2 An Overview of Global Organic and Regenerative Agriculture Movements

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Abstract
This chapter gives an historical overview of the organic agriculture (OA) sector and the closely aligned production systems of agroecology, permaculture and regenerative agriculture. It explains how the modern organic movement emerged from concern over the loss of quality in crops with an increase in diseases and pest attacks affecting yields in the later part of the 1800s in Europe and the USA, after the introduction of chemical fertilizers. The researchers and farmers involved in the movements that would lead to modern OA believed that there was a direct relationship between the health of the soil, of the crops that were grown in it and of the animals and people who consumed these crops. The formal international organic movement began in France on 5 November 1972 at a meeting at Versailles and formed the International Federation of Organic Agriculture Movements (IFOAM). It is the global umbrella organization that sets the international standards, policies, definitions and positions around the multi-functionality of organic agriculture through consulting with its members; these cover the whole spectrum of the sector in most countries in the world. Consequently, IFOAM documents are seen as credible source texts for reference material. Most of the world’s organic standards and certification systems are based directly or indirectly on IFOAM’s Standards. IFOAM put forward the concept of Organic 3.0 in 2013 to enable a widespread uptake of truly sustainable farming systems and markets based on organic principles and imbued with a culture of innovation, of progressive improvement towards best practice, of transparent integrity, of inclusive collaboration, of holistic systems, and of true value pricing. A rapidly emerging sector is regenerative agriculture. It is a concept of agricultural systems improving the resources they use, rather than destroying or depleting them. It is a holistic systems approach to farming that encourages continual innovation for environmental, social, economic and spiritual well-being. It is closely aligned with the concept of Organic 3.0.

Introduction
Organic agriculture (OA) works with ecological systems to produce multi-functional benefits and avoids the use of inputs with adverse effects such as toxic synthetic pesticides. The International Federation of Organic Agriculture Movements (IFOAM)-Organics International, the only global umbrella body for the organic sector, with around 1000 affiliated organizations in 130 countries, developed a consensus definition of OA which was adopted in 2008, clearly showing that organic systems are based on environmental, economic, social and cultural sustainability by working with ecological sciences, natural cycles and people:
OA is a production system that sustains the health of soils, ecosystems and people. It relies

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on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. OA combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved. (IFOAM, 2008)


The History of Organic Agriculture

The name ‘organic’ was popularized by J.I. Rodale in the 1940s.

Jerome Irving Rodale was the first major international author and publisher of books and magazines on organic farming. His primary magazine was called Organic Farming and Gardening and was first published in 1942. It was based in the USA; however, this publication was widely read by many thousands of people around the world. He actively promoted the name ‘organic farming’ in this and other publications and the name ‘organic’ quickly dominated over the numerous other names like natural, permanent and ecological that were being used at the time to describe alternative farming systems.

The word organic has several meanings in the dictionary, with many people taking the dictionary definitions of ‘Organised or systematic or co-ordinated’ (OUP, 1970) as the context for the use of the word in organic farming. Others take the term to refer to a ‘living organism’, as mentioned in Chapter 1 of this volume.

Rodale’s use of the term ‘organic farming’ was specific to the farming system’s use of organic matter as the primary source of soil health and plant nutrition in contrast to the use of synthetic chemical fertilizers in conventional farming. Rodale repeatedly stated that the fundamental basis of organic farming was to improve soil health and build up colloidal humus through a variety of practices that recycled organic matter (Rodale Institute, 2018).

The OA movement arose over the concern over the loss of quality in crops with an increase in diseases and pest attacks affecting yields in the later part of the 1800s in Europe and the USA, after the introduction of chemical fertilizers.

