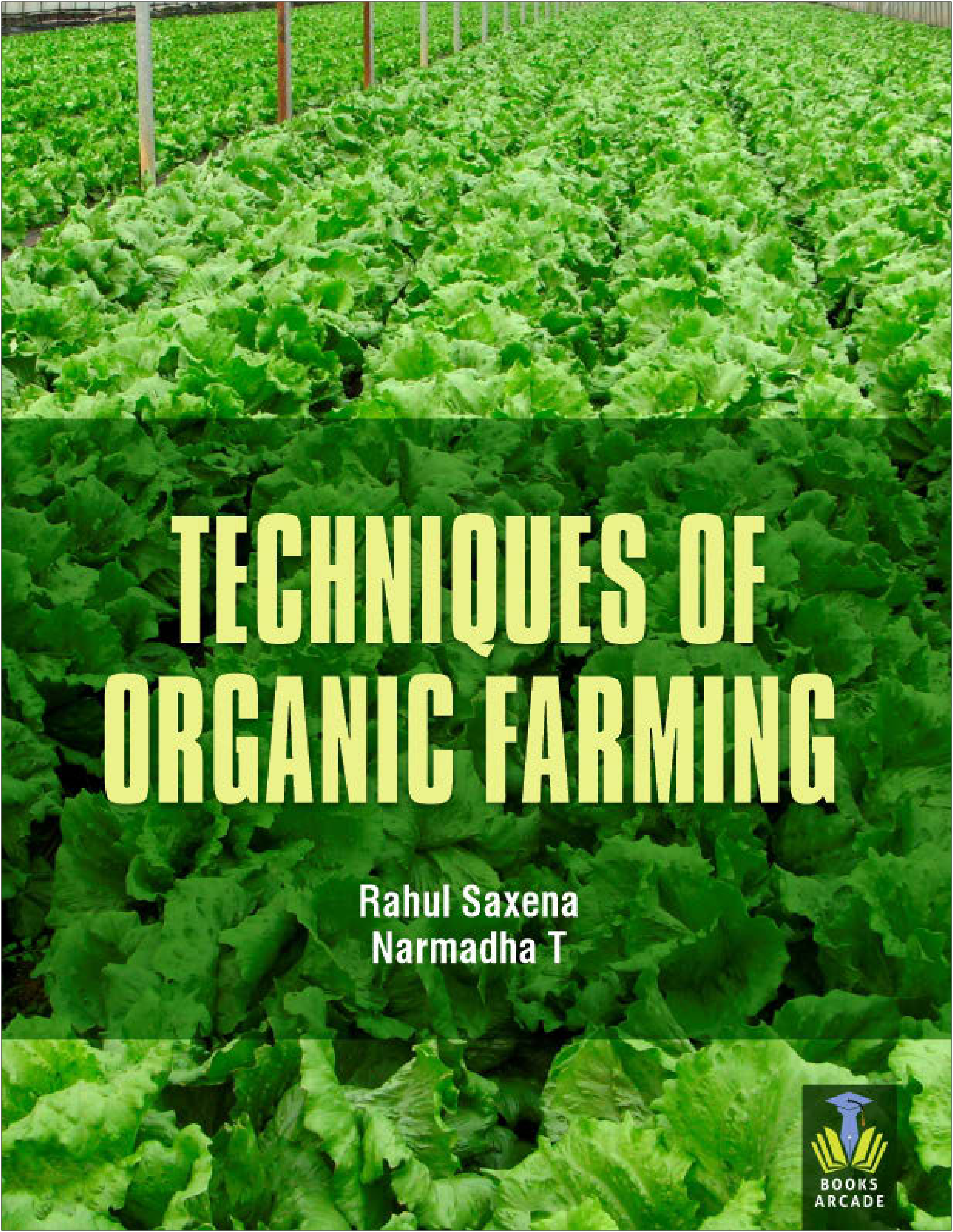

TECHNIQUES OF ORGANIC FARMING

Rahul Saxena
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Techniques of Organic Farming

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CHAPTER 1

FUNDAMENTALS OF ORGANIC FARMING

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Organic farming is a method of agriculture that emphasizes the use of environmentally friendly and sustainable practices to produce crops and livestock. It is a production system that avoids the use of synthetic chemicals, pesticides, and fertilizers, and instead relies on natural processes and materials to promote healthy soil and crops. Organic farming aims to create a self-sustaining, closed system where soil fertility is maintained through the use of cover crops, composting, and crop rotation, and pests and diseases are controlled through natural methods such as the use of beneficial insects and crop diversity.

The principles of organic farming were first established in the 1940s by scientists and farmers who were concerned about the environmental impact of chemical-intensive agriculture. Since then, organic farming has evolved into a comprehensive system of food production that incorporates social, economic, and environmental concerns. Organic farmers work to create a harmonious balance between the needs of their crops, animals, and the environment, and to produce healthy food for consumers. One of the key benefits of organic farming is the improvement of soil quality. The absence of synthetic chemicals and fertilizers helps to maintain the soil's natural structure and fertility, leading to healthier and more productive crops. Organic farming also promotes the use of cover crops and crop rotation, which help to improve soil structure, reduce soil erosion, and control pests and diseases.

Another important aspect of organic farming is the reduction of environmental pollution. By avoiding the use of synthetic chemicals, organic farmers help to reduce the amount of pesticides and other pollutants that can harm the environment and wildlife. Organic farming also encourages the use of alternative methods of pest control, such as the use of beneficial insects and crop diversity, which can reduce the need for synthetic pesticides and help to protect the environment. Organic farming is also beneficial for human health. Organic food is often higher in essential nutrients such as vitamins and minerals, and is free from harmful chemicals and synthetic additives. This means that consumers can be confident that they are eating food that is not only healthy, but also produced in an environmentally responsible way.

Organic farming can also provide a number of economic benefits. Organic farmers often receive a premium price for their products, and the demand for organic food is growing rapidly, leading to increased opportunities for farmers. In addition, organic farming can provide a more stable and secure income, as it is less dependent on the fluctuations of the global market and the price of synthetic chemicals and fertilizers. Despite the many benefits of organic farming, it can also have some challenges and limitations. Organic farmers face higher production costs, as they often have to rely on more labour-intensive methods of production and use higher-priced organic inputs. Organic farmers may also face challenges in terms of access to markets, as the distribution channels for organic food are not as well established as those for conventional food.

In conclusion, organic farming is a holistic and sustainable approach to food production that takes into account the needs of the environment, farmers, and consumers. By reducing the use of synthetic chemicals, promoting soil health, and producing healthy food, organic farming can help to create a more sustainable and environmentally responsible food system.

Organic farming is an agricultural method that avoids the use of synthetic fertilizers, pesticides, and genetically modified organisms (GMOs) in order to produce crops and livestock. Instead, organic farmers rely on techniques such as crop rotation, composting, and natural pest control methods to maintain soil fertility and protect crops from pests. The goal of organic farming is to create a self-sustaining, closed system where soil fertility is maintained through the use of organic matter and beneficial soil microorganisms. Organic farmers aim to create a balance between crop production and the preservation of natural resources, such as soil, water, and biodiversity.

Organic farming dates back to the early 20th century, when scientists began to raise concerns about the long-term effects of synthetic fertilizers and pesticides on soil health and human health. In the 1960s and 1970s, a growing number of farmers began to embrace organic principles as an alternative to conventional agriculture.

Today, organic farming has gained widespread popularity and is a growing segment of the global food industry. According to the U.S. Department of Agriculture (USDA), sales of organic products in the United States reached $50 billion in 2020, and the global organic food market is expected to reach $320 billion by 2025.

One of the key benefits of organic farming is improved soil health. By avoiding synthetic fertilizers, organic farmers allow soil microorganisms to thrive, which helps to maintain soil structure and fertility. This in turn leads to healthier crops that are more resilient to disease and pests. Organic farming also promotes biodiversity by encouraging the presence of beneficial insects, birds, and other wildlife. This helps to create a more balanced ecosystem that supports a wider range of species.

Another important benefit of organic farming is reduced pollution. Synthetic fertilizers and pesticides can have negative impacts on water quality, air quality, and human health. By avoiding these chemicals, organic farmers help to protect the environment and reduce the risks associated with exposure to these substances. Organic farming also supports local economies. By using locally sourced inputs and marketing their products directly to consumers, organic farmers can help to create local jobs and stimulate local economic activity. This helps to strengthen the local food system and make communities more self-sufficient.

However, organic farming can also be more challenging and labor-intensive than conventional agriculture. Organic farmers must rely on traditional methods, such as crop rotation and composting, to maintain soil fertility and control pests, which can be time-consuming and require a greater investment of labor. Additionally, organic crops are often more expensive to produce and are therefore sold at a premium, which can limit their affordability for some consumers.

In conclusion, organic farming is an agricultural method that seeks to create a sustainable, closed system where crops are produced in a way that protects natural resources and promotes soil health, biodiversity, and reduced pollution. While organic farming can be more challenging than conventional agriculture, it offers many benefits, including improved soil health, reduced pollution, and support for local economies.

Figure 1.1 Shows the Organic Farming Basic Steps.

Organic farming also supports biodiversity, as it encourages the use of a wide range of crop and animal species and the preservation of natural habitats. This is in contrast to conventional farming, which often relies on monoculture crops and intensive livestock production, which can lead to the loss of habitat and the decline of wildlife populations. In addition to the benefits for the environment and wildlife, organic farming also supports rural communities and can contribute to social and economic development. Organic farming provides employment opportunities and can help to revitalize rural areas, as it often involves smaller-scale, family-run farms. Organic farmers also work to build strong relationships with their local communities, and many are involved in education and outreach programs to promote the benefits of organic farming.

Organic farming can also help to promote food security, as it provides a reliable source of healthy food and can help to reduce dependence on imports. This is particularly important in developing countries, where organic farming can help to provide food for local communities and support rural livelihoods. Despite these benefits, organic farming still faces many challenges and limitations. One of the main challenges is the lack of research and development in organic farming, which means that organic farmers often have limited access to the latest information and technologies. This can make it more difficult for organic farmers to stay competitive and to adopt new practices and technologies that can improve the sustainability and efficiency of their operations.

Another challenge facing organic farmers is the lack of consumer awareness and understanding about the benefits of organic food. While the demand for organic food is growing, many consumers are still unaware of the differences between organic and conventional food, and the benefits of organic farming.

Organic farming also faces challenges in terms of certification and labeling. Certification is a key component of organic farming, as it helps to ensure that organic products are produced in accordance with strict environmental and social standards. However, the certification process can be complex and time-consuming, and the cost of certification can be a barrier for some small-scale farmers. In addition to these challenges, organic farmers also face a number of economic and marketing challenges, such as the need to find reliable markets for their products and to receive fair prices for their products. Organic farmers may also face difficulties in terms of access to credit, as many conventional banks and lending institutions are not familiar with the principles and practices of organic farming.

Despite these challenges, the organic farming movement continues to grow and gain momentum, as consumers become more concerned about the environmental and health impacts of conventional agriculture and seek out alternatives. Many governments and organizations are also working to support the growth of organic farming and to help address some of the challenges facing organic farmers.

For example, some governments are providing financial support to help farmers transition to organic farming, and to help develop the organic farming sector. Some organizations are also working to promote consumer awareness and understanding of organic farming, and to help increase the availability of organic products in local markets.

