



Young reporters for the environment
International collaboration Turkey and Spain



Article -15-18 years

İZMİR PRIVATE ÇAKABEY HIGH SCHOOL and COLEGIO SANTA MARÍA VILA-REAL

The main theme of this study is to promote sustainable agriculture by converting organic waste into valuable resources to improve food security and protect the environment.

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Students: İzmir BARIŞCAN, Duru Naz KIRBEYİ, Ali Baray ÖLÇER, Yiğit Kaan GÜLDAĞ, Egemen ŞAHİN, Mar Oquendo LLORENS, Adriana Romero ALBALAT, María Morcillo MIURA, Sergi Fernández REDÓ, Marc Adell MIRÓ

Mentors: Viki CALDERON- Dilce İNANÇ- Özge DOĞAN – Sezgin ONUR - Xisco MARCO

**Title of the submission: IMPACT OF SUSTAINABLE VERMICOMPOST PRODUCTION
FROM CITRUS WASTE ON SOIL FERTILITY**

Rapid urbanization and the Green Revolution have increased environmental waste and reliance on chemical agriculture (Ngoc & Schnitzer, 2009). In Mediterranean countries such as Spain and Turkey, citrus production generates millions of tons of organic waste annually, highlighting the urgent need for sustainable waste recovery solutions (FAO, 2017; Baysal, 2014; Tridge, 2024; Türkiye Tarım Orman Bakanlığı, 2025).

Soil organisms, particularly California red earthworm (*Eisenia fetida*), play critical role in enhancing soil fertility, improving structure, supporting nutrient cycling. Organic fertilization practices help improve soil quality, reduce dependence on chemical inputs, and contribute to both environmental and human health (Ateş & Coşkan, 2016). Here, vermicomposting emerges as a sustainable, practical, and eco-friendly approach for managing organic waste.

This study focuses on producing vermicompost from citrus waste and evaluating its effects on soil fertility and waste management. It is aligned with the United Nations Sustainable Development Goals, particularly Goals 2, 12, 13, and 15. Within the framework of the YRE program, students from Spain and Turkey collaborated on a joint study, aiming to raise awareness of environmental challenges and contribute to their countries' commitments under the European Green Deal by sharing their findings with the public.

In this collaborative study, tasks were divided between the two groups. The Turkey group focused on producing vermicompost from citrus waste and analyzing its effects on soil fertility and waste management. Meanwhile, the Spain group evaluated the impact of red earthworms on soil fertility by comparing worm-amended soil with a non-amended control.

Overall, the study demonstrates the potential of citrus waste-based vermicomposting as an effective and sustainable strategy to enhance soil fertility while promoting circular economy practices and reducing environmental impacts.

What Are Vermiculture and Vermicompost?

Long-term use of chemical fertilizers degrades soil structure, disrupts nutrient balance, and reduces beneficial microorganisms (Brady & Weil, 2017). Vermicompost is an eco-friendly organic fertilizer produced through vermiculture, where earthworms decompose organic waste to support sustainable agriculture. The red Californian earthworm (*Eisenia fetida*) is commonly used due to its high efficiency and adaptability (Edwards et al., 2011). During digestion, organic matter is broken down by enzymes and microbes, while pH is regulated, resulting in improved soil quality and enhanced plant growth (Domínguez & Edwards, 2011).

Preparation for the Experimental Setup by Çakabey High School



Figure 1. In this figure, you can see our experimental work, the sensors used, our earthworms, and the Munsell color analysis results of the soil samples.

The experiment was conducted over 10 weeks in temperature-controlled containers under monitored conditions. Two groups were established: a control group and an experimental group receiving 1 kg of citrus waste weekly. Each container included 40 kg of soil, 300 earthworms equally distributed, regular irrigation, and controlled temperature (18–25 °C). Ventilation systems and low-heat lighting ensured optimal living conditions and continuous earthworm activity. Environmental parameters, including soil moisture, temperature, and pH, were monitored and recorded every 2–3 days using sensors.

Preparation for the Experimental Setup by Colegio Santa María Vila-real

Under the same experimental conditions as the Turkish school, the experimental group was established using 7 kg of soil, 400 g of dried orange waste, and 200 earthworms of various sizes. In the other container, 7 kg of soil and 400 g of dried orange were used for a control group

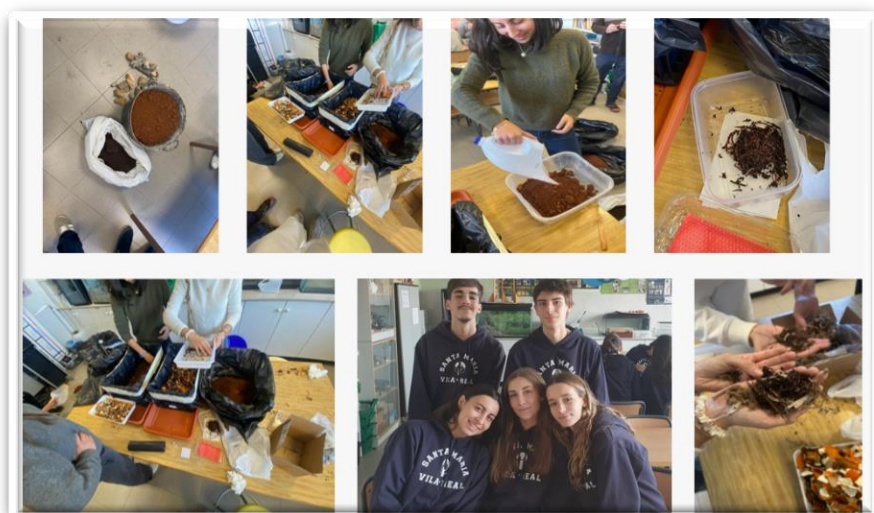


Figure 2. In this figure, you can see the soil materials used, our experimental work, earthworms, and the Spanish team

Results and Discussion

The results obtained by İzmir Private Çakabey High School showed that the experimental group treated with citrus waste had improved soil properties and increased earthworm activity compared to the control group. The experimental soil exhibited higher moisture stability, a shift toward neutral pH, and more stable temperature conditions. Munsell color analysis indicated darker soil tones, reflecting improved soil quality. Laboratory analyses confirmed increases in organic matter, carbon, and nitrogen levels, indicating enhanced soil fertility and active decomposition processes. Earthworm digestion and calcium carbonate secretion helped regulate pH, enabling the effective transformation of citrus waste into nutrient-rich soil (Bano, 2001; Yu et al., 2022).

The results obtained by Colegio Santa María Vila-real highlighted the effects of earthworm activity on soil properties. Both soil samples showed slightly alkaline pH values suitable for plant growth. The worm-amended soil exhibited higher electrical conductivity and improved nutrient availability. Increases in organic carbon and organic matter indicated enhanced biological activity and improved soil structure. Nitrogen levels were slightly higher, while nitrate and potassium remained consistently high. A notable increase in phosphorus suggested improved nutrient mobilization due to earthworm activity. Overall, earthworms enhanced soil fertility through biological activity and nutrient cycling while maintaining soil balance.

By employing *Eisenia fetida* as a biological processing agent, this research evaluates the conversion of citrus residues into nutrient-rich vermicompost and examines its effects on soil quality, structure, and color characteristics. The findings provide evidence that vermicomposting is an effective strategy for promoting circular economy practices, reducing environmental pollution, and enhancing soil health. Additionally, this study contributes to sustainable agricultural systems by offering a scalable approach for transforming agricultural waste into high-value organic fertilizer.



Figure 3. Joint meeting of Turkey and Spain

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DISSEMINATION

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