reduction is also caused using tolerant cultivars. This indicator is estimated through fuel consumption and application frequency obtained in similar IPM trials and empirical results that demonstrate lower fuel use due to targeted spraying[3].	
Water	Approximate indicator improvement around 10%: 
This indicator is estimated through empirical knowledge; water quality improves as runoff polluted with pesticides is reduced, thus reducing the pollution of local waters.	
Soil	Indicator improvement up to 15%: 
Soil health is considered for this indicator, measured as organic matter content and microbial biodiversity. In this case, this indicator improves because reducing the input of chemical products maintains microorganisms and soil structure, as has been seen in related studies[4].	
Air	Approximate indicator improvement around 20%: 
This indicator is estimated through empirical knowledge. There is a positive impact due to reducing emissions from chemical applications and promoting the use of biological treatments.	
Biodiversity	Indicator improvement up to 15%: 
This indicator considers the presence and diversity of beneficial soil organisms. It is estimated through the literature consulted, where it has been observed that biodiversity improves with IPM[5] since the dependence on pesticides is reduced and beneficial organisms are favoured, promoting ecological balance.	

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GleoControl Operational Group: integrated smart management system for olive anthracnose

Short description of the OG

GleoControl is an operational group focusing on the development of an integrated management system to control olive anthracnose, a major disease affecting olive crops, especially in western Greece. This project aims to implement biological and chemical methods and disease prognostic models to monitor and control the spread of the disease, thereby enhancing productivity and sustainability for Greek olive producers.

The GleoControl project employs an innovative approach, developing integrated pest management (IPM) systems that combine chemical and biological pesticides to manage olive anthracnose. Additionally, it identifies olive varieties that are either sensitive or resistant to the disease — a previously unavailable insight that significantly aids with managing and reducing the disease's impact on olive crops. The project also utilises precision agriculture technologies by integrating meteorological data with epidemiological information, enabling targeted and timely interventions that enhance both ecological and economic outcomes for farmers.

Benefits

The GleoControl project provides farmers with a cutting-edge, integrated management system for effectively controlling olive anthracnose, resulting in healthier olive crops.

Stage of implementation

The project is currently in progress and is scheduled for completion in September 2025.

Key data box

Theme

1. Adaptive management
2. Climate change adaptation
3. Digital technologies
4. Pest management

Context

GleoControl operates primarily in Western Greece, where climatic conditions such as increased humidity favour the spread of anthracnose. The project includes extensive sampling from various regions and microenvironments to tailor disease management solutions.

Duration

The project is set to run for 36 months until September 2025.

Partners involved

1. Agricultural cooperative–Union of Agrinio: Agricultural organisation, pilot field testing, data collection, outreach
2. Agricultural University of Athens: Research institution, laboratory and field experiments

Budget

Total budget for the action: €144,999.98

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Main achieved or expected results

The GleoControl project aims to manage olive anthracnose, a disease that significantly impacts olive yield and quality (Picture 1). Key achievements include the isolation of > 100 unique strains of *Colletotrichum* spp. from Western Greece, revealing substantial morphological and genetic diversity. Many strains demonstrated resistance to various chemical pesticides, implying tailored disease management strategies. A primary goal is to validate a predictive model that links disease progression to environmental factors such as temperature and humidity, helping farmers anticipate outbreaks and optimise treatment timing. The project also promotes integrated pest management (IPM) solutions, combining chemical and biological control methods. Efficacy trials on olive drupes showed promising results, with certain biological plant protection products reducing disease severity by over 20% and spore production by more than 50%. Chemical treatments were also effective, achieving up to 77% inhibition of spore production. Resistance evaluations across six olive varieties indicated that cv. Mastoides is the most resistant, while cv. Koroneiki is more susceptible. The field studies in 2024 will further validate these findings and refine treatment recommendations.

***Picture 1**. Olive drupes severely infected by* Colletotrichum acutatum

Existing materials

Videos https://www.youtube.com/watch?v=DQs9WcMXON0&t=3s

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