Organic farming is a valuable and important part of the global food system, providing a range of benefits for the environment, farmers, communities, and consumers. Despite the challenges and limitations, the organic farming movement continues to grow and gain momentum, and is likely to play an increasingly important role in shaping the future of agriculture. With the support of governments, organizations, and consumers, organic farming has the potential to contribute to a more sustainable and environmentally responsible food system that supports the health and well-being of both people and the planet.

Organic farming is based on the principles of ecological balance, which means that it mimics natural ecosystems by relying on the interactions between soil, plants, animals, and the environment. This is achieved by using practices that maintain soil fertility, conserve natural resources, and promote biodiversity. Some of the key principles of organic farming include:

1. **Soil fertility management:** Organic farmers aim to improve and maintain soil fertility by using natural methods such as crop rotation, composting, and the use of cover crops. These methods help to add organic matter to the soil and create a healthy soil environment that supports the growth of crops.
2. **Pest and disease management:** Organic farmers use a combination of cultural, biological, and physical methods to control pests and diseases. For example, they may use companion planting, row covers, and natural predators to control pests, or use crop rotation and sanitation to prevent the spread of diseases.
3. **Biodiversity:** Organic farming promotes biodiversity by creating a diverse range of habitats for wildlife and beneficial insects. This helps to create a balanced ecosystem that supports a wider range of species and helps to maintain soil fertility and control pests.

4. **Energy conservation:** Organic farming aims to conserve energy by reducing the use of synthetic inputs, such as pesticides and fertilizers, which require large amounts of energy to produce. Additionally, organic farmers often use practices such as intercropping, green manuring, and cover cropping that help to reduce energy inputs and promote energy efficiency.
5. **Reduced pollution:** Organic farming helps to reduce pollution by avoiding the use of synthetic fertilizers and pesticides that can leach into the soil and water, and by reducing the emissions of greenhouse gases associated with synthetic inputs.
6. **Support for local communities:** Organic farming supports local communities by creating local jobs, stimulating local economic activity, and helping to strengthen local food systems.

Organic farming also offers many benefits to consumers. Organic foods are often more nutritious than conventional foods, with higher levels of vitamins, minerals, and antioxidants. Additionally, organic foods are free from synthetic chemicals, such as pesticides and fertilizers, which can be harmful to human health. Organic farming also benefits the environment by reducing the use of synthetic inputs and promoting energy efficiency. This helps to reduce greenhouse gas emissions and conserve natural resources, such as soil and water. Additionally, organic farming promotes biodiversity by creating habitats for wildlife and beneficial insects.

However, there are also some challenges associated with organic farming. Organic farming can be more labor-intensive and time-consuming than conventional farming, as it requires the use of traditional methods to maintain soil fertility and control pests. Additionally, organic crops are often more expensive to produce and are therefore sold at a premium, which can limit their affordability for some consumers. The tenets and logic of organic farming are based on the idea that everything in a living system soil, plants, farm animals, insects, farmers, and environmental factors—is interconnected and works as a single unit. When practical, agronomic, biological, and mechanical means are used to achieve this, according to the utilising the natural ecosystem as a model, the principles underlying these interactions.

Modeling the Natural Ecosystem

Many of the practises employed in other sustainable agricultural systems, such as intercropping, crop rotation, mulching, and integrating crops and animals, are also utilised in organic agriculture. However, the fundamental principles that distinguish organic agriculture as a distinct agricultural management system are the use of natural (non synthetic) inputs, the enhancement of soil structure and fertility, and the adoption of a crop rotation plan. An organic production system is intended to: Improve biological diversity within the system; Increase soil biological activity; Maintain long-term soil fertility; Recycle wastes of plant and animal origin in order to return nutrients to the soil, thereby minimising the use of non-renewable resources; Rely on renewable resources in locally organised agricultural activities. Additionally, criteria for organic production and processing have been extensively embraced by the organic community by the International Federation of Organic Agriculture Movements (IFOAM), a nonprofit organisation that networks globally and promotes organic agriculture.

The aim of organic agriculture is to maintain and improve the health of ecosystems and creatures, from the tiniest in the soil to humans, whether in farming, processing, distribution, or consumption. Given this, it should refrain from using fertilisers, pesticides, animal medications, and food additives that might be harmful to one's health. Ecological principle: organic farming should be based on dynamic ecological cycles and processes and should cooperate with, model, and support them. Organic management has to be adjusted to the size, ecology, and culture of the area. Reusing, recycling, and managing materials and energy effectively can help reduce inputs, enhance environmental quality, and save resources.

The fairness concept stresses that people participating in organic agriculture should conduct their interpersonal interactions in a way that provides equity for all stakeholders, including farmers, employees, processors, distributors, merchants, and consumers. Additionally, it demands that circumstances and possibilities for life be given to animals in accordance with their physiology, natural behaviour, and wellbeing. The management of natural and environmental resources utilised in production and consumption should be fair from a social and ecological perspective and should be done so with regard to future generations. Principle of Care: According to this principle, caution and responsibility are the main concerns in management, development, and technology choices in organic agriculture. Fairness necessitates open, equitable, and commercial systems of production, distribution, and trade that take real environmental and social costs into account. To guarantee that organic farming is safe, secure, and environmentally sound, science is required.

However, it has to take into account workable solutions derived from real-world experience, accumulated traditional knowledge, and indigenous wisdom and avert major hazards by embracing suitable technology and eschewing uncertain ones, like genetic engineering. To improve sustainability, organic agriculture aims to have a positive impact. What, though, does sustainability entail? Sustainability in agriculture refers to the effective management of agricultural resources to meet human needs while also preserving or improving the environment's quality and protecting natural resources for future generations. Therefore, sustainability in organic farming must be seen holistically, taking into account ecological, economic, and social factors.

The Three Dimensions of Sustainability

An agricultural system can only be said to be sustainable if all three criteria are met. Crop rotations, organic manure, mulches, and the use of fodder legumes for providing nitrogen to the soil fertility cycle are known as organic agricultural practises. They also include the prevention of soil erosion and compaction via the use of mixed and relay crops. Promoting biological diversity by using natural pest controls (such as biological control and plants with pest control properties) as opposed to synthetic pesticides, which are known to kill beneficial organisms (such as bees, earthworms, and natural pest parasites) and often pollute water and land when used improperly. Performing crop rotations, which promote a variety of food crops, fodder, and underutilised species; this may help with on-farm conservation of plant genetic resources in addition to enhancing overall farm output and fertility. Using agricultural wastes (straws, stovers, and other inedible portions) as compost, mulch, or farmyard manure is one way to recycle the nutrients.

Using on-farm forestry, including livestock, tree crops, and renewable energy sources into the system. In addition to draught animal power, this increases revenue via the sale of organic meat, eggs, and dairy goods. The system's integrated tree crops and on-farm forestry provide food, money, fuel, and timber. Equity between and among generations is another aspect of sustainability. By lowering the loss of arable land, water pollution, biodiversity erosion, GHG emissions, food losses, and pesticide toxicity, organic agriculture improves societal well-being.

Traditional knowledge and culture are the foundation of organic agriculture. Its agricultural practises adapt to the specific biophysical, socioeconomic, and environmental limits and possibilities in the area. The economic climate and growth of rural areas may be enhanced by using local resources, local expertise, and establishing connections between farmers, consumers, and their markets. In order to maximise farm production, reduce farm susceptibility to weather whims, and ultimately improve food security, whether via the food the farmers produce or the cash from the items they sell, organic agriculture places a strong emphasis on variety and adaptive management.

Organic farming seems to increase employment in rural regions by 30%, and labour productivity is greater for each hour worked. Organic farming helps smallholder's access markets and generate revenue by better using local resources. It also relocalizes food production in market-marginalized regions. In wealthy nations, organic yields are typically 20% lower than high-input systems, but in dry and semi-arid regions, they may be up to 180% greater. In humid environments, rice paddy yields are comparable but perennial crop output is lower, while agroforestry adds extra benefits.

Operating expenses in organic agriculture are much cheaper than those in conventional agriculture (seeds, rent, maintenance, and labour costs range from 50–60% for grains and legumes to 20–25% for dairy cows and 10–20% for horticultural products). This is a result of decreased labour cash expenses, which include both paid and family labour, cheaper irrigation costs, and lower input prices for synthetic inputs. However, overall expenses are only marginally cheaper than traditional because of additional expenditures made during conversion (such as new orchards and animal quarters) and certification, which raises fixed costs (such as land, buildings, and equipment). New export potential are brought about by the demand for organic goods. Exports of organic goods often command premiums of 20% or more over comparable goods grown on non-organic farms. By raising household incomes under the correct conditions, market returns from organic agriculture may be able to support local food security.

It's difficult to break into this profitable sector. To ensure that their farms and companies uphold the organic criteria imposed by different trade partners, farmers must yearly hire an agency that certifies organic products. Farmers cannot market their food as "organic" during the 2 to 3 year conversion phase to organic management and lose out on price premiums. Customers anticipate residue-free organic products, which is why this is the case. However, products produced on land under organic management for at least one year but less than the two to three year requirement could be sold as "transition to organic" according to the Codex Guidelines on Organically Produced Food (2007); however, very few markets have developed for such products. While the majority of manufacturers in developing nations have focused on the EU and North American export markets, local market potential for organic food are now expanding globally.

Alternative alternatives to certification have developed globally, acknowledging the part local organic markets play in fostering a thriving organic industry. Consumers and organic farmers have established direct routes in industrialised nations for the home delivery of non-certified organic products (such as community supported agriculture). Small-scale organic producers are technically excluded from certification in the United States of America (USA). Participatory Guarantee Systems (PGS) are increasingly accepted as a replacement for third-party certification in poor nations (e.g. India, Brazil, Pacific islands). More recently, organic farming has emerged as a viable alternative for enhancing family food security or lowering input costs. This behaviour is being seen in industrialised nations as a result of the economic crisis. Farmers either consume their own produce or sell it on the open market at no premium since it is not certified. The goals of organic farmers frequently include maximising interactions between the land, animals, and plants, preserving natural nutrient and energy flows, enhancing biodiversity, as well as protecting the health of family farmers and advancing the overall goal of sustainable agriculture. Economic goals are not the only motivation for organic farmers.

One of the key principles of organic farming is the use of natural methods for pest and disease control, rather than relying on synthetic chemicals. Organic farmers use a variety of techniques, such as crop rotation, companion planting, and the use of natural predators, to maintain healthy soil and crops. This helps to reduce the use of harmful chemicals and reduce the negative impacts on the environment, wildlife, and human health.

Organic farming also promotes soil health, as it emphasizes the use of natural methods to maintain soil fertility. This includes the use of cover crops, compost, and other organic matter to improve soil structure and fertility. By promoting soil health, organic farming helps to increase the resilience of crops to pests and disease, and to improve crop yields over the long term.

Organic farming also supports animal welfare, as it requires that animals are treated humanely and are provided with adequate space, food, and water. Organic livestock must also be fed a diet that is free from genetically modified organisms (GMOs) and synthetic chemicals, and they must be free from routine use of antibiotics and growth hormones. By promoting animal welfare, organic farming helps to improve the health and well-being of farm animals and to reduce the negative impacts on the environment and human health.

