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Exploring the Ecological Harmony of Organic Farming Practices

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Abstract

As global consciousness regarding the environmental consequences of human decisions has grown, organic farming has experienced a meteoric rise in popularity. It is an ecologically safe and sustainable method of agriculture that emphasizes the use of natural techniques for crop cultivation and livestock husbandry. Both the quality of the food and its safety are two significant aspects that have garnered an ever-increasing amount of attention from customers in general. Conventionally farmed foods have significant detrimental health impacts as a result of greater levels of pesticide residue, increased nitrate content, heavy metals, hormones, antibiotic residue, and the presence of genetically modified organisms. The production of food, fiber, and other agricultural goods may be accomplished via the use of organic farming. This is a holistic strategy that places an emphasis on the health of the land, the environment, and the people who are responsible for growing and consuming the food.

The case study used in this study contrasts organic and conventional tomato production over three months. The research compares yield, cost, and environmental effect to show the trade-offs. It examines how farmers and stakeholders may balance economic returns and sustainable agriculture using hypothetical data.

Keywords: Organic Farming, Environment, Economical Harmony, Farmers, Conventional Methods.

I. INTRODUCTION

By definition, organic farming does not include the use of GMOs, industrial pesticides, or fertilizers. Natural practices including crop rotation, composting, and biological pest control are typically employed by organic farmers. The demand for organic food is on the rise, and the organic agricultural business is booming as a result. This is because more and more people are learning about how organic farming is good for people and the planet. Two essential issues that have received continuous attention from the general public are food quality and safety.

In recent decades, there has been a significant decline in customer trust about food quality due to many food risks such as bacterial contamination, bovine spongiform encephalopathy, and dioxins, as well as increased environmental awareness. The pollution of the food chain can be a consequence of intensive conventional farming. That's why people are looking for regional systems that can provide safer and healthier food in a more sustainable way. Everyone thinks that organically cultivated food items may satisfy these needs [5].

By the end of 2019, 103 nations have established protocols for organic farming. There were other nations where it was being prepared.

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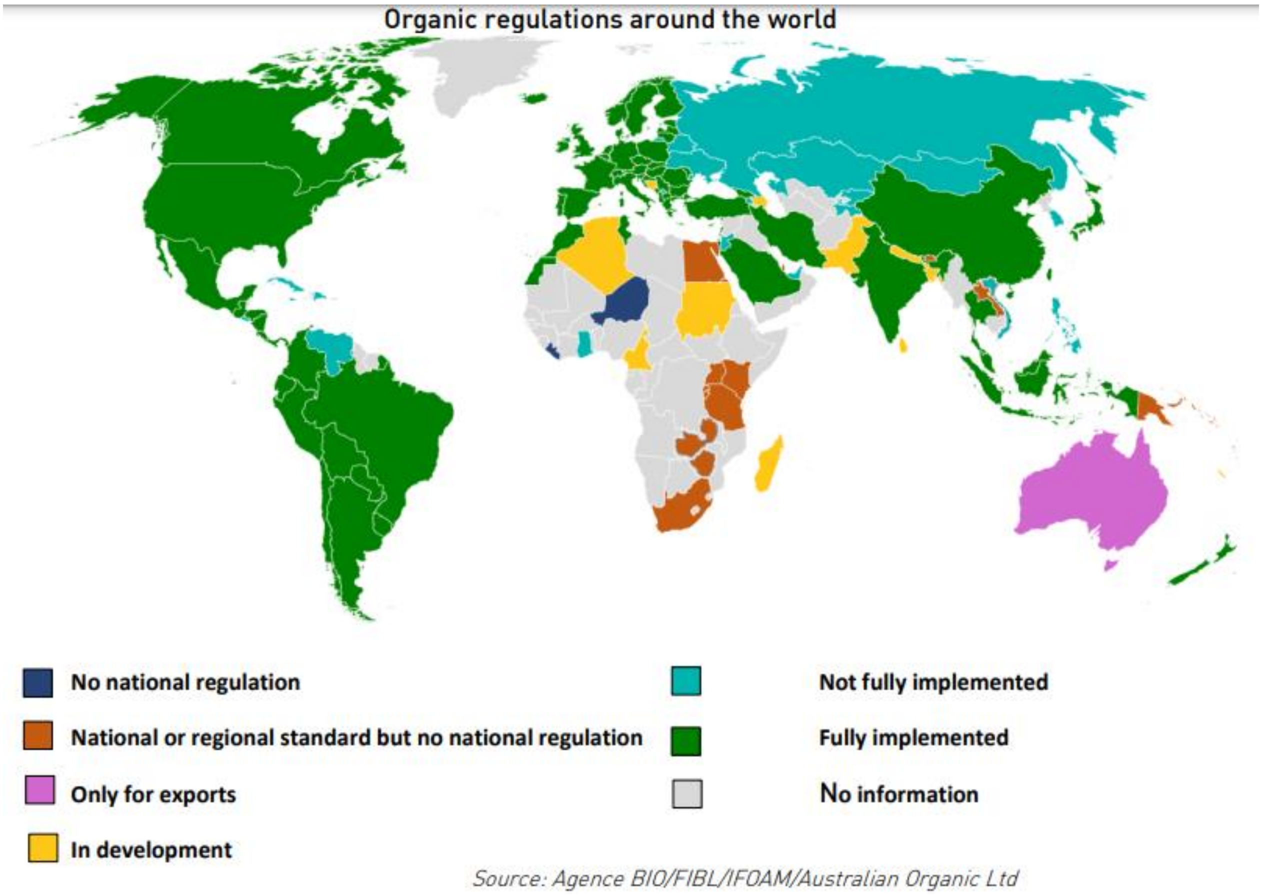