These chemical fertilizers were based on the published research of Baron Justus von Liebig, in Germany, and John Bennet Lawes, in England, in the 1840s. Von Liebig was the first modern chemist to look at plant growth in a laboratory. He determined that plants needed minerals from the soil and carbon dioxide (CO₂) from the air. He showed that although plants are surrounded by nitrogen in the air, they needed nitrogen in the form of ammonia (which they take up through their roots). Von Liebig stated that nitrogen was the most important mineral and proved that synthetic chemical fertilizers could replace natural ones such as animal manures as the source of nitrogen (R.M.B. Auerbach, 2017, unpublished lecture notes ‘Systems and technologies for sustainable agriculture’, Stellenbosch University).

Because many of his experiments were done in a laboratory in sand and other soil-less potting media that did not contain humus and organic matter, von Liebig believed that humus did not have a significant role in plant nutrition. He believed that plants only needed minerals in certain types of water-soluble chemical forms and in the correct ratios. Von Liebig did produce a phosphate fertilizer, but it was ineffective.

R.M.B. Auerbach comments:

It took the work of the practical farmer, Sir John Bennet Lawes, to produce a ‘super-phosphate of lime’ using sulphuric acid to dissolve bones, and various super phosphates have been used as fertilizers ever since. Lawes experimented with pot-grown plants in the 1830s, and then in the field in 1840–1841, and developed his fertilizer at that time. However, he did not patent it until 1842, as his friends advised him that ‘a gentleman does not engage in the manure trade!’ However, in 1842 he opened his commercial fertilizer factory, the first in the world. Lawes then appointed the chemist, Joseph Henry Gilbert to help him in 1843, and this partnership resulted in many agricultural innovations, and in assistance to many landowners in prescribing to their tenants what crop rotations they should use, and what practices were needed to maintain soil fertility. Like Justus von Liebig, they argued from research and practical experience, that crop
rotation was essential to soil health. The work at Rothamsted showed that fields where farmyard manure (FYM) was applied for 160 years became very fertile after about 20 years, even if cropped continuously with barley (the Hoosfield trials). If the fields had not had FYM, yields (and soil organic carbon) declined steadily. After 19 years of treatments, the FYM plots were split, and one half continued to receive FYM, while the other had no fertilizer. A 120 years later, the FYM plots were still yielding twice as much as the plots which never had FYM (although yields had declined in comparison with plots still receiving FYM). Thus, although Rothamsted advocated the use of water-soluble fertilizer, they also advised farmers to look after the soil organic matter, and to practise crop rotation.


This research fundamentally changed the direction of modern agriculture and became the basis of conventional agriculture as practised around the world.

The people involved in the movements that would lead to modern OA believed that there was a direct relationship between the health of the soil, the crops that were grown in it and the animals and people who consumed these crops.

In the midst of this concern of farmers and researchers, around the turn of the 20th century several key books were published, giving alternatives to chemical fertilizers. These books are still used as reference texts by the organic movement. Two of the critical texts were *Bread from Stones* by Julius Hensel (published in Germany in 1893) and *Farmers of Forty Centuries, Or Permanent Agriculture in Japan, China and Korea*, by F.H. King (written around 1900 and published posthumously in the USA in 1911).

Steiner tasked Dr Ehrenfried Pfeiffer with developing the specific soil, plant and compost preparations and farming methods based on the broader, philosophical concepts that he used in his lectures.

Dr Pfeiffer developed the preparations and also the name ‘biodynamic’ (literally ‘life force’) to describe this new farming approach. He gave numerous lectures throughout Europe and started the biodynamic (BD) movement. This is why many European countries use the words ‘bio’ or ‘biological’ to describe organic farming. BD practices and preparations have now spread around the world.

Not long after the beginning of the BD movement a range of other organizations concerned about the link between soil health and human health began to form in the 1930s and 1940s. These organizations were based around the concept of soil health and were called names such as the Soil Association, the Healthy Soil Society, and Soil and Health and were formed primarily in the English-speaking countries or ex-colonies of the UK such as Australia, New Zealand, the USA, India and South Africa (SA).

The most significant of these is the UK Soil Association which still continues to play a leading role in the organic movement in the UK and internationally. Dr Ehrenfried Pfeiffer gave several lectures at key conferences and events that were organized by the founding members of the UK Soil Association. Most of these organizations produced magazines and books that were widely read.