Organic farming also helps to reduce greenhouse gas emissions, as it encourages the use of sustainable land management practices that help to sequester carbon in the soil. In addition, organic farming helps to reduce the use of synthetic fertilizers and pesticides, which are significant sources of greenhouse gas emissions. By reducing greenhouse gas emissions, organic farming helps to mitigate the impacts of climate change and to contribute to a more sustainable and environmentally responsible food system.

One of the challenges of organic farming is the higher cost of production, compared to conventional farming. This is due to the need for more labor-intensive practices, such as manual weeding and the use of natural methods for pest control, which can increase the cost of production. However, the cost of organic food is often higher for consumers, reflecting the higher costs of production and the greater demand for organic products.

Organic farming also faces challenges in terms of scalability and commercial viability, as it often involves smaller-scale operations that may struggle to compete with larger, more industrialized farming operations. In addition, organic farmers may face challenges in terms of access to markets and distribution channels, as many conventional food retailers and distributors may not be familiar with the principles and practices of organic farming.

Despite these challenges, organic farming is growing and gaining popularity, as consumers become more concerned about the environmental and health impacts of conventional agriculture and seek out alternative food options. In response, many countries are developing policies and programs to support the growth of the organic farming sector, and to help address some of the challenges facing organic farmers.

For example, some governments are providing financial support to help farmers transition to organic farming, and to help develop the organic farming sector. Some organizations are also working to promote consumer awareness and understanding of organic farming, and to help increase the availability of organic products in local markets.

Organic farming is an important and valuable part of the global food system, offering a range of benefits for the environment, farmers, communities, and consumers. Despite the challenges and limitations, organic farming is growing and gaining popularity, and is likely to play an increasingly important role in shaping the future of agriculture. With the support of governments, organizations, and consumers, organic farming has the potential to contribute to a more sustainable and environmentally responsible food system that supports the health and well-being of both people and the planet. Organic farming has become increasingly popular in recent years, as consumers and farmers alike seek more sustainable and environmentally friendly methods of food production. In many countries, the demand for organic foods has grown rapidly, leading to the establishment of many new organic farms and the conversion of existing conventional farms to organic methods.

One of the key benefits of organic farming is its positive impact on the environment. Organic farming practices conserve natural resources, such as soil and water, by avoiding the use of synthetic inputs such as pesticides and fertilizers. These inputs can leach into the soil and water, causing pollution and reducing the quality of these resources. Additionally, organic farming practices reduce greenhouse gas emissions, as they rely on natural processes and avoid the use of synthetic inputs that are energy-intensive to produce. Organic farming also promotes biodiversity by creating habitats for wildlife and beneficial insects. This helps to create a balanced ecosystem that supports a wider range of species and helps to maintain soil fertility and control pests.

In addition to its environmental benefits, organic farming offers many benefits to farmers. Organic farming practices are based on the principles of ecological balance, which means that they mimic natural ecosystems and rely on the interactions between soil, plants, animals, and the environment. This helps to improve soil fertility and reduce the need for synthetic inputs, which can be expensive and time-consuming to apply. Additionally, organic farming practices can be less labor-intensive than conventional methods, as they rely on natural processes and avoid the use of heavy machinery.

Organic farming also offers many benefits to consumers. Organic foods are often more nutritious than conventional foods, with higher levels of vitamins, minerals, and antioxidants. Additionally, organic foods are free from synthetic chemicals, such as pesticides and fertilizers, which can be harmful to human health. This makes organic foods a safer and more healthful option for consumers who are concerned about the impact of conventional farming practices on their health and the environment.

However, there are also some challenges associated with organic farming. Organic farming can be more expensive to produce than conventional farming, as it relies on traditional methods and avoids the use of synthetic inputs. Additionally, organic crops are often more expensive to produce and are therefore sold at a premium, which can limit their affordability for some consumers.

Organic farming offers a sustainable and environmentally friendly alternative to conventional agriculture, and its benefits to human health, the environment, and local communities make it an important aspect of the global food industry. However, in order for organic farming to be successful, it must be supported by government policies and programs that promote sustainable agriculture and provide farmers with the tools and resources they need to transition to organic methods. Additionally, consumers must be willing to pay a premium for organic foods, in order to support farmers and ensure the long-term viability of organic farming. By working together, farmers, policymakers, and consumers can help to create a more sustainable and equitable food system that benefits everyone.

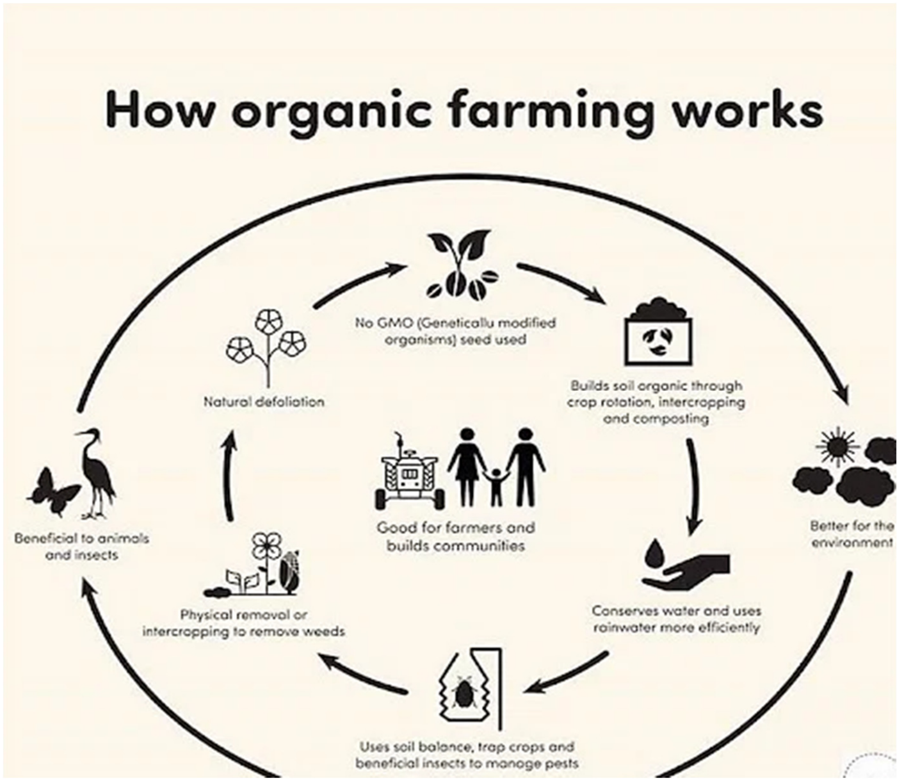

Figure 1.2 shows the working of organic farming.

An agricultural system called "organic farming" places a strong emphasis on using natural farming methods and protecting the environment. It is worried about the complete system utilized to create and supply the agricultural product as well as the final result. Due to the use of artificial goods, such as genetically engineered organisms (GMOs), and some external agricultural inputs, such as pesticides and artificial fertilizers, is prohibited throughout the whole farm cycle, from manufacturing and processing to handling and delivery. Instead, organic farmers use ecologically sound natural farming techniques and cutting-edge scientific ecological knowledge to improve the ecosystem's long-term health and production, raise the standard of their products, and preserve the environment. The argument for organic farming is that it is more environmentally friendly and less.

The initial kind of agriculture was traditional farming, which has been done for countless generations and in a variety of settings. Even though there weren't any known inorganic materials at the time, all conventional farming is today regarded as the organic farming method. An organic movement started in the 1930s as a response to agriculture's increasing reliance on chemical fertilizers and pesticides when the industrial revolution brought inorganic technologies, the majority of which were poorly developed and had negative side effects. For instance, the extensive use of chemically created agriculture inputs like urea and DDT was condemned by academics, thinkers, and professionals who questioned if such methods were sustainable. The background of this contemporary organic agricultural renaissance.

The tenets and logic of organic farming are based on the idea that everything in a living system—soil, plants, farm animals, insects, farmers, and environmental factors—is interconnected and works as a single unit. When practical, agronomic, biological, and mechanical means are used to achieve this, according to the utilizing the natural ecosystem as a model, the principles underlying these interactions Many of the techniques used in other sustainable agricultural systems, such as cropping system, crop rotation, mulching, and integrating crops and animals, are also used in organic agriculture. But the use of resources the fundamental principles that distinguish organic agriculture as a special type of agricultural management are the use of non-synthetic inputs, the enhancement of soil fertility and structure, and the adoption of a crop rotation strategy.

Increase soil biological activity, maintain long-term soil fertility, and improve biological diversity across the entire system. Rely on renewable energy sources in locally structured agricultural systems; recycle waste products of animal and plant origin to replenish nutrients in the soil; promote healthy use of soil, water, and air; and reduce all types of pollution that may result from farming methods. Finally, promote careful processing of agricultural products to preserve their organic integrity and vital qualities.

The origins of organic farming may be traced to the theories advanced by scientists like Rudolph Steiner, J.I. Rodale, Lady Eve Balfour, Sir Albert Howard, and others starting in the 1930s the organic agriculture movements serve as the foundation for modern American organic farming. From the 1920s to the 1950s extended over continental Europe and Great Britain. The early proponents of the organic movement were driven by a desire to combat agriculture's enduring issues, such as soil depletion, crop variety decrease, and erosion. Rural poverty, poor food quality, and poor livestock feed. By "feeding the earth," or increasing soil fertility, organic farming proponents felt that the greatest food quality and the longevity of agriculture could be attained. Their methods—mainly inspired by the management of crop residues, application of animal manures, permaculture, green manuring, planting longstanding forages in spinning with other crops, and the addition of lime as well as other natural stone clouds of dust to control pH and providing sufficient mineral levels were all aspects of the European and Asian models. This contrasts with the method of employing soluble fertilizers, which nourish plants directly by avoiding the soil food web.

Technology developed during World War II sped up post-war innovation in agriculture, leading to significant advancements in automation including extensive irrigation, fertilization, and insecticides. Two compounds in particular that had been made in mounts intended for military use were converted to agricultural purposes during peacetime. As a result of the abundance and low cost of ammonium nitrate as a nitrogen source, several novel pesticides were developed, with DDT ushering in an age of widespread chemical use. These technological developments had enormous economic advantages, but in the post-World War II era, organic producers and consumers were very concerned about the proliferation of chemical treatments. The Green Revolution, a global movement that began in Mexico in the 1940s, helped to create new, high-yield, disease-resistant wheat types. By fusing the existing wheat cultivars with fresh.

The importance of organic agriculture in farming and processing is a principle of health to maintain and improve the health of ecosystems, trade, or consumption organisms of all sizes, from the tiniest inside the soil to people. Given this, it should stay away from the usage of potentially harmful food additives, animal medications, insecticides, and fertilizer effects. Ecological principle: organic farming should be built on dynamic ecological systems and work with them, imitate them, and contribute to their maintenance. Organic management is required to be adjusted to the scale, ecology, and culture of the area. Reducing inputs through reuse, Recycling, and effective material and energy management will help things become better environmental quality and resource conservation.