Figure 1: *103 nations have regulations and equivalency agreements.*

The number of organic farms throughout the globe expanded by 11.2 times between the years 2000 and 2018, while the amount of land that was farmed organically climbed by 4.6 times. (Fig-2) [2].

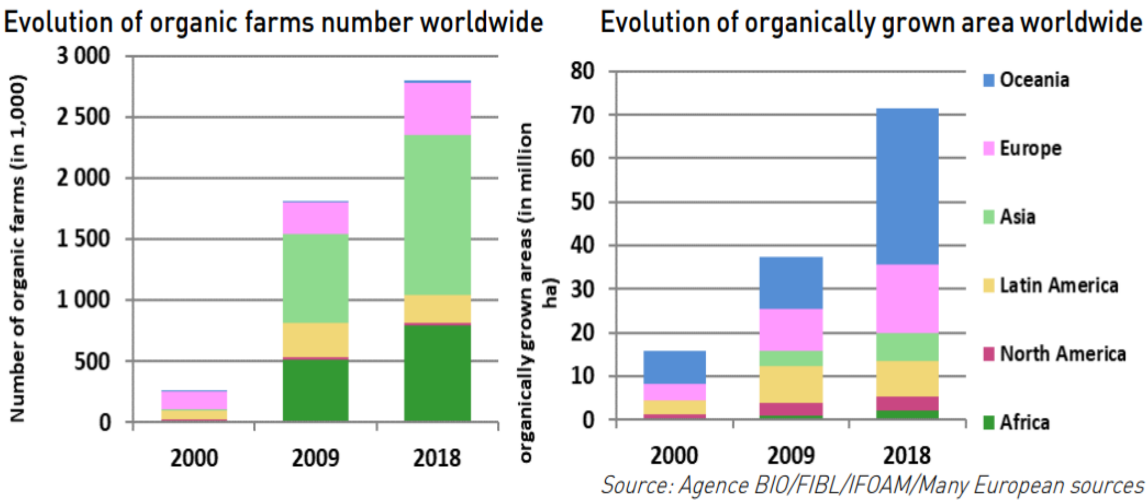


Figure 2: *Global organic agriculture land and share growth 2000–2018 as per the Survey conducted by FiBL-IFOAM-BIO.*

In the year 2021, there were around 3.7 million organic growers across the globe. The information that was gathered indicated that more than 91 percent of the producers were located in the regions of Asia, Africa, and Europe (Fig-3). India has the highest number of organic growers, with Uganda and Ethiopia following closely after. The number of producers has risen by almost 170,000, representing a 4.9 percent increase compared to 2020.