The book from that time that had the most profound influence was *An Agricultural Testament* by Sir Albert Howard (published in 1940, and quoted briefly in Chapter 1, this volume). Howard had spent much of his time in India and had pioneered efficient forms of composting that achieved high yields of healthy plants. Howard had an enormous influence on J.I. Rodale who published the *Organic Farming and Gardening* magazine in 1942 to promote his methods based on the widespread use of recycling organic matter through composting, green manuring and mulching (Rodale Institute, 2018).

The publication of *Silent Spring* in 1962 by Rachel Carson had a significant effect in raising public awareness about the dangers of the pesticides that were being used in farming at the time. *Silent Spring* created a huge controversy and a massive concern about build-up of chemical residues in foods and the environment. Public
pressure saw strengthening of pesticide regulations and most importantly the start of the consumer movement that demanded food grown without toxic chemicals. It also saw the beginning of awareness of how farming was impacting on the environment and gave rise to a number of ‘whole systems’ approaches that fit within the broad organic paradigm.

Examples of these are The One Straw Revolution by the Japanese farmer Masanobu Fukuoka. Fukuoka had published earlier books in Japanese, however, The One Straw Revolution was published in English in 1978 and quickly became one of the most influential books of that time. His ‘natural farming’ methods were based on observing how nature works and then designing the system so that nature did the work for you (Fukuoka, 1978). He was one of the pioneers of organic no-till grain systems that did not use herbicides. These systems are easily applied to smallholder farms.

Quite independently of Fukuoka, two Australian researchers, Bill Mollison and David Holmgren published a book called Permaculture One in 1978. Permaculture was a shortened word for ‘permanent agriculture’ (the concept put forward by King, 1911).

Permaculture is a comprehensive whole systems approach which designs completely integrated systems that include cropping and animal systems design. Permaculture works with ecology, horticulture, and vertical stacking of production systems to maximize solar capture, integrating animals, water systems, architecture, energy use efficiency and numerous other concepts. The ideal was to start with a vacant block of land and design the new system based on the specifics of that block, its climate, topography and other attributes. Each permaculture farm would be unique because of this.


This saw the beginning of the agroecology movement. The Laboratory of Agroecology at the University of California, Berkeley offers the following definition:

Agroecology is both a science and a set of practices. As a science, agroecology consists of the application of ecological science to the study, design and management of sustainable agroecosystems ... This implies the diversification of farms in order to promote beneficial biological interactions and synergies among the components of the agroecosystem so that these may allow for the regeneration of soil fertility, and maintain productivity and crop protection. (Altieri, 2002)

It is both a science and a movement. Agroecology has very strong movements in Latin America and Africa and to a lesser extent in Asia, Europe, North America and Australasia. Many of these movements are highly political, focusing not just on farming production systems; they also concentrate on the rights of farmers to have a fair standard of living and the rights of communities to have food sovereignty (Holt-Gimenez, 2006). Agroecology is now taught and researched in many universities on every arable continent and it is gaining considerable credibility as can be seen from the many peer-reviewed scientific publications (see www.orgprints.org).

The Food and Agriculture Organization of the United Nations (FAO) has been promoting agroecology since 2014 when it organized the first United Nations (UN) International Agroecology Conference at its headquarters in Rome. Since then FAO has organized regional agroecology conferences in Africa, Asia and Latin America, and has published several papers and books on the practices and research of agroecology.

The Origins of the Formal International Movement

The formal international movement began in France on 5 November 1972 when at the invitation of Roland Chevriot of Nature et Progrès in France, Lady Eve Balfour a founder of the UK Soil Association, Kjell Arman from the Swedish Biodynamic Association, Pauline Raphaely from the Organic Soil Association of SA, and Jerome Goldstein from the Rodale Institute (and others) held a meeting at Versailles and formed IFOAM (IFOAM, 2018).