Fairness principle:

This concept stresses that people participating in organic agriculture should conduct their interpersonal interactions in a way that provides fairness to all parties - farmers, employees, processors, distributors, merchants, and consumers - at all levels and in all situations. Additionally, it insists animals should be given the living circumstances and opportunities that are appropriate for their physiology, natural activity, and overall well-being. The management of natural and environmental resources used in both production and consumption should be fair from a social and ecological perspective and should be done so for future generations. Systems of production, distribution, and commerce must be open, equal, and take into account the true costs to the environment and society.

The release of Rachel Carson's book Silent Spring in 1962 marked a turning point for organic farming. The risks of pesticides, both actual and imagined, were brought to light in Silent Spring, which made organic farming particularly appealing and avoided using the majority of synthetic insecticides. Many people agree that DDT was banned in many nations as a result of the book Silent Spring. Frequently, the book as well as its author.

Since the earliest days of hunter-gatherer societies, through pastoral and swidden phases, to agrarian societies, with an associated trend away from nomadic to sedentary lifestyles, the acquisition of food, textiles, and other resources from plants and animals has been a major concern for human societies. However, as agricultural output increased and grew, the detrimental consequences on the foundation of resources has grown as well. Agriculture has a long history of causing environmental harm. Some of these effects include air pollution from greenhouse gases like carbon dioxide, methane, and nitrous oxide; land degradation due to clearing, cultivation of sloping land, and salinity; water pollution from fertilizers, pesticides, overuse, and wetland draining; and the loss of biological and ecological diversity (Norse and Tschirley 2003). For instance, herbicides have received a lot of attention in traditional weed research, yet they haven't led to a long-term drop in agricultural weed populations. Instead, due to widespread weed species' development of resistance to herbicides, farmers have become dependent on them (Gill 2002).

Although some may contest the magnitude of the harm, the significance of these difficulties with agricultural sustainability is shown by the official laws put in place in many nations to lessen those effects and by the financial rewards offered for (certified) excellent environmental performance (OECD 2001). Bans on an increasing number of pesticides, such as the fumigant methyl bromide, financial incentives for revegetation, fines for water pollution, and funding for research into efficiency improvement (such as fertiliser applications) or damage abatement technologies are just a few of the policies designed to improve the environmental sustainability of agriculture. The several policy instruments may be used haphazardly or, preferable, strategically, integrating the tools and creating an environment that is conducive to adoption and progress. Environmental management systems (EMS) for agriculture have lately gained popularity with certain farmers, governmental organisations, and consumers in terms of assessing performance. EMS are very new and have a number of drawbacks, including as credibility, complexity, financial risk, ambiguous customer demand, and uneven environmental improvement data (Chang and Kristiansen 2006).

A worldwide view of organic farming

Adapting organic agriculture to local agricultural, social, geographical, and climatic conditions is necessary to guarantee that it is the solution to the sustainability issue. The European model of organic agriculture, particularly its present market-driven approach, may not be the best one for other nations. The guiding principles of organic farming serve as a template for customising organic methods to each unique agricultural environment. For instance, there will always be areas where some crops cannot be economically or sustainably cultivated utilising the variety of organic techniques now available. Rational decisions about the prospects and constraints of organic agriculture can be made, and general requirements for success can be identified, as more information about the environmental, social, and economic performance of organic agriculture in a growing range of settings becomes available (OECD 2003).

It seems sense that environments like those in Europe, where organic agriculture first took off, would be the most ideal. However, it has also been shown that low-input systems in isolated areas with poor conditions, such as rangeland grazing, are well adapted to organic farming. Early proto-organic producers confronted agricultural circumstances in New Zealand and Australia that were considerably unlike from those in Europe. Australia's uneven and infrequent rainfall, old, depleted soils, widespread producing areas, and tiny population centres provide significant difficulties for both conventional and organic agriculture. It was going to take some experimenting and adapting. Because the permitted organic fertilisers are insufficient, broadacre organic farming depletes the soil of phosphorus in several areas of south-eastern Australia. On contrast, raising beef cattle organically is simple in the rangelands of western Queensland, farther north, and the farms there seem to be just as sustainable as they were before the conversion. It is obvious that the sustainability issue must be discussed in terms of certain farm types.

The majority of agricultural and food production sectors in many nations have been impacted by organic farming, which often began in niche markets like "direct to customer" or on-farm processing. It has been modified to fit social and agronomic factors in the area to create practical, sustainable agricultural methods. This has led to the emergence of several successful organic businesses all over the globe (Stokstad 2002; Thompson 2002), demonstrating the critical role that organic agriculture can play in ensuring that agriculture is entirely sustainable.

Organic farming is a tiny portion of the agribusiness industry, which is a tiny portion of the larger global socioeconomic system and its prevailing cultural ideals. As a result, organic agriculture has a limited ability to affect things like global commerce, labour relations, and agrichemical regulation. The US National Organic Program (NOP) discussions, where members from the organic movement were subordinate to government entities, serve as an illustration of this lack of influence (Merrigan 2003). The movement may have internal goals, but global markets and politics will unavoidably have an impact on how it develops.

Looking at the performance of the organic movement in a broader context reveals that, despite tremendous growth during the 1990s, organic agriculture still represents a very small share of total commercial agricultural output (Norse and Tschirley 2003).

This introduction provides an outline of the origins and growth of the organic movement from those in early 20th-century Europe to its present status as a well-known, successful niche industry in world agriculture. The chapter discusses some of the significant figures and developments that helped to create contemporary organic agriculture and provides information on the state of organic farming in various nations worldwide. The development of the fundamental ideas is also explored in order to comprehend the goals and procedures of organic agriculture. The difficulties facing organic agriculture are finally listed.

The definition of organic farming

The term "organics," or the "O-word," as sarcastically referred to organic agriculture in acknowledgement of the word's ambiguity, is a problematic one that may be used to refer to a variety of things. In his book Look to the Land from 1940, Northbourne used the word "organic" in reference to farming, writing that "the farm itself must have a biological wholeness; it must be a living creature, it must be a unit which contains within itself a balanced organic life." Clearly, Northbourne was talking about more than just organic inputs like compost when he spoke of the idea of running a farm as an integrated, entire system.

In many nations, it is illegal to use the term "organic" in relation to agricultural production or food, and different certifying bodies have different standards for compliance. Due to their traditional methods of production, many farmers in less developed nations may already practise organic farming. To simply explain what organic agriculture is meant to accomplish, it is helpful to provide a broad description of the field.

Organic farming is a comprehensive approach to production management that supports and improves the health of the agro-ecosystem, including biodiversity, biological cycles, and soil biological activity. It emphasises the use of management strategies above the use of off-farm inputs while taking into consideration the need for regionally tailored systems according to area variables. In order to do this, it is best to use agronomic, biological, and mechanical approaches rather than synthetic materials to carry out any necessary system functions.

The phrase is now used to refer to the whole organic and biodynamic supply chain, from inputs to finished manufactured items, as well as the movement's cultural and social facets, rather than simply its on-farm production facets. It's possible that the term "organic movement" is no longer relevant and that the correct word is "organic industry". However, the fact that organic agriculture continues to play a significant social and political role implies that it is more than simply an enterprise. Even when a market for conservation farming (lower tillage) has been established in the business sphere, the social movement for it still exists. Organic standards are dynamic, and certification criteria are often updated every several years. The majority of certification organisations have some kind of certification review committee that takes into account newly developed materials, updated knowledge of currently permitted inputs, and newly developed manufacturing and processing methods.

The phrase "conventional agriculture," which is often used, refers to the traditional, dominant agricultural methods that are pushed and studied by the majority of government and corporate entities and are employed by farmers and growers all over the globe. Typically, conventional agriculture only places legal requirements on management constraints. Organic and conventional farming are rather mutually exclusive. Organic farming could not exist as a notion until an alternative agricultural paradigm that allowed for a differentiation to be drawn was established. In fact, the phrase "organic" didn't really take off until the 1960s. It is acknowledged that the term "conventional" conceals the wide range of management techniques employed; for instance, a conventional grain farmer may use mineral fertilisers but also green manures and avoid pesticides, or a permaculture orchardist may decide to use herbicides to control woody weeds in sloped land.

Growing EMS usage is a sign that different supply chain nodes understand the need for better tracking of agricultural effects.

Developmental stage

Contemporary "industrially based" agriculture was developed at the same time as modern organic agriculture. Before the development of chemically synthesised fertilisers, biocides, pharmaceuticals, mechanisation, and fossil fuels that enable industrial agriculture to work, many of the methods of organic agriculture were the only options available to farmers. Farmers had little choice but to operate within biological and ecological processes in the absence of such technology. For instance, leguminous plants and human and animal dung were the sole sources of fertiliser to replenish nutrients from farmed areas. Because there were no insecticides to manage them, crops that were not rotated led to a buildup of pests. According to this viewpoint, conventional industrial agriculture deviates from the traditions that agriculture has upheld from its start, while organic agriculture is the original and principal form of agriculture.

This division between industrial and organic agriculture began at the turn of the 19th century, when it was realised that plants really absorbed mineral salts found in humus and manure, not organic matter. The two main proponents of this hypothesis, Sir Humphrey Davy and Justus von Liebig, presented their theories in the works Elements of Agricultural Chemistry and Organic Chemistry in its Application to Agriculture and Physiology, respectively. They claimed that inorganic mineral fertilisers might take the place of manures and bring agriculture into the scientific realm, increasing output and effectiveness as a consequence. The first commercial manufacture of inorganic fertilisers started in the 1840s, along with the agricultural revolution. But like other revolutions, it wasn't without flaws, and fertiliser use didn't really take off until the start of World War Two.

People who were worried about the way that agriculture was going began to speak out and band together in the 1920s. In 1924, Rudolph Steiner, the creator of the philosophy known as "Anthroposophy," delivered his lectures on agriculture. Though these lectures and other Steiner teachings laid the groundwork for biodynamic agriculture, which differs from organic agriculture primarily due to its astrological, mystical, and spiritual components, they were prophetic in their denunciations of industrial agriculture and in their attempts to chart an alternative course. Due to Steiner's initiatives, the first organic certification and labelling system, "Demeter," was developed in 1924.

A renowned scientist named Robert McCarrison was investigating the health of the fighting men of India at the time and the reasons for their absence of western ailments. He advocated for health as a positive idea of energy as opposed to a bad form seen as the absence of sickness. A diet high in whole foods, cultivated on land where all manures were returned (i.e., according to the "rule of return"), with a limited quantity of fresh plants and grains and meat, was the foundation for good health. Following up on his findings, McCarrison fed two groups of rats a diet similar to that of the Indians and the destitute in Britain. The rats fed an Indian diet thrived, whereas the other rodents had various illnesses and undesirable societal repercussions. McCarrison then went on to discuss the value of eating a healthy food cultivated on land that has been fertilised with manures and other organic waste.

In the 1920s, Sir Albert Howard developed an experimental agricultural research institution there as well. Although Howard was a very skilled scientist and had more than enough schooling to comprehend the new chemical concepts, his childhood on a farm in Shropshire made him quite sceptical of the approach. He said that he learned considerably more from the local peasant farmers than from his scientific background since he was a close observer of them. Howard engaged in a broad variety of initiatives, including a very successful plant breeding programme and research on the impact of fodder production on farm animal health. As a result, he came to feel that there are unbreakable connections between the soil's health and

An overview of organic farming

The health of the plants and animals nourished by that soil. The 'Indore process,' which is now indelibly tied to his name, is the outcome of his adapting eastern ways of composting to Indian circumstances as a result. His book The Waste Products of Agriculture, which condensed these experiences, helped him propagate his message across many countries.