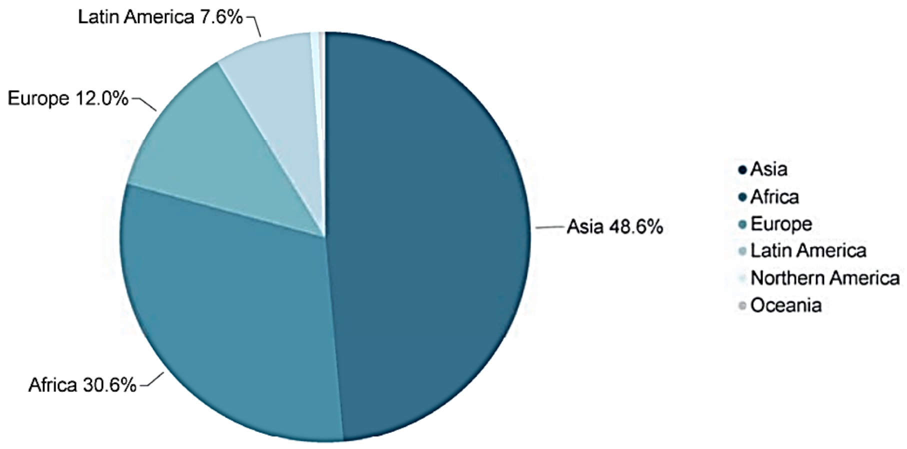


Figure 3: ***Global: Organic Producers' Distribution by Region in 2021 as survey of FiBL 2023.***

II. ORGANIC FARMING TYPES

a) Pure organic farming**:** It is completely forbidden to utilize any synthetic inputs in this kind of organic farming, including pesticides, herbicides, and fertilizers. Crop rotation, composting, and biological pest management are among the natural techniques used by pure organic farmers to maintain their crops.

b) Integrated organic farming**:** A restricted range of synthetic inputs, specifically those deemed low-risk and with minimal ecological repercussions, are permitted in this form of organic agriculture. Crop management practices employed by integrated organic producers generally involve a blend of synthetic and natural approaches.

2.1. Principles in organic farming

Several chemical principles are used in organic farming to preserve the productivity and health of the soil [6]. Organic producers endeavor to establish a closed-loop system in which nutrients are recycled internally on the property. The implementation of techniques including crop rotation, green manuring, and composting facilitates this objective.

Microbiology of the soil: Organic farmers understand the value of preserving a balanced soil microbiome. Numerous critical functions, including the cycling of nutrients, the prevention of disease, and fostering of plant development, are carried out by the soil microbiome.

Organic farmers rely on a wide range of all-natural pest and disease management strategies. Crop rotation, planting with companion plants, and biological pest management are all examples of such techniques.

Livestock grown on pasture and fed organic feed is considered organic.
Genetically modified organisms (GMOs) are not used by organic farmers.

III. METHODS OF ORGANIC FARMING

In the industrial process known as "organic farming," organic materials are shaped into the appropriate shapes by applying pressure and heat. The precise techniques employed in organic shaping differ based on the substance being shaped and the intended form.

The compression molding process entails affixing heat and pressure to the organic material within the mold, thereby compelling the material to conform to the mold's contours. For the formation of thermoset plastics, such as phenolic and epoxy compounds, compression molding is frequently employed.

In order to create a continuous shape, the organic material is forced through a die using the extrusion process. Polyethylene and polypropylene are two examples of thermoplastics that are frequently formed via extrusion.

High pressure is applied while inserting organic material into a mold using the injection molding technique. High-precision components, including those found in electronics and medical equipment, are frequently formed using injection molding.

Figure 4: ***Organic farming and its components***

3.1. Vermicomposting's role

Earthworms excrete the remaining components after keeping 5–10% for their own development. It eats all kind of biological stuff. Vermicompost is the term for earth worm excrement covered with mucus. The introduction of vermicompost into soils resulted in detrimental impacts on nematode populations, while the existence of earthworms led to a decrease in the numbers of free-living nematodes. Entitlement to toxic byproducts of earthworm vermicomposting, including nitrite, hydrogen sulfate, and ammonia, may induce nematode mortality. Additionally, vermicomposting products promote the growth of nematode-predatory fungi and encourage rhizobacteria to generate toxic enzymes and toxins. Furthermore, vermicompost tea applications have exhibited noteworthy efficacy in controlling phytoparasitic nematodes [3].