IFOAM is the international umbrella movement that has the role to both lead and unite the organic sector around the world. It is the
organization that sets the international standards, policies, definitions and positions around the multi-functionality of OA through consulting with its members; these cover the whole spectrum of the sector in most countries in the world. Consequently, IFOAM documents are seen as credible source texts for reference material. Most of the world’s organic standards and certifications systems are based directly or indirectly on IFOAM’s Standards. The affiliates of IFOAM adopted the name IFOAM-Organics International at the General Assembly in 2014. This change makes it easier for people to understand that it is the international change agent and umbrella body for the organic sector.

Organic Agriculture Principles and Definitions

The principles of organic agriculture

The major concerns and concepts that were advocated by the founders and key opinion leaders of the organic movement over the last century, such as soil health, ecology, care, and using the precautionary principle with new technologies have been clearly articulated in IFOAM’s four principles of OA.

The four principles of OA were developed from current organic practices through extensive worldwide consultation by IFOAM-Organics International. They are the agreed international consensus on the fundamental basis of organic production.

These principles are used by IFOAM-Organics International and other organic organizations to inform the development of practices, positions, programmes and standards. The definition and the four principles may be found on the IFOAM website, which also has many links to training, research and national OA movements (see IFOAM, 2008).

In summary, OA is based on:

- the principle of health;
- the principle of ecology;
- the principle of fairness; and
- the principle of care.

Principle of health

OA should sustain and enhance the health of soil, plant, animal, human and planet as one and indivisible.

This principle points out that the health of individuals and communities cannot be separated from the health of ecosystems – healthy soils produce healthy crops that foster the health of animals and people.

Health is the wholeness and integrity of living systems. It is not simply the absence of illness, but the maintenance of physical, mental, social and ecological well-being. Immunity, resilience and regeneration are key characteristics of health.

The role of OA, whether in farming, processing, distribution or consumption, is to sustain and enhance the health of ecosystems and organisms from the smallest in the soil to human beings. In particular, OA is intended to produce high quality, nutritious food that contributes to preventive healthcare and well-being. In view of this, it should avoid the use of fertilizers, pesticides, animal drugs and food additives that may have adverse health effects.

Principle of ecology

OA should be based on living ecological systems and cycles, work with them, emulate them and help sustain them.

This principle roots OA within living ecological systems. It states that production is to be based on ecological processes, and recycling. Nourishment and well-being are achieved through the ecology of the specific production environment. For example, in the case of crops this is the living soil; for animals it is the farm ecosystem; for fish and marine organisms, the aquatic environment.

Organic farming, pastoral and wild harvest systems should fit the cycles and ecological balances in nature. These cycles are universal but their operation is site specific. Organic management must be adapted to local conditions, ecology, culture and scale. Inputs should be reduced by reuse, recycling and efficient management of materials and energy in order to maintain and improve environmental quality and conserve resources.

OA should attain ecological balance through the design of farming systems, establishment of habitats and maintenance of genetic and agricultural diversity. Those who produce, process, trade or consume organic products should protect and benefit the common environment including landscapes, climate, habitats, biodiversity, air and water.
**Principle of fairness**

OA should build on relationships that ensure fairness with regard to the common environment and life opportunities.

Fairness is characterized by equity, respect, justice and stewardship of the shared world, both among people and in their relations to other living beings.

This principle emphasizes that those involved in OA should conduct human relationships in a manner that ensures fairness at all levels and to all parties – farmers, workers, processors, distributors, traders and consumers. OA should provide everyone involved with a good quality of life, and contribute to food sovereignty and reduction of poverty. It aims to produce a sufficient supply of good quality food and other products.

This principle insists that animals should be provided with the conditions and opportunities of life that accord with their physiology, natural behaviour and well-being.

Natural and environmental resources that are used for production and consumption should be managed in a way that is socially and ecologically just and should be held in trust for future generations. Fairness requires systems of production, distribution and trade that are open and equitable and account for real environmental and social costs.