Beyond Europe: continued development and new coalitions

The efforts and writings of individuals like Howard, McCarrison, and Steiner had an effect on the subsequent generation of organic pioneers. With the founding of the first organisations like the Rodale Institute in the United States of America (USA), Soil and Health in New Zealand, and the Soil Association in the United Kingdom, this second wave gave rise to the organic movement (UK). Northbourne (1940) used the phrase "organic farming" for the first time (see above).

The "Haughley experiment," which contrasted organic and non-organic agriculture over time, was being set up in the UK by Lady Eve Balfour. Her work The Living Soil, which drew inspiration in part from the Haughley experiment, was also very significant. She also served as the Soil Association's first president and founding member in 1946. The Soil and Health Association in New Zealand, established in 1942 by dentist Dr. Guy Chapman under the original name of the "Humic Compost Club," predates both of these organisations.

Hans and Maria Mueller were pioneers of organic agricultural practises in Switzerland. Steiner's biodynamic farming inspired Herr Mueller, who in the 1950s created the "organic- biological" farming technique. The scientific foundation for Hans's work was supplied by Hans-Peter Rusch, a physician, microbiologist, and close friend of Hans, in his book Bodenfruchtbarkeit, which connected soil microbiology with fertility. With the establishment of the trademark Bioland, today the biggest certifier in Germany, this movement took on a more formalised shape in the 1970s.

In the late 1930s, J.I. Rodale was eager to learn about and engage in organic agriculture in rural Pennsylvania, USA. He soon saw how crucial it was to develop and maintain the natural health of the soil in order to maintain and safeguard human health. He established the Soil and Health Foundation in 1947, which ultimately evolved into The Rodale Institute. Additionally, he was the author of several books on organic farming, gardening, and health, all of which had the guiding principle that "good soil, equals healthy food, equals healthy people."

In Japan, separate developments were taking place. Mokichi Okada started using "natural farming" in 1936. To better mankind, nature farming incorporates both spiritual and agronomic components. As a result, it bears striking resemblance to Rudolph Steiner's anthroposophy and biodynamic farming. The Sekai Kyusei Kyo organisation was established, and it still works to advance "Kyusei natural farming" via its offices and experimental farms spread over South-East Asia. The Mokichi Okada Association, an offshoot organisation, was established in 1980 with the purpose of proving the scientific viability of its agricultural practises. Masanobu Fukuoka started a separate kind of natural farming in Japan about the same time as Okada was starting his movement. Fukuoka, who had studied soil science and microbiology, intended to engage in what is frequently referred to as "do nothing farming". Fukuoka's agricultural strategy had a spiritual foundation with Okada's. The persistence and growth of these groups emphasise how crucial it is to see organic farming as a worldwide phenomenon rather than just a European one. There were a sizable number of pioneers whose political and religious convictions would be incompatible with current organic agriculture, even if many of these pioneers' concepts are still applicable.

Considering organic farming from a global viewpoint

Be abominable to today's politically left-of-center, socially conscious, and organic followers. Many early proponents of organic farming had conservative political views and were fervent Christians, even to the point of fundamentalism and evangelicalism. Conford has extensively studied the political, philosophical, and theological reasons of these organic forerunners in the UK (2001). The organic movement experienced substantial change and turmoil in the 1960s, which is why some of its early pioneers' ideals are now alien to it. The release of Rachel Carson's book Silent Spring in 1962 marked a significant turning point and the beginning of the contemporary environmental and organic movements.

This transformation may be seen as a revolution or, at the very least, a crucial step in the organic movement's growth. As with how most people participating in the present organic movement see politics and religion, many of the environmental issues and notions of modern organic agriculture would be rather foreign to many of the pioneers in organic farming. Environmental activism may have rescued the organic movement from oblivion since it had lost the post-World War Two debate about the future of agriculture and had seen a sharp fall by the 1950s. The current organic movement is thus quite different from its early manifestations, notwithstanding the continuity of philosophy and membership from the beginning to the present. In addition to the founders' concerns for healthy soil, good food, and healthy people, environmental sustainability is now at the Centre of the organisation.

The publication of Silent Spring brought to light the harm that pesticides and other chemicals were causing to the ecosystem on a worldwide scale. As a result, in addition to the arguments that the organic movement had been making for many years, Silent Spring also introduced a whole new set of reasons against industrial farming. The 1960s, when Silent Spring was released, saw a lot of social unrest and tremendous societal change. New school debates on political and philosophical thinking were arising. Many of them also had a significant impact on the evolving organic movement. Limits to Increase, which examined the topic of the growth of the human population and the global economy, is an example of one of these theories. It posed concerns such, "What would happen if growth in the world's population continues unchecked?"

What will happen to the environment if economic development keeps up at its present rate? What steps may be taken to guarantee that the human economy meets everyone's needs and fits within the Earth's physical boundaries? Another was Small is Beautiful: A Study of Economics as if People Mattered by E.F. Schumacher (1974), which had a number of radical notions, such as the notion of forgoing economic growth in favour of a more meaningful working life and making quality of life the primary objective of economics. Additionally, Schumacher served as the Soil Association's president.

In the 1970s, organic farming reemerged as ecoagriculture, and new organic organisations were established as well as old ones were strengthened. Many of these organisations were centred on the certification of farmers and producers. Organic farming was obviously outside of conventional agriculture and national politics, and despite the movement's members' persistent efforts, they had little success with the government despite the rising interest in it. However, the degrees of self-organization were quickly rising, moving from isolated units acting independently to more coordinated action.

One of the milestones by which social and political movements might declare they have matured is the creation of a formal worldwide network. The International Federation of Organic Agriculture Movements (IFOAM), the only worldwide organic non-governmental organisation that exists today, was established for the organic movement in 1972. (NGO). Its development and maintenance were not simple tasks. In its early years, it was significantly dependent on a great deal of goodwill and the labour of many unpaid individuals, like many other organic organisations, and its financial stability was sometimes in jeopardy. It has developed into an organisation that national governments now recognise after years of being ignored or resisted by them.

Governments and international organisations' overview of organic agriculture. The objective of IFOAM is to "guide, unite and help the organic movement in its whole variety." IFOAM (2005), Woodward and Vogtmann (2004) To make an agreed-upon international guarantee of organic quality a reality, the organization's main goals are to:

1. Provide authoritative information about organic agriculture;
2. Promote its global application;
3. Exchange knowledge;
4. Represent the organic movement at international policy making forums;
5. Maintain the Organic Guarantee System, setting international organic standards and certification procedures; and
6. Audit member certification organisations to ensure compliance.

In the 1980s, organic farming saw rapid expansion. Numerous factors contributed to this, many of which were beyond the movement's control. The public's concerns about the increasing loss of important farmland features, the intensification of livestock production (such as the use of battery hens), and food scares (such as bacterial contamination) led to the public's first exposure to the workings of industrial food production and processing systems, many of which they found revolting and shocking. Because organic food provided an alternative, consumption of organic food significantly increased after food scares. Organic food became very "in" among upper socioeconomic classes as a consequence of growing affluence and disposable money in various industrialised nations. This is very paradoxical since organic agriculture rejects the idea of using the production and consumption of food as a social status symbol.

Globalization of Organic Farming

In the 1980s, organic agriculture expanded significantly outside of western Europe and North America's industrialised nations in Oceania, Central and South America, Asia, and Africa. Many of these areas already had indigenous agricultural systems in place that could be easily converted to organic farming, the export revenues were significant, labour was readily available, and some locations got help from organisations like their governments, aid organisations, and NGOs. Although organic agriculture is compatible with or comparable to numerous local and regional movements across the globe, it is the latter that has grown to be the most well-known and commonly used complementary agricultural method. The other systems demonstrate how many communities, based on their worldviews and the natural, intellectual, and financial resources at their disposal, create their own ways to low-external-input or chemical-free farming. These indigenous systems should be preserved and supported as needed since they are very valuable in and of themselves. However, in situations where farmers' options are shifting becoming more focused on the market, for instance a blend of local agricultural practises and organic agriculture may be a workable substitute.

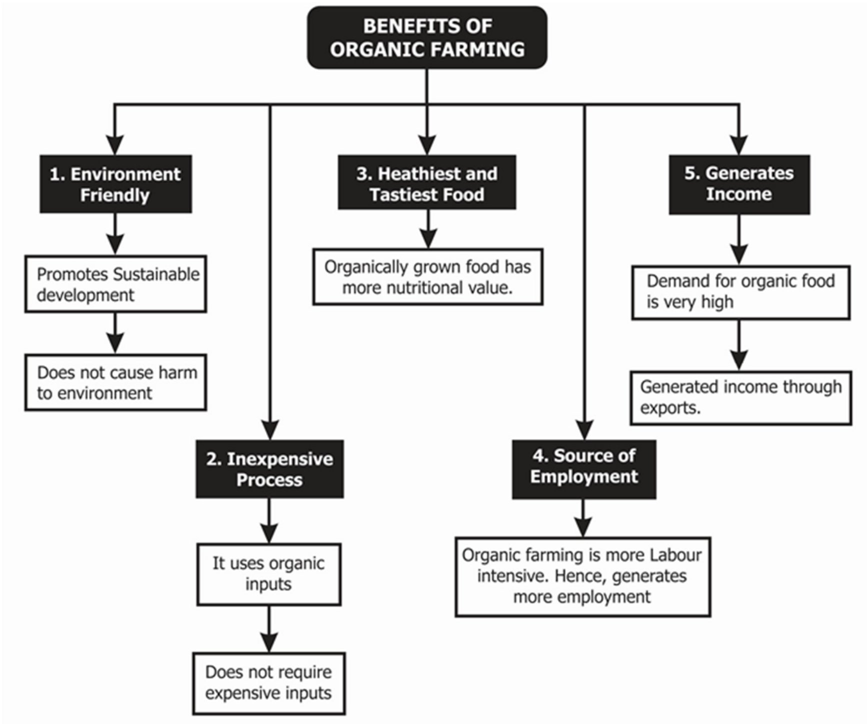

Figure 1.4 Shows the Benefit of Organic Farming.

Agroecology, a scientific approach to low-input farming, was developed using the ideas and practises found in the indigenous agricultural systems of Central and South America, which have been extensively researched over a long period of time. Organic agriculture is ideally suited to the focus on facilitating biological and ecological processes, utilising available resources, and trading locally in the local agricultural system. Throughout terms of certified land area and the number of farms, organic farming has been widely adopted in Central and South America, with Argentina leading the way.