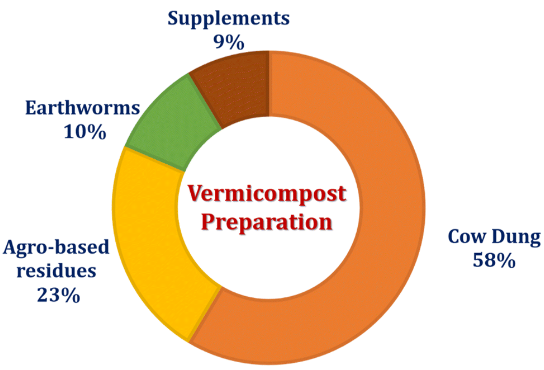


Figure 5: ***Role of Vermicompost and its preparation***

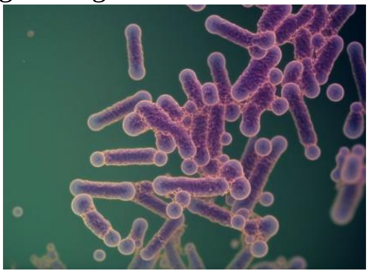
3.2. Biofertilizers

Biofertilizers work by fixing nitrogen, solubilizing or mineralizing phosphate and potassium, producing antibiotics, biodegrading organic materials in the soil, and releasing chemicals that regulate plant development. This ensures that the soil remains rich in micro- and macronutrients [1].

3.3. Different Types of Biofertilizers:

a) Rhizobium b) Azotobacter c) Azospirillum


d) Blue green algae e) Azolla


f) Pseudomonas g) Bacillus h) Aspergillus

Figure 6: ***Different types of Biofertilizers***

a) Rhizobium**:** It's a symbiotic nitrogen fixer that is a member of the bacterial family. It has been calculated that the microbial activities of Rhizobium fix 40–250 kg N/ha/year in various legume crops.
b) Azotobacter**:** It is a well-known aerobic free-living nitrogen-fixing bacteria. For all non-leguminous plants, including rice, cotton, vegetables, etc., it serves as a biofertilizer.
c) Azospirillum**:** It is a kind of bacterium. It promotes the synthesis of substances that promote growth (IAA), resilience to disease, and tolerance to drought.
d) Blue green algae or cyanobacteria**:** These are both free-living and symbiotic microorganisms. Utilized for cultivating rice and are unable of surviving in an acidic environment.
e) Azolla**:** The nitrogen-fixing blue green algae Anabaena azollae works in tandem with the free-floating water fern Azolla to fix atmospheric nitrogen. Azolla has been utilized as a sustainable alternative for animal feed, particularly for fish, poultry, dairy cattle, and pigs.
f) Phosphate solubilizing microorganisms (PSM)**:** PSM are phosphate solubilizing microorganisms. Pseudomonas, Bacillus, Aspergillus, and other similar species secrete organic acids that reduce the pH in their immediate environment, thereby facilitating the dissolution of bound phosphates in soil.

IV. CASE STUDY: ORGANIC VS. CONVENTIONAL VEGETABLE FARMING

4.1. Case study Introduction:

The growing of vegetables utilizing organic farming procedures is contrasted with traditional farming methods that include the use of synthetic chemicals and pesticides in this case study in which we compare and contrast the two. The research is conducted over a period of five months, and its primary objective is to investigate important parameters such as yield, cost, and environmental effect.

4.2. Date collected from the results of experiment

Table 1: ***Experimental data collection from organic and conventional farming***

Category	Organic Farming	Conventional Farming
Vegetable Type:	Tomatoes	Tomatoes
Area Cultivated:	1 acre	1 acre
Seed Cost:	$500	$500
Fertilizer Cost:	$300 (organic compost)	$800 (synthetic fertilizers)
Pest Control:	Beneficial insects (Ladybugs, Praying Mantis)	Chemical pesticides
Yield:	5,000 kg of tomatoes	7,000 kg of tomatoes
Market Price:	$2 per kg	$1.5 per kg

4.3. Analysis and Interpretation of the results:

Yield:

Organic Farming: 5,000 kg
Conventional Farming: 7,000 kg

***Interpretation*:** Conventional farming has a higher yield in this scenario.

***Costs*:**

Organic Farming: Seed ($500) + Fertilizer ($300) = $800
Conventional Farming: Seed ($500) + Fertilizer ($800) + Pesticides (cost not specified) = Higher than organic

***Interpretation*:** Organic farming may have lower input costs, especially considering the potential cost of synthetic pesticides in conventional farming.