**Principle of care**

OA should be managed in a precautionary and responsible manner to protect the health and well-being of current and future generations and the environment.

OA is a living and dynamic system that responds to internal and external demands and conditions. Practitioners of OA can enhance efficiency and increase productivity, but this should not be at the risk of jeopardizing health and well-being. Consequently, new technologies need to be assessed and existing methods reviewed. Given the incomplete understanding of ecosystems and agriculture, care must be taken.

This principle states that precaution and responsibility are the key concerns in management, development and technology choices in OA. Science is needed to ensure that OA is healthy, safe and ecologically sound. However, scientific knowledge alone is not sufficient. Practical experience, accumulated wisdom and traditional and indigenous knowledge offer valid solutions, tested by time. OA should prevent risks by adopting appropriate technologies and rejecting unpredictable ones, such as genetic engineering. Decisions should reflect the values and needs of all who might be affected, through transparent and participatory processes (IFOAM, 2018).

**Organic 3.0**

IFOAM-Organics International put forward the concept of Organic 3.0 in 2013. This is the third phase in the development of the organic sector.

The overall goal of Organic 3.0 is to enable a widespread uptake of truly sustainable farming systems and markets based on organic principles and imbued with a culture of innovation, of progressive improvement towards best practice, of transparent integrity, of inclusive collaboration, of holistic systems, and of true value pricing. (Arbenz et al., 2016)

The three phases of development in the organic sector are:

- **Organic 1.0** – This was started by our numerous pioneers, who observed the problems with the direction that agriculture was taking at the end of the 19th century and the beginning of the 20th century and saw the need for a radical change.
- **Organic 2.0** – This was started in the 1970s when the writings and agricultural systems developed by our pioneers were codified into standards and then later into legally mandated regulatory systems.
- **Organic 3.0** – This is about bringing organic out of its current niche into the mainstream and positioning organic systems as part of the multiple solutions needed to solve the tremendous challenges faced by our planet and our species.

The aim is to promote OA as a lighthouse for truly sustainable agriculture and agriculture production systems. Organic 3.0 expands the participation options, and positions organic as a modern, innovative farming system that holistically integrates local and regional context including its ecology, economy, society, culture and accountability. Regeneration of resources, responsibility
in production, sufficiency in consumption, and the ethical and spiritual development of human values, practices and habits are concepts that guide the building of a new organic culture that can drive societal development. At the heart of Organic 3.0 are the living relationships between consumers and producers, which include information on products, production and the multiple benefits of OA.

Organic 3.0 is not prescriptive but descriptive; instead of enforcing a set of minimum rules to achieve a static result, this model is outcome-based and continuously adaptable to local context. Organic 3.0 is grounded upon clearly defined minimum requirements such as the ones maintained by many government regulations and private schemes around the world, and in the objectives of the IFOAM Standards Requirements. It expands outward from these base requirements. It calls for a culture of continuous improvement through private sector- and stakeholder-driven initiatives towards best practices based on local priorities, and as described in the Best Practices Guidelines of IFOAM-Organics International.

IFOAM-Organics International spent 3 years consulting with a wide cross section of stakeholders to ensure that there was a true consensus over Organic 3.0.

The strategy for Organic 3.0 includes six main features:

1. A culture of innovation, to attract greater farmer adoption of organic practices and to increase yields.
2. Continuous improvement towards best practice, at a localized and regionalized level.
3. Diverse ways to ensure transparent integrity, to broaden the uptake of OA beyond third-party assurance and certification.
4. Inclusiveness of wider sustainability interests, through alliances with the many movements and organizations that have complementary approaches to truly sustainable food and farming.
5. Holistic empowerment from the farm to the final product, to acknowledge the interdependence and real partnerships along the value chain.
6. True value and fair pricing, to internalize costs, encourage transparency for consumers and policy makers and to empower farmers as full partners.

The final document that defines Organic 3.0 (Arbenz et al., 2016) was approved at the IFOAM-Organics International General Assembly in New Delhi, India in November 2017.

