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Briefing

Water management in organic agriculture

1. Setting the context

Organic farming practices are recognised for promoting a sustainable approach to agriculture that benefits both the environment and human health. Notably, the absence of synthetic pesticides and fertilisers prevents the dispersion of harmful chemicals, resulting in improved water quality. Less explored are the impacts of organic farming practices on water quantity—particularly water usage. Understanding this is especially crucial during times when water resources and aquatic ecosystems are under significant pressure.

This briefing aims to address the question of water management in organic agriculture and gather evidence for the upcoming European Commission initiative on the European Water Resilience Strategy.

2. Soil structure in organic agriculture

Soil is a finite resource that is crucial for sustaining life; thus, maintaining its health is of utmost importance. Improving soil health enhances its ability to efficiently store water, preventing excessive usage.

Organic management practices have a positive impact on soil characteristics, promoting an increase in soil organic matter content (Borron, 2006). In contrast, conventional cultivation methods—characterised by the intensive use of synthetic pesticides and fertilisers—tend to reduce organic matter levels in the soil.

Organic matter enables soil to retain moisture, enhances its water infiltration capacity, and improves soil aggregate stability. Organically managed soils can retain up to 100 % more water at the root level compared to conventionally cultivated soils, which positively affects crop yields (Gomiero et al., 2011). A review found that, under severe drought conditions, organic systems obtain higher yields by 70–90 % than conventional systems (Gomiero et al., 2011). However, results may vary depending on geographical areas.

A study conducted by the Rodale Institute on Farming System Trial from 1981 to 2002 found that in 1999, a year marked by extreme drought, corn yield on organic plots was significantly higher than on conventional ones (1511 kg/ha vs. 1100 kg/ha) (Pimentel & Patzek, 2005).

Research Institute of Organic Agriculture FiBL Europe | Rue de la Presse 4 | 1000 Brussels
Phone +32 2 227 11 22 | info.europe@fibl.org | www.fibl.org

In Switzerland's temperate climate, water holding capacity in organically managed heavy loess soils was reported to be 20 % to 40 % higher than that in conventional farming systems (Mäder et al., 2002). A study comparing organic (biodynamic) and conventional fields under simulated drought conditions found that organically cultivated soils exhibited improved water storage capacity (Kundel et al., 2020).

Organically managed soils are more resistant to rain and wind erosion, making them less susceptible to soil depletion (Borron, 2006). In contrast, conventionally farmed soils with lower organic matter content are more vulnerable to the effects of wind and rain. When exposed to rainfall, these soils break down into finer particles that form a crust upon drying. This crust reduces the soil's ability to absorb water, leading to increased runoff (Morvan et al., 2018).

When converting from conventional to organic practices, the increase in organic matter occurs gradually, typically taking several years before becoming detectable (Gomiero et al., 2011). Comparing two soils, both cultivated with organic practices but at different conversion times, the soil with the later conversion date will be more prone to runoff compared to the older organically managed soil. Nonetheless, both soils exhibit lower surface runoff and increased water infiltration capacities compared to conventionally farmed soil (Zeiger and Fohrer, 2008).

A similar study also compared runoff rates between conventional and organically managed soils under varying intensities of rainfall. The study was carried out in France and indicated that in the conventionally managed field, runoff was observed with runoff coefficients (RC) of 4.8 % and 6.9 % at rainfall intensities of 25 and 40 mm h^{-1}, respectively. In contrast, no runoff occurred in the organic farming field at these intensities (Morvan et al., 2018).

In conclusion, due to their higher organic matter content and improved soil structure, organically managed soils exhibit better water infiltration rates and water holding capacity. These attributes enhance the resilience of the system during extreme weather events such as flooding and drought.

3. Reduced irrigation needs in organic agriculture

The intensive utilisation of water resources by human activities is depleting these vital reserves. Currently, 30 % of EU groundwater bodies are experiencing significant pressure. Among these, 59 % are impacted by pollution from pesticides and fertilisers, while 22 % are affected by water extraction for irrigation needs (European Commission, 2025). Consequently, promoting organic land management is essential, as it enhances the soil's ability to absorb and retain water, thus mitigating its impact on critical water bodies.

Organic farming practices, such as minimum tillage, intercropping and mulching, reduce soil disturbance and improve soil structure, thereby limiting evaporation of water from the soil (Borron, 2006). Furthermore, intercropping and the use of cover crops year-round protect the soil from drying out (Kundel et al., 2020). Additionally, the cultivation of water-efficient crops and plant varieties further supports effective water management practices (Gomiero et al., 2011). Moreover, in organic systems, the movement of water through the soil to the groundwater level is 15 to 20 % higher, facilitating a faster groundwater recharge (IFOAM EU & FiBL, 2016).

Organically farmed soils exhibit increased quantities of organic matter, which enhances water absorption and retention, thereby reducing the need for irrigation (Aivazidou & Tsolakis, 2021). A study by Borsato et al. (2020) in Italian vineyards found that the reduced need for irrigation significantly contributed to the smaller total water footprint of organic farming. The blue water (irrigation) footprint is lower per ha (420 m^3 ha^{-1} for the organic; 720 m^3 ha^{-1} for the conventional vineyard), as well as per ton of production (33 m^3 ton^{-1} for the organic; 50 m^3 ton^{-1} for the conventional vineyard). Similar findings were observed in Australia, where water-use productivity in organic systems is 3.53 times higher than in conventional systems, particularly in viticulture and horticulture. However, results may vary for other production systems, such as dairy (Wheeler et al., 2015).

The benefits of organic farming extend to water quality, primarily due to the utilisation of natural fertilisers and pesticides instead of synthetic alternatives, which helps protect surface and groundwater resources, enabling water reusability and promoting efficient water usage (Parizad & Bera, 2021).

Furthermore, because organic farming practices align with natural cycles and foster greater environmental awareness, it can be inferred that organic farmers are more likely to adopt efficient water-use practices such as mulching or cover crops, as suggested by several studies (Aivazidou & Tsolakis, 2021).

Organic agriculture: a resilient system in times of water stress

The increased organic matter content in soils managed organically, as opposed to conventional practices, significantly enhances water absorption and retention capacities, making organically managed soils more drought-resistant (Borron, 2006) and capable of absorbing more water, preventing erosion and flooding.

This represents a crucial strategy for regions experiencing water scarcity. Various studies have shown that, under drought conditions, fields managed organically can achieve higher yields compared to those managed conventionally (Gomiero et al., 2011). This is achieved through specific measures that prevent soil dryness, such as surface cover, intercropping, and the use of water-efficient crops (Kundel et al., 2020). Consequently, policy incentives that reward and promote sustainable farming practices should be implemented to encourage circular water usage, preserve water quality, and prevent its depletion.

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Imprint

Publisher

Research Institute of Organic Agriculture FiBL Europe, Rue du Congrès 37, BE-1000 Brussels, Belgium

Authors: Francesca Bellino (FiBL Europe) and Olivier Ejderyan (FiBL Switzerland)

Review: Bram Moeskops (FiBL Europe)

Permalink: https://orgprints.org/id/eprint/55228/

Suggested citation: Bellino, F. & Ejderyan, O. (2025). Water Management in Organic Agriculture.Briefing. Research Institute of Organic Agriculture FiBL Europe, Brussels