4.4. Market Revenue:

Organic Farming: $2 per kg x 5,000 kg = $10,000
Conventional Farming: $1.5 per kg x 7,000 kg = $10,500

Interpretation: Despite higher costs, the higher yield in conventional farming could result in slightly higher revenue.

4.5. Environmental Impact:

Organic Farming: Relies on natural processes, promotes soil health, and reduces synthetic chemical usage.

Conventional Farming: Involves synthetic chemicals that may have environmental implications, such as soil degradation and water pollution.

***Interpretation*:** Organic farming tends to have a lower environmental impact, promoting sustainability.

4.6. Case study Conclusion

In this experimental case study, while conventional farming shows a higher yield and potential for slightly higher revenue, organic farming demonstrates benefits in terms of lower input costs, environmental impact, and a market that often pays a premium for organic produce. The choice between organic and conventional farming involves a trade-off between yield and sustainability, and the decision should consider market dynamics, environmental concerns, and economic factors.

V. BENEFITS OF ORGANIC FARMING

Organic food does not include synthetic pesticides, which are potentially hazardous to human health. In comparison to conventionally grown foods, organically grown foods, particularly leafy vegetables and tubers, have a greater dried matter content [7]. There have been reports indicating that organic wheat contains 25–30% more lysine than conventional wheat.

Organically fed cow's muscle has four times higher linolenic acid, a recommended cardio-protective omega-3 fatty acid, with corresponding decreases in oleic acid and linoleic acid. The flesh of a cow raised on organic pasture has a high polyunsaturated fat content. The milk from the organic farm has more vitamin E and polyunsaturated fatty acids.

Organic virgin olive oil has been discovered to have a higher oleic acid content. There is a considerable increase in magnesium, iron, and phosphorus in organic plants. In addition, they have higher concentrations of manganese, iodine, chromium, molybdenum, selenium, boron, copper, vanadium, and zinc as trace elements and calcium, sodium, and potassium as significant elements.

Phytochemicals, including carotenoids, resveratrol, and pro-vitamin C, are abundant in fruits and vegetables. These compounds are typically secondary metabolites of plants. Organic fruits and vegetables are comprised of 27% more vitamin C than their conventional counterparts.

As a result of their substantial regulatory effects at the cellular level, these secondary metabolites have been identified as protective against malignancies, chronic inflammations, and other diseases. Certain organic foods, including corn, strawberries, and marionberries, contain an excess of 30% antioxidants that combat cancer. Organic fruits and vegetables include greater levels of antioxidants called polyphenols and phenols. According to estimates, phenolic chemicals found in organic plants are twice as abundant as those found in conventional plants.

Crop rotation practices enable organic farms to sustain biodiversity more effectively than conventional farms. In comparison to conventionally farmed soil, organic farming enhances the physico-biological properties of the soil by increasing its organic matter, biomass, enzyme content, stability, water percolation, holding capacities, and decreasing wind erosion and water ingress [4].

VI. SCOPE FOR FUTURE STUDY

6.1. Long-term Comparative Analysis:

Over the course of further research, the methodology might be extended to include numerous growing seasons in order to capture fluctuations in production, expenses, and environmental implications. It would be possible to get a more thorough knowledge of the economic feasibility and sustainability of both organic and conventional farming systems via the use of a longitudinal research.

6.2. Market Dynamics and Consumer Preferences:

An investigation of the preferences of consumers and the dynamics of the market in respect to fruits and vegetables cultivated organically and conventionally will provide significant information. If farmers have a better understanding of how market patterns affect the price and demand for organic products, they will be better equipped to make educated choices on planting.

6.3. Regional Variances:

In order to get a more nuanced understanding, it would be beneficial to investigate the ways in which the effectiveness of organic and conventional agricultural approaches vary across various locations and at different temperatures. The results of regional studies might provide light on particular difficulties and prospects, so helping farmers to customize their strategies to the unique circumstances of their own regions.

6.4. In-Depth Environmental Impact Assessment:

Research in the future might investigate the environmental effect of both farming systems in more depth, taking into consideration aspects such as the condition of the soil, the amount of water used, and the biodiversity of the area. An exhaustive investigation would be of assistance in the process of creating environmentally responsible farming techniques that reduce the adverse effects on the environment.

