

Organic Agriculture in the Framework of Circular economy in the Mediterranean Region

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Introduction

Due to the increasing global population, the demand for energy, water and food is growing as the cities become more developed and urbanized. However, the Earth's resources are scarce and have a limited capacity to meet these rising needs (Aznar-Sánchez et al., 2020). The current economic model of "take-make-use-dispose" must be replaced by "prevention-reuse-remake-recycle" (Papamichael et al., 2022). The implementation of modern farming practices rapidly improves productivity, however with a high cost in terms of resources overconsumption and unsustainable energy use. To develop more sustainable future, environmental threats such as pollution, climate change, and biodiversity must be addressed. Specifically, it is estimated that by 2050, the need for food production will increase by 5.1 billion tonnes (FAO, 2017). Considering that farming systems are the primary providers of food, this will put enormous strain on them. In a yearly base, approximately 90 billion tons of raw materials are extracted and used, with only 10% recycled. Moreover, agriculture accounts for approximately 70% of global freshwater withdrawals and 31% of GHG emissions, making agriculture a significant contributor to climate change (Ferrari Machado et al., 2021). Furthermore, agriculture, alongside the food industry, had the second biggest material footprint with 21.3 billion tons and a carbon footprint of 10 billion tons of CO₂ equivalent (eq.), according to Circle Economy data (Velasco-Muñoz et al., 2022). The aim of this study was the identification of the most effective action that should be taken action in the Mediterranean Agriculture sector to enhance organic farming under the Circular Economy Strategy, the SDGs, and the European Green Deal, giving emphasis on organic fertilizers. The research is a part of the wider effort of the European program ClimaMed LIFE17 CCM-GR-000087 that aims the promotion of innovative technologies for climate change mitigation by Mediterranean agricultural sector.

Considering that the use of chemical fertilizers increased from approximately 12 million tons in 1961 to more than 110 million tons in 2018, and that the use of nitrogen and phosphorus now exceeds planetary boundaries by a factor of two, highlighting the immense challenge of improving sustainability in the farming sector. The European Union (EU) Farm to Fork Strategy encourages Member States to minimize nutrient losses by at least 50% and fertilizer use by 20% by 2030, as well as to use 25% of agricultural land for organic farming (EC, 2020). Farm to Fork Strategy recommends using organic waste as renewable fertilizers.

Materials and Methods

An extensive literature review was conducted in order to select the most effective and applicable practice for the circularization of the agriculture sector through the use of organic fertilizers. The proposed literature was carried out in accordance with the PRISMA process, which includes 27 routes and encompasses the well-defined stages of a systematic review, such as eligibility criteria and related information sources, strategy exploration, selection process, results and data synthesis (Voukkali and Zorpas, 2022). The eligibility criteria used, included both inclusion and exclusion criteria. The inclusion criteria cover: (i) research related with farming and circular economy, organic and inorganic fertilizers; (ii) articles published from 1990 since today; (iii) review papers; (iv) methodical demonstration and synthesis of findings; (v) records identified using the keywords chosen by the authors. The exclusion criteria include: (i) narrative reviews; (ii) studies that are not useful to the proposed research; and (iii) available papers in languages other than English; (iv) everything not included in the inclusion criteria. From the 8907 papers that the authors collected and evaluated, 123 were finally selected for this study.

Results and Discussion

Circularizing agriculture is based on three key factors that should be considered. The first is the efficient use of inputs and the prevention of waste; the second is the promotion of environmental, economic, and social sustainability; and the third is the regeneration of systems that allows for the closure of nutrient loops and the

minimization of outputs (Velasco Nunez 2022). Circular economy in agriculture could be viewed as an economic growth driver, a business strategy, or a multi-layered sustainability action plan (Nattassha et al., 2020).

To enhance the circular economy in agriculture, all stages of the food chain, from growing to consuming and disposing, should be designed to consider sustainable development by default. The combination of mixed crop-livestock production, along with the promotion of organic farming and water recycling, is an important factor of a circular agriculture model aimed at lowering CO₂ emissions and making better use of natural resources (Velasco-Muoz et al., 2022). Moreover, the focus should be on the promotion of a holistic set of policies and strategies centered on the investigation of innovations and research for circular farming, as well as the strengthening of organizations and incentives for circular economy adoption.

Conclusion

The existing economic model should be restructured to enable for a smooth transition from linear to circular supply chains in order to decrease natural resource overconsumption and restore environmental impacts. The circular economy, is a promising method for preserving natural resources and offering sustainable, reparative, and regenerative agriculture in the face of resource scarcity, climate change, pollution, and rising food demand. Reusing and recycling agricultural waste could benefit economic growth while also minimizing environmental impact and improve industrial symbiosis.

According to EU legislation, strategies, and incentives, could maintain and strive for food security and sustainable development. Implementing a circular economy in agriculture activities could make a significant contribution to the UN SDGs for creating an innovative and sustainable society (SDG 11), characterized by responsible consumption and production (SDG 12). Other economic opportunities, aside from recycling, include sustainable biomass, increased product life cycle, waste reuse, biofuels and bioenergy, composting, and recycling, whilst also the use of bio-fertilizers in combination with inorganic fertilizers is recommended as a more eco-friendly and cost-effective option.

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