Regenerative Agriculture

The Rodale Institute has pioneered regenerative agriculture. Robert Rodale, the son of J.I. Rodale, coined the term ‘regenerative OA’ to distinguish a kind of farming that goes beyond simply ‘sustainable’ (Rodale Institute, 2018).

It is a concept in which agricultural systems improve the resources they use, rather than destroying or depleting them. It is a holistic systems approach to farming that encourages continual innovation for environmental, social, economic and spiritual well-being. It is closely aligned with the concept of Organic 3.0.

Regeneration is far more than being sustainable. Sustainable is defined as meeting the needs of the present without compromising the ability of future generations to meet their own needs (Regeneration International, 2018).

However, as pointed out in the Introduction of this book, in this era of the Anthropocene, the world is facing multiple environmental, social and economic crises. These include global warming, climate change, food insecurity, an epidemic of non-contagious chronic diseases, wars, refugees, migration crises, increasing poverty, ocean acidification, the collapse of whole ecosystems, the unsustainable extraction of resources and the greatest extinction event in geological history. Simply being sustainable is not enough.

Do we want to sustain the current status quo or do we want to improve and rejuvenate it? Regeneration improves the current system. We need to do more than ensure that things don’t run down any further; we have to repair the extensive damage that our species has caused to our only planet.

Regenerative agriculture improves the land by using technologies that regenerate and revitalize the soil and the environment. The primary aim of regenerative agriculture is to increase the levels of soil organic matter. This leads to multiple positive outcomes such as: (i) better resilience to extreme weather events; (ii) increased efficiency in the soil’s water holding capacity;

...
(iii) fewer diseases due to the beneficial soil biota controlling pathogens; and (iv) increases in the bioavailability of the nutrients that plants, animals and humans need (Regeneration International, 2018).

Regenerative agriculture is dynamic and holistic. It incorporates a mix of best practices that are known to improve soils and agrobiodiversity. These include agroecology, organic farming practices, no-till/low-till, cover crops, crop rotations, holistic grazing, permaculture, composting, mobile animal shelters, pasture cropping, agroforestry, analog forest farming, ecological agriculture and others.

The Formation of the International Regeneration Movement

The international regeneration movement started at a meeting in the Rodale headquarters in New York during the UN Climate Change meeting (Regeneration International, 2018), and the protest march which followed in September 2014.

Regeneration International, an organization that promotes food, farming and land use systems, was formed at a conference in Costa Rica the following year. Its aim is to regenerate and stabilize climate systems, the health of the planet and people, communities, culture and local economies, democracy and peace. At the time of writing (2018) it has over 100 partner organizations in over 30 countries. One of Regeneration International’s main aims is to reverse climate change by using photosynthesis processes of agriculture to draw down CO₂ and store it in the soil as soil organic matter. It is working closely with the ‘4 per 1000 Initiative’ (Regeneration International, 2018).

On 1 December 2015, the French Government launched the ‘4 per 1000 Initiative: Soils for Food Security and Climate’, that will use a range of agricultural systems to sequester CO₂ and store it in the ground as soil organic carbon. A total of 31 countries signed on to this initiative along with key international organizations such as the FAO, the Global Environment Facility, the International Fund for Agriculture Development, the World Bank and the Asian Development Bank. In addition, 26 research institutes and universities have signed on along with over 100 non-government organizations (NGOs) and private sector organizations. This initiative is intended to complement the efforts needed to reduce global greenhouse gas (GHG) emissions. The 4 per 1000 Initiative is part of the framework of the Lima–Paris Action Agenda and consequently it is part of the global climate change agreement that was signed in Paris in December 2015. The title comes from research that determined that an annual growth rate of four parts per 1000 in global soil carbon stock would make it possible to stop the present increase in atmospheric CO₂.