6.5. Integration of Technology:

In both organic and conventional farming operations, it could be interesting to investigate the role that technology plays in optimizing resource use and increasing productivity. Some examples of such technologies are precision farming and data analytics. There is a possibility that technological improvements may help bridge the gap between efficiency and sustainability.

6.6. Social and Economic Implications:

In order to contribute to a comprehensive review, it would be beneficial to evaluate the social and economic consequences of adopting organic agricultural techniques. This would include analyzing the impact on local communities and living conditions. In order to achieve sustainable agricultural growth, it is essential to have a solid understanding of how various farming approaches influence the larger socioeconomic environment.

By addressing these areas of emphasis, future research will be able to expand upon the results of this case study and give vital insights to the current conversation on agricultural techniques that are both environmentally friendly and economically successful.

VII. CONCLUSION AND DISCUSSION

Growing public awareness of the possible advantages of eating organic food has led to an increase in the popularity of organic farming. In the upcoming years, it is anticipated that the demand for organic food would only increase.

Organic farming is a viable strategy for sustainable agriculture, despite its difficulties. Organic agricultural methods can lessen their negative effects on the environment, increase biodiversity, and enhance soil health. Organic farming may become increasingly more cost-effective and productive as research and development continue, making it a feasible solution for feeding the world's expanding population.

Compared to traditional agricultural practices, organic farming methods might need more money and work. Pests and infections may pose a greater threat to organic farmers than to conventional ones. Effects on the environment a protective function for organic farming exists in environmental conservation. There has been much research done on the environmental impact of both conventional and organic farming. Since organic farming forgoes the use of synthetic pesticides, the majority of which have the potential to harm local terrestrial and aquatic fauna as well as water and soil, it has been suggested that organic farming is less detrimental to the environment. Per unit area of yield, organic farming requires less energy and generates less waste. Organic farms produce more because their soils are better maintained and have a higher ability to hold water, even in years of drought.

Around the world, a number of nations have implemented unique initiatives to promote organic farming, such as Saudi Arabia's National Policy for Organic Agriculture, India's Paramparagat Krishi Vikas Yojana (PKVY), and several more that are urgently needed. The case study concludes that organic and conventional vegetable production have complex relationships. Organic farming has lower input costs, environmental effect, and a price premium, while conventional techniques may yield more. Economic viability and environmental sustainability should be considered, but the best strategy depends on conditions and market needs.

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Conflicts of Interest

The authors declare no conflict of interest.

References:

[1] Lobley, M., Reed, M., Butler, A., Courtney, P., Warren, M. (2005). Impact of Organic Farming on the Rural Economy in England. Exeter: Centre for Rural Research, Laffrowda House, University of Exeter, Exeter, UK.

[2] Research Institute of Organic Agriculture FiBL IFOAM – Organics International the World of Organic Agriculture Statistics and Emerging Trends 2023. (2023). Retrieved from http://www.organic-world.net/yearbook/yearbook-2023.html.

[3] Mathlouthi, F., Ruggeri, R., Rossini, F. (2022). Alternative solution to synthetic fertilizers for the starter fertilization of bread wheat under Mediterranean climatic conditions. *Agronomy*, *12*(2). https://doi.org/10.3390/agronomy12020511.

[4] Walmsley, A., Sklenicka, P. (2017). Various effects of land tenure on soil biochemical parameters under organic and conventional farming - Implications for soil quality restoration. *Ecological Engineering*, *107*, 137–143. https://doi.org/10.1016/j.ecoleng.2017.07.006.

[5] Lockeretz, W. (2007). What explains the rise of organic farming? In *Organic Farming: An International History*, W. Lockeretz (Ed.), CABI International: Oxford, UK, pp. 1–8.

[6] Muller, A., Schader, C., El-Hage Scialabba, N., Bruggemann, J., Isensee, A., Erb, K.H., Smith, P., Klocke, P., Leiber, F., Stolze, M., et al. (2017). Strategies for feeding the world more sustainably with organic agriculture. *Nature Communications*, *8*, 1290.

[7] Tuomisto, H.L., Hodge, I.D., Riordan, P., Macdonald, D.W. (2012). Does organic farming reduce environmental impacts? A meta-analysis of European research. *Journal of Environmental Management*, *112*, 309–320.