CHAPTER 2

ORGANIC AGRICULTURE AS A TOOL FOR SUSTAINABLE AGRICULTURE

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Converting to organic agriculture involves several factors that must be taken into consideration:

1. **Soil health:** Building healthy soil is critical to organic farming success. This involves practices such as crop rotation, cover cropping, and adding organic matter to the soil.
2. **Crop selection:** Choose crops that are well-suited to organic farming methods and local conditions, such as pest and disease resistance.
3. **Pest and disease management:** Organic farmers rely on natural methods such as beneficial insects and crop rotation to control pests and diseases.
4. **Fertilization:** Organic farmers use natural sources of fertilizer, such as compost and animal manures, to provide the necessary nutrients for crops.
5. **Weed management:** Organic farmers rely on mechanical, cultural, and biological methods to control weeds, rather than synthetic herbicides.
6. **Market demand:** Consider the demand for organic products in your area and research the market before investing in a conversion.
7. **Financial considerations**: Organic farming requires a significant investment of time, resources, and capital. Careful planning and budgeting is necessary to ensure long-term success.
8. **Technical support:** Seek out expert advice and training in organic farming methods to ensure a successful transition.
9. **Certification:** Consider obtaining organic certification to increase market access and demonstrate the integrity of your organic operation.
10. **Patience:** Conversion to organic farming takes time and requires patience as soil health and productivity are gradually improved over time.

Converting to organic agriculture is a complex process that requires careful consideration of multiple factors. By focusing on soil health, selecting appropriate crops, managing pests and diseases, using natural fertilizers, controlling weeds, understanding market demand, budgeting carefully, seeking technical support, obtaining certification, and exercising patience, farmers can be well on their way to a successful transition to organic agriculture. Organic agriculture is a farming system that avoids synthetic chemicals and promotes environmentally sustainable practices. Here are key considerations for converting to organic agriculture:

1. **Planning:** It is important to have a clear plan and strategy in place before converting to organic agriculture. This includes a review of the farm’s resources, soil type, climate, market demand and financial viability.

2. **Soil health:** Organic agriculture places a strong emphasis on soil health. A soil test is necessary to determine the soil's nutrient levels and pH, which will determine the type of crops that can be grown and what inputs are necessary.
3. **Crop rotation:** Crop rotation is an important aspect of organic agriculture that helps to improve soil health and reduce pest and disease pressure.
4. **Pest and disease management:** Organic farmers use a combination of cultural, physical and biological methods to manage pests and diseases. This includes the use of cover crops, crop rotation, and biological control agents such as beneficial insects and bacteria.
5. **Inputs:** Organic farmers must rely on natural inputs, such as compost, green manures and organic fertilisers, to maintain soil fertility. These inputs must be sourced from within the farm or from certified organic sources.
6. **Certification:** Organic agriculture certification is important for farmers who want to sell their produce as organic. Certification verifies that the farm is following organic standards and provides a market advantage for organic produce.
7. **Market:** It is important to consider the market demand for organic produce and the prices that organic produce commands. Organic produce tends to command a premium price compared to conventionally grown produce.
8. **Finances:** Conversion to organic agriculture requires a significant investment in time and resources, including the cost of certification, inputs, labour, and equipment. Financial planning and analysis is necessary to determine the long-term viability of the farm.
9. **Education:** Organic agriculture requires a different approach to farming compared to conventional agriculture. It is important for farmers to educate themselves on organic farming practices and seek advice from experienced organic farmers and advisors.
10. **Patience:** Conversion to organic agriculture takes time, typically three years or more, before the farm can be certified organic. During this time, farmers must be patient and persistent in their efforts to establish a successful organic farm.

Additionally, when converting to organic agriculture, it's important to understand the principles and standards of organic farming. Organic farming is a holistic approach to agriculture that emphasizes the use of natural processes and avoids the use of synthetic chemicals and genetic modifications. Some of the key principles of organic farming include:

1. **Biodiversity:** Organic farming promotes diversity in crops and livestock, as well as the habitats that support them, to promote soil health, pest control, and overall ecosystem balance.
2. **Soil conservation:** Organic farmers work to conserve soil health through practices such as reducing tillage, cover cropping, and crop rotation.
3. **Animal welfare:** Organic farmers must provide their animals with access to the outdoors, fresh air, and adequate space, and they must avoid the use of antibiotics and growth hormones.
4. **Energy conservation:** Organic farmers aim to reduce their energy usage and promote sustainability by relying on renewable energy sources and reducing waste.
5. **Water conservation:** Organic farmers use techniques such as conservation tillage, cover cropping, and mulching to reduce water usage and prevent soil erosion.

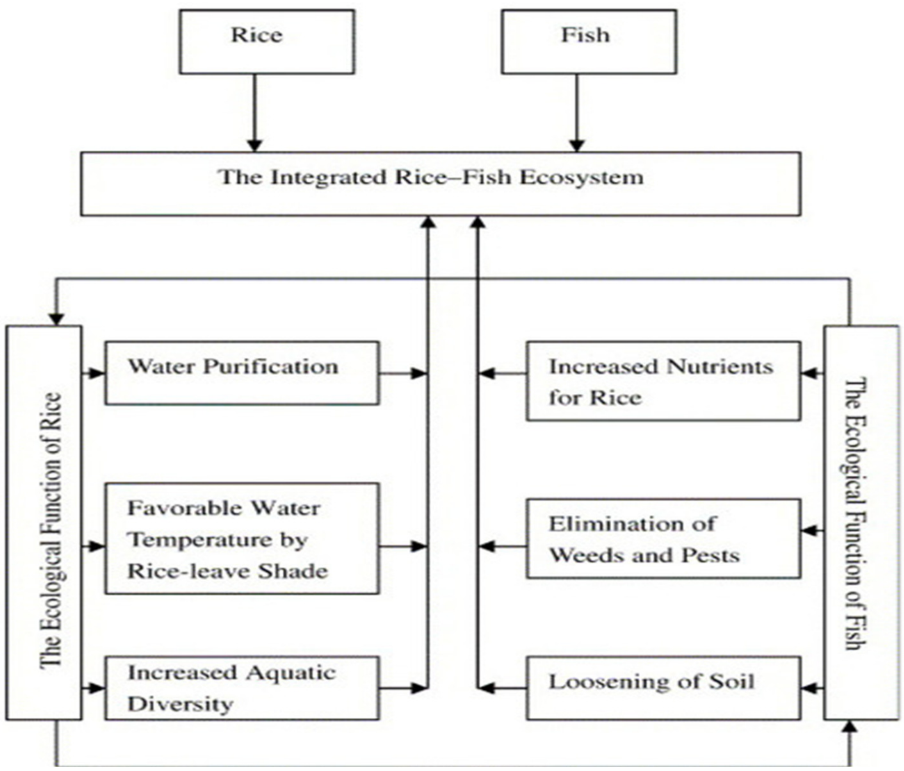

Figure 2.1 Shows the Technological Approach to Sustainable Agriculture.

It's also important to understand the regulations surrounding organic farming. To be certified as organic, farmers must follow the standards set by the National Organic Program (NOP), which is administered by the USDA. These standards include guidelines for soil and water conservation, crop and livestock management, and record-keeping. Organic farmers must also undergo an annual inspection to ensure that they are following the regulations. The benefits of converting to organic agriculture are numerous. Organic farming can result in healthier soils, more diverse ecosystems, and improved water quality. It can also benefit farmers by providing access to premium prices for their crops and helping to reduce input costs by relying on natural methods. Furthermore, organic farming can contribute to the overall health and well-being of rural communities by promoting sustainable agriculture and reducing exposure to harmful chemicals.

However, converting to organic agriculture can also present some challenges. Organic farmers may experience lower yields in the early stages of conversion as they work to build soil health and improve productivity. In addition, organic farming often requires more manual labor and a greater investment of time and resources. Organic farmers may also face challenges in finding markets for their crops and obtaining fair prices for their products. Organic agriculture is a farming system that focuses on the health of the soil, the environment, and the animals. Unlike conventional agriculture, organic farmers rely on natural methods such as crop rotation, composting, and biological pest control to maintain soil fertility and manage pests and diseases.

One of the main benefits of organic agriculture is that it promotes soil health and fertility. By relying on natural inputs such as compost and green manures, organic farmers are able to maintain soil structure, improve water-holding capacity and enhance the populations of beneficial microorganisms in the soil. This in turn leads to healthier crops, higher yields, and improved crop quality.

Another benefit of organic agriculture is that it reduces the use of synthetic chemicals in farming. Chemical pesticides and fertilisers can be harmful to the environment and human health, and can also contribute to the development of resistant pest populations. By relying on natural methods to manage pests and diseases, organic farmers reduce the risk of environmental contamination and maintain the health of the ecosystem.

Organic agriculture also provides numerous environmental benefits, including reduced greenhouse gas emissions, improved water quality, and increased biodiversity. By relying on natural inputs, organic farmers reduce their carbon footprint and contribute to the conservation of the planet's resources. Furthermore, the use of crop rotation and cover crops helps to improve soil structure, reduce soil erosion, and increase the availability of nutrients for crops. Another key advantage of organic agriculture is that it can provide a premium price for organic produce. Consumers are becoming increasingly aware of the benefits of organic food, and are willing to pay a premium price for food that is grown without synthetic chemicals and is environmentally sustainable. This can provide a significant advantage for organic farmers in terms of profitability.

However, converting to organic agriculture requires a significant investment in time and resources, including the cost of certification, inputs, labour, and equipment. Organic farmers must also be willing to invest time and effort into learning about organic farming practices and seeking advice from experienced organic farmers and advisors. Additionally, the conversion process typically takes three years or more before the farm can be certified organic, which requires patience and persistence.

Organic agriculture also requires a different approach to farming compared to conventional agriculture. Organic farmers must be proactive in managing soil health and fertility, and be willing to invest time and resources into developing a crop rotation plan, using compost and green manures, and managing pests and diseases using natural methods. Furthermore, organic farmers must be knowledgeable about the market demand for organic produce, and be able to market their produce effectively in order to receive a premium price. A transitional phase is necessary when switching from a conventional to an organic system, during which the organic practises are gradually implemented in accordance with a set plan. It is crucial to thoroughly assess the farm's current position during this time and decide what steps need to be implemented.

It must be included in the farm analysis:

1. **Farm characteristics:** size, distribution of plots and crops, types of crops, plants, and animals included in the farm system.
2. **Soil analysis:** a review of the soil's composition, organic matter concentration, erosion rate, and/or degree of contamination.
3. **Climate:** temperatures, chances of frost, humidity, and the amount and distribution of rainfall.
4. Sources and management of organic matter (manures).
5. The presence of equipment or housing systems for animals.
6. Restrictive elements, including those related to labour, capital, and market access.

You may make judgments and have a clear image of your farm with the aid of this information. The process of studying and implementing adjustments on the farm toward a more sustainable and natural style of farming is referred to as conversion to organic agriculture. The way the process unfolds differs from farm to farm and is influenced by the environment, the farmer, and the community.

The transition to organic farming will be simpler for a farmer if they are more familiar with its principles and methods. Even while organic farming doesn't need certain land conditions to begin with, if soils are depleted, for instance, it could take more time and work to set up a sustainable production system and provide satisfactory harvests. Here are some tips to help you succeed in the conversion to organic agriculture as well as the considerations to take into account. Different conversion obstacles might be anticipated depending on the agricultural situation:

Farms Using High Amounts of External Input

Larger farms make up the bulk of intensively managed farms in Asia, Latin America, and Africa that heavily depend on outside inputs. These farms mostly cultivate a small number of annual or perennial revenue crops and significantly depend on the use of pesticides, herbicides, and fertilisers for plant nutrition.

On these farms, farm animals are often not included in the nutrient cycle and crops are frequently planted without a scheduled rotation. On these farms, diversification is often minimal. To allow for considerable automation, trees and shrubs are often cut down, and crops are typically produced on their own. (Figure \s2-2).