This growth rate is not a normative target for every country but is intended to show that even a small increase in the soil carbon stock (agricultural soils, notably grasslands and pastures, and forest soils) is crucial to improve soil fertility and agricultural production and to contribute to achieving the long-term objective of limiting the temperature increase to +1.5–2°C, the threshold beyond which the IPCC indicates that the effects of climate change are significant.

(Initiative 4 pour 1000, 2018)

Regeneration International is an active part of the 4 per 1000 Initiative consortia. It has been organizing meetings and events to raise awareness that the widespread adoption of regenerative agriculture practices can sequester enough CO₂ to reverse climate change. These events feature published peer-reviewed papers and evidence-based practice (Regeneration International, 2018).

A new Regenerative Organic Certification was launched in 2018. It was developed through a cooperative effort among a coalition of farmers, ranchers, non-profit organizations, scientists and brands, led by the Rodale Institute. Its aim is to reach above the basic organic standards and set guidelines for soil health and land management, animal welfare, and farmer and worker fairness (Rodale Institute, 2018).

Editor’s note: To this chapter by Andre Leu, I have added an historical perspective, shown in Box 2.1, consisting of reflections sent to me by Paul Hepperly, who ran the Rodale Institute’s long-term trials for many years (Paul Hepperly, Research Director (retired), Rodale Institute, Kutztown, Pennsylvania, 2018, personal communication).
Box 2.1. Paul Hepperly’s reflections on the historical perspective of organic agriculture

In the first 40 years of the 20th century advances in genetics, biochemistry and engineering rapidly and profoundly changed farming. The introduction of the internal combustion engine ushered in the tractor era of mechanization, with the allied development of numerous petroleum-driven implements for farm use. Plant breeding research and development led to hybrid seed commercialization. Chemists Haber and Bosch developed a new manufacturing process making nitrogen fertilizer cheap and available. Based on this, nitrogen fertilizers, which rapidly stimulate plant growth at low cost, were widely adopted by farmers in the 20th and 21st centuries.

In 1944 in Mexico the Rockefeller Foundation sponsored the campaign termed the Green Revolution. The Rockefeller Foundation is historically tied to the domestic and global petroleum industry Standard Oil. Green Revolution agriculture depends on heavy use of synthetic fertilizer (which requires fossil fuels), heavy equipment, pesticides, dwarfed grain varieties (which would respond to high input without lodging) and large-scale energy-intensive irrigation.

Machinery diminishes the large need for human hand labour in agriculture: there were almost no tractors in the USA around 1910, but over 3,000,000 by 1950; in 1900, it took one farmer to feed 2.5 people, but currently the ratio is one farmer to well over 100 consumers. As fields grew bigger and cropping more specialized to make more efficient use of machinery the use of animal/human labour was reduced by substituting machinery. This made it possible to farm more intensively and genetics, agrochemistry and mechanization coevolved simultaneously and rapidly and were sold as a systematic approach to modern farming. These technologies, which are petroleum based, have large energy and environmental costs associated with them which, for instance, are shown in agriculture-driven deterioration of soil, air and water quality.

In the USA modern organic farming has grown to respond to Green Revolution agriculture which featured the use of ammoniated fertilizers, pesticides and new narrow genetic proprietary seed resources increasingly dominated by international corporate interests. As more and more sophisticated machinery was developed, large tracts of land were put into production by fewer and fewer farmers. After the Second World War, agricultural research concentrated on new machinery, genetics and agrochemical approaches. The explosive use of chemicals was sold to the public as imperative, in order to improve the ability of producing food for burgeoning human populations. The scare tactic employed was the assertion that high global population growth would lead to massive starvation unless the US’ intensified agriculture system was employed globally.

In 1962, Rachel Carson, noted writer, scientist and naturalist, published *Silent Spring*. This transformative work chronicled the effects of DDT (dichlorodiphenyltrichloroethane) on the environment. A bestseller in many countries, including the USA, and widely read around the world, *Silent Spring* is widely considered as being a key factor in the US government’s 1972 banning of DDT. The book and its author are often credited with launching the worldwide environmental movement. In the 1970s, global movements concerned with pollution and the environment increased their focus on organic farming. As the distinction between organic and conventional food became clearer, one goal of the organic movement was to encourage consumption of organic and locally grown food. This was promoted through slogans like ‘Know Your Farmer, Know Your Food’.