1. It often takes many years to establish a varied, balanced agricultural system with a built-in capacity for self-regulation.
2. It could take substantial work to replenish the soil's natural fertility by adding a sizable quantity of organic matter.
3. In the early years of conversion, giving up high input external fertilisers reduces yields until soil fertility is restored and yields increase.
4. New methods and procedures often need a great deal of education and close monitoring of crop growth as well as the dynamics of pests, diseases, and natural enemies.

However, if the following procedures are followed, the conversion process may be accomplished:

1. **Increase agricultural system diversity:** Choose the best annual crops for the region, then rotate them in a predetermined order. Include legume crops in the rotation to provide nitrogen to the following crops, such as beans or leguminous feed crops. To promote insect control and natural enemies, plant hedges and flower strips.
2. **Commence recycling priceless agriculture byproducts:** Establish a composting operation on the farm using harvest waste and, if available, manure, and combine the compost with topsoil. By introducing stable organic matter into the soil, this will strengthen the soil's structure and increase the soil's ability to feed plants and retain water. A lot of plant material may be found in green manures, which can feed soil organisms and increase soil fertility.
3. **Bring farm animals into the equation:** Animals raised for farming provide extra animal products and supply essential manure. Cultivate cover crops. The soil is protected by using cover crops or mulching perennial crops.

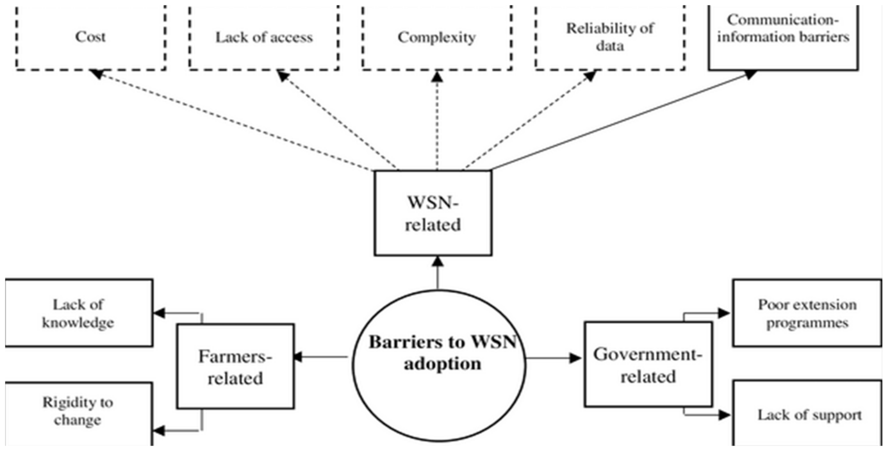

Figure 2.2 Shows the Facts and fears that limit digital transformation in farming.

Farm Using Little External Input

On the same plot of land, farmers using traditional methods and minimal outside assistance may cultivate a wide variety of crops in a densely mixed system, switching crops at random. There may be a small number of animals maintained, including chickens, pigs, cattle, and/or goats, who distribute the excrement in their feeding areas and provide relatively little manure for the plants. For the purpose of making charcoal and firewood, the trees may be drastically chopped. Burning rubbish and bushes could be a popular practise, particularly while preparing land. Due to unpredictable and inadequate precipitation, harvests are definitely low and becoming harder. The crops could barely be enough to feed the family, leaving nothing to be sold for money.

Traditional farmers already adhere to certain organic farming principles by using farm-owned resources, cultivating many crops at once, and rearing animals. However, there are still several methods that set such farms apart from organic farms. The following issues must be resolved in order to convert: Refrain from burning agricultural wastes after harvesting since doing so usually isn't a good idea because it eliminates important organic matter and harms soil organisms. Establish well-organized intercropping and crop rotation systems as part of your diversification strategy.

Amass knowledge and expertise in the management and enhancement of soil fertility, particularly with reference to compost production. Refrain from indiscriminately chopping down trees for fuel and charcoal. Create a mechanism for collecting animal waste for composting. Implement strategies to stop soil from eroding and to keep it from drying out. Pay close attention to meeting the farm animals' nutritional and medical needs. Avoid harvest and storage losses by avoiding disease-infected seeds, learning about disease cycles, and taking preventative actions. In this system. Put intercropping and planned crop rotation into practice. Leguminous green manure cover crops and a mix of annual and perennial crops are required. Crop and soil management will be made easier by the use of 15 carefully chosen or upgraded crop types with high resistance to plant pests and diseases.

The growing conditions for the crops and the encouragement of greater development will be improved by the proper integration of animals into the agricultural system, as well as by the planting of rows of nitrogen-fixing trees between annual crops, which will also provide more food for the ruminant animals. Better housing is also required to make it easier to gather animal excrement for use in fields. Increasing soil fertility, for instance, by adding high-quality compost to the soils.

In organic gardening, compost is a very important fertilizer. After harvest, gather the crop wastes for composting or incorporate them into the soil instead of burning them. The plant matter and animal manures should be routinely gathered for composting. Another option for feeding the soil and the crops is to plant nitrogen-fixing legumes in between annual crops. It is recommended to take further steps to prevent soil erosion, such as constructing trenches, planting trees along the slope, and covering the soil with live or dead plant matter. Some organic farming techniques to test on your own farm.

Multiple Farm

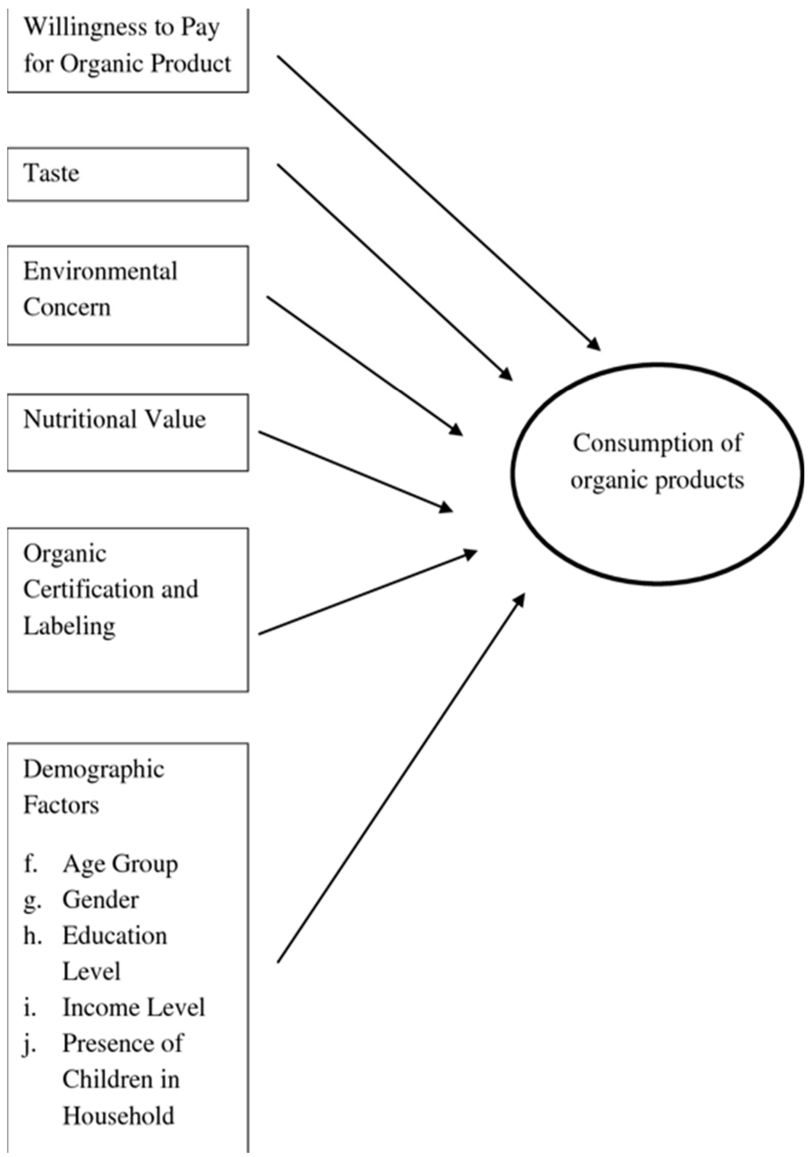

Figure 2.3 shows the factors influence consumer behavior on the purchase of organic products.

Crops and farm animals may coexist on mixed farms, where the animal manure is collected and used to the gardens after rotting for a few weeks. There are a few soil conservation techniques that may be used, such mulching perennial crops and digging trenches to stop erosion. Weeds may sometimes be controlled in the production of fruits and vegetables by using herbicides, insecticides, and treated seeds. It goes without saying that the farmers of these mixed farms are conversant with certain organic farming techniques. These farmers will have no trouble implementing organic practises over their whole farm and learning new techniques from other farmers or a trainer.

Use organic weed and soil-management techniques as an alternative to herbicides. Grow a leguminous cover crop, for instance, in fruit orchards to cover the soil. Alternately, plant a planned crop rotation with weed-suppressing green manure or feed crops in vegetable and arable crops. Continue to increase the recycling of farm-owned nutrients from animals and crop wastes to get the most out of them, such by composting them with crop residues. To prevent nitrogen losses, improve the storage of animal manures.

If pesticide-free seeds are available, use them. Make careful you only utilize healthy seeds, and learn about non-chemical seed treatment methods. Become acquainted with the strategies and techniques used for natural disease and pest management. By routinely monitoring pest population dynamics while crops are growing, you may learn about beneficial insects. Expand the agricultural system's diversity to boost soil production and provide homes for helpful insects and spiders.

Rutten Land

Due to shifting agriculture, excessive grazing, over cultivation, or deforestation, salinity from years of extensive groundwater irrigation, or water logging and floods, land may become degraded. On such ground, creating favourable growth conditions can need more time and effort. Organic methods are a great way to rehabilitate such soils at the same time. To halt soil erosion and restore soil fertility, particular actions can be necessary. These techniques include creating terraces or planting a leguminous green manure crop in an intense fallow that thrives on rocky soils

Conversion of Degraded Land

Numerous examples demonstrate that organic farming is a potential strategy for restoring damaged land to productivity. The majority of the time, adding more organic matter is crucial to restoring the quality of damaged soils. Digging terraces is necessary for organic farming when the soil is barren and degraded on slopes (for an example, see the fanya juu terraces in the image below). In order to create fanya juu terraces, which translate to "throw it upwards" in Kiswahili, trenches are dug along contour lines, and soil is then thrown uphill to create embankments (bunds), which are stabilised with fodder grass like napier (Pennisentum purpureum) and multipurpose agroforestry trees. Crops are grown in the area between the embankments, and the fanya juu eventually transform into bench terraces. They help gather and save water in semi-arid environments. Compost and green manures may also be utilised to improve soil structure and promote healthy crop harvests.

Large concentrations of water soluble salts in saline soils prevent seed germination and plant development. Particularly in dry and semi-arid areas, the overuse of irrigation water may have contributed to the salt buildup. By maintaining regular watering and improving the soil's structure with compost, one may gradually lower these salt levels and enable natural drainage of the surplus salts. Crops that can withstand salt may be cultivated in the beginning. By adding compost and lime, acidic soils may be recovered. Flooded soils might benefit from drainage canals that remove the extra water. It will be more difficult to convert a farm to organic farming in a region with little rainfall, high temperatures, or strong winds than in an area with widespread rainfall and comfortable temperatures. The benefits of adopting organic methods will also be more apparent in dry environments than they would be in ideal humid environments.