In the USA during the 1970s and 1980s, J.I. Rodale and the Rodale Press led the way in getting Americans to think about the side effects of non-organic methods, and the advantages of organic ones. The Rodale books offered how-to information and advice to Americans interested in trying organic gardening and farming. In 1981 Robert Rodale initiated a biometrically well-designed trial (the Rodale Farming Systems Trial) that compared OA systems to conventional maize and soybean production, as recommended by the state Cooperative Extension Service. Within 3 years, yields of all crops were comparable for organic and conventional systems, but as soil organic matter increased, drought losses decreased and the soil fertility of trial plots under organic management compared favourably with conventional treatments. The Rodale organic systems used no synthetic inputs and produced yields superior to the yields of county conventional farmers.

By 1984, Oregon Tilth and Rodale established an early organic certification service in the USA. In the 1980s, around the world, farming and consumer groups began seriously pressuring for government regulation of organic production. This led to legislation and certification standards being enacted through the 1990s. In the USA, the Organic Foods Production Act of 1990 tasked the United States...
Department of Agriculture (USDA) with developing national standards for organic products, and the final rule establishing the National Organic Program (NOP) was first published in the 2000 Federal Register. From the early 1990s, the retail market for organic farming in developed economies has been growing by about 20% annually due to increasing consumer demand. Concern for the quality and safety of food, and the potential for environmental damage from conventional agriculture, are apparently responsible for this trend. In the 1990s principal field crops starting with soybean, maize and cotton were genetically engineered (GE) by major chemical seed companies to be dependent on glyphosate herbicide and *Bacillus thuringiensis* (BT) insecticide.

As concerns about GE technology grew, the acreage of certified organic farms expanded greatly. Throughout this history, the focus of agricultural research and the majority of publicized scientific findings have been on chemical, not organic, farming. This emphasis has continued with biotechnologies in general, and with GE in particular. This imbalance is largely driven by agribusiness, which, through research funding and government lobbying, continues to have a predominating effect on agriculture-related science and policy. Agribusiness has lobbied continually to change the rules of the organic market. Organic farming was driven by small, independent producers and consumers. In recent years, explosive organic market growth has encouraged the participation of agribusiness interests. As the volume and variety of ‘organic’ products increases, the viability of the small-scale organic farm is at risk, and the meaning of organic farming as an agricultural production system is ever more easily confused with the related but separate areas of organic food and organic certification.

(Paul Hepperly, Research Director (retired), Rodale Institute, Kutztown, Pennsylvania, 2018, personal communication)

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**References**


Regenerative Agriculture works best when the farming or ranching operation is viewed as an ecosystem. There are six core principles of regenerative agriculture that we use as the basis for our work. We believe that to generate positive impact at scale, all types of agriculture - organic and conventional - can be part of the solution. Measuring Outcomes. We believe measuring outcomes is critical to ensure that implementing regenerative agriculture leads to desirable outcomes. Farmer Economic Resilience. Regenerative agriculture is a conservation and rehabilitation approach to food and farming systems. It focuses on topsoil regeneration, increasing biodiversity, improving the water cycle, enhancing ecosystem services, supporting biosequestration, increasing resilience to climate change, and strengthening the health and vitality of farm soil. Practices include recycling as much farm waste as possible and adding composted material from sources outside the farm. What is Regenerative Agriculture? Why is it important? What kinds of benefits does it bring? We revisit the birthplace of the Campesino a Campesino movement in Guatemala where resilience intersects with agroecology and longstanding agrarian demands. View. Show abstract. Regenerative Agriculture and the Quest for Sustainability - Inquiry of an Emerging Concept (Master Thesis). Thesis. Full-text available.