For instance, adding compost to the topsoil or planting holes would improve the soil's ability to retain water and raise the tolerance of the crop to water shortage. Water is lost via transpiration from plants and soil evaporation at significant rates in hot, dry climates. Strong winds may further increase these losses by accelerating soil erosion. Because biomass output is often low and the organic matter content of the soils is generally low, there is a significant reduction in the nutrients that are available to the plants. Protecting the soil from intense sun and wind, as well as boosting the amount of organic matter and water that the soil receives, are the keys to enhancing crop yield under these circumstances. Composting or growing green manure crops may both enhance the amount of organic matter in the soil. In order to produce compost, it is necessary to produce more plant biomass, which presents a hurdle.

Conversion in Dry Climate

High aboveground biomass output and quick breakdown of soil organic matter suggest that nutrients are readily accessible to the plants in warm, humid climates. However, there is a significant chance that the nutrients will be lost and readily washed away. To prevent soil depletion under these circumstances, it's crucial to maintain a balance between the production and breakdown of organic matter.

Combining several methods to safeguard the soil and provide it with organic matter turns out to be the most fruitful course of action. These techniques include planting a variety of crops in many layers, preferably including trees, cultivating nitrogen-fixing cover crops in orchards, and adding compost to the soil to improve its organic matter content and hence boost its ability to hold onto water and nutrients.

Since the beginning of agriculture, people have worked to enhance the hardiness, sweetness, adaptability, and beauty of plants. Farmers just stored seeds from their greatest plants hundreds of years ago to replant. Plant breeders advanced steadily over time, becoming more complex methods to get particular qualities. The most recent technique some may even argue the best is GE, and supporters claim that it is only the next development in a long line of agricultural plant improvements made by humans. The fundamental and harmful differences between traditionally bred and genetically altered plants are insisted upon by critics.

Conventional fertilization has been practiced for many centuries and is still widely employed today. For replanting, traditional breeding might simply mean selecting plants with advantageous features, such as a high yield or superior taste. Farmers continue to do so year after year because produced novel crop strains. Cross-pollination is a method of plant breeding that includes purposefully transferring pollen from one flower's stigma to another flower's stigma from a different plant of the same or closely linked species. Successful pollination produces seeds that will grow. One or both of the plant progeny will display advantageous features as the seeds mature. The parent plants must be of an identical species or a close relative for cross-pollination to occur.

Hybridization is the method of plant breeding that is most often used the process of hybridization involves mating two genetically distinct individuals to produce new genotypes. For instance, a cross between two parents that has the biological makeup (genotype) BB and parent two results in hybrid offspring having the genetic makeup of BB Unique plants can also be produced via natural mutations. The progeny (or perhaps only a piece of the mother plant) might exhibit unusual traits when something spontaneously disrupts the normal inheritance process, such as an "error" in DNA replication. The feature might be handed on to the next generations if the mutation has certain advantages that help the plant survive rarely, do these mutations result.

Insect-resistant cotton and corn, weed-killer soybean, soybeans, canola, and alfalfa, as well as virus-resistant papaya and squash, have all been marketed today using GE technology. In the United States, more than 93 percent of soybeans farmed are genetically modified to be herbicide-tolerant being Roundup, which contains glyphosate. A gene from the soil-dwelling bacteria Bacillus thuringiensis, which naturally creates a toxin that serves as a pesticide, has been inserted into maize. For instance, the European corn borer, a Lepidopteran caterpillar pest, is deterred by the poison from damaging crops. Cotton crops have also benefited from their usage.

The technique of genetic engineering goes beyond traditional breeding it differs greatly. Typically, traditional plant breeding creates new plant types via the process of selection and aims to express genetic information that is already present in the plant an attribute of a species. The main method of genetic engineering is the insertion of genetic material into the host plant's chromosomes, however, the selection is also necessary after gene insertion. To make the implanted gene express itself, engineers must also include a "promoter" gene from a virus as part of the package. Even if the main objective is just to introduce genetic material, this approach, which uses a gene cannon or a related technology, and a promoter, is significantly different from traditional breeding.

Few agricultural subjects are more divisive than genetically engineered (GE) goods, which refer to the practice of modifying an organism's genetic makeup, including genes from other species, to achieve desirable features like insect resistance or drought tolerance. Both advantages and disadvantages of it are arguable if GE, a technology of generic components and brand names of particular goods that are determined to be compliant with the USDA organic requirements, can address the world's agricultural challenges and benefit the environment. Since product labels don't include all the detail the OMRI Items List is a trustworthy source for information on active and inert compounds and offers a current and comparatively comprehensive inventory of permissible products these lists aid in understanding the National List of the NOP.

The OMRI website has the most recent product listings to assist producers in finding organic seeds, OMRI also runs an organic seed information system. Companies pay a charge and provide all of their confidential information, including formulae data to OMRI for in-depth analysis. As a result, OMRI offers a valuable service to manufacturers that want to sell their goods to organic growers but do not want to divulge "trade secrets" to the broader public. Participation on the OMRI list is optional, therefore a substance's exclusion from the list does not imply that it is illegal. However, the choice of which goods may or cannot be used on an organic farm is ultimately made by the certifying body.

Sellers of products that have successfully undergone the OMRI product assessment procedure and been given an OMRI status of Authorized or Permitted with Restrictions in line with the Organic

Materials Assessment Institute are handed certifications by the OMRI. Standard organic specification. Products that have received OMRI approval may be used on facilities that have received USDA NEP Program certification. Regardless of OMRI's classification, it is up to the certifying body to decide whether it is permissible to use one of the goods that are listed on its website. Therefore, even if a farmer is permitted to use a chemical on the OMRI listing, they must first consult their certifier. Creating the actual, processing, or handling are prohibited from using prohibited products. Products that OMRI has identified.

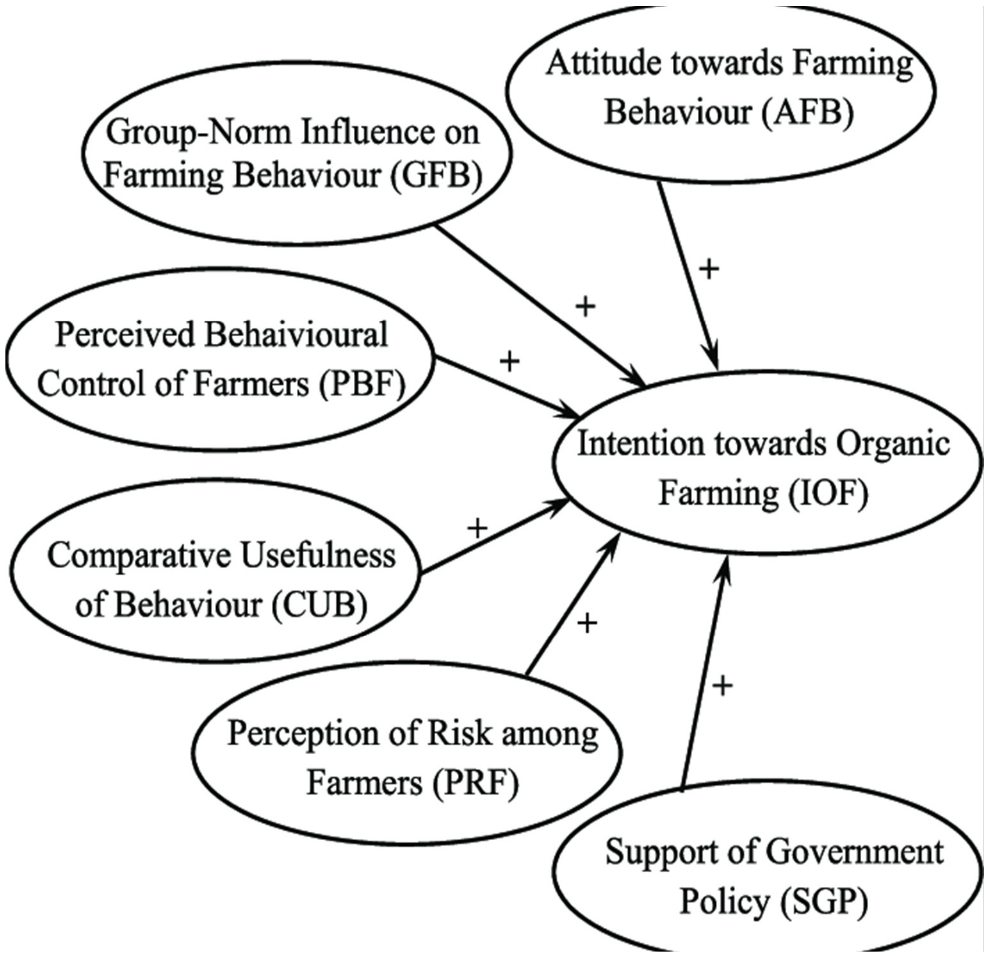

Figure 2.4 shows the Conceptual Framework: Model of farmers' intentions towards organic.

Certificates are only good for a year and need to be renewed every year some goods might only be featured for a year after that a product may become incompliant as a result of reformulation. Alternatively, a new formulation can make a product that wasn't compliant before compliant. In some cases, a producer will have to provide proof of a product's lot number to confirm conformity. OMRI simply verifies that a product is permitted to be used following the NOP; no claims on its efficacy are made. The Brand Name Materials List (BNML), which is maintained by the Washington State Agriculture Department Natural Foods Program, a USDA-accredited certifier, is a list of goods that have been found to comply with the National Organic Standards. The WSDA does not suggest that any of the items are guaranteed or recommended. Available on the BNML. Additionally, these items' makers are not compelled to list them on the BNML. This list of well-known brand materials that adhere to organic standards is not exhaustive.

CHAPTER 3

CROP PROTECTION IN ORGANIC AGRICULTURE

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Crop protection in organic agriculture is a key challenge that requires a holistic and integrated approach. Organic farmers must rely on natural methods and practices to control pests, diseases, and weeds, without the use of synthetic chemicals. Some of the key strategies for crop protection in organic agriculture include:

1. **Crop rotation:** Organic farmers use crop rotation to break pest and disease cycles, reduce soil-borne pathogens, and build soil health. By alternating crops and changing the location of crops each year, organic farmers can reduce the build-up of pests and diseases and minimize their impact on crops.
2. **Cultural practices:** Organic farmers use cultural practices, such as proper tillage, weed management, and plant nutrition, to promote plant health and reduce pest and disease pressure.
3. **Biological controls:** Organic farmers use biological controls, such as predators and parasites, to control pests and diseases. For example, ladybugs and lacewings can control aphids, while beneficial nematodes can control root-knot nematodes.
4. **Physical controls:** Organic farmers use physical controls, such as row covers, screens, and reflective mulches, to exclude pests and provide physical barriers to disease.
5. **Botanical insecticides:** Organic farmers use botanical insecticides, such as neem oil, pyrethrins, and rotenone, to control pests. These insecticides are derived from natural sources and are less harmful to the environment and human health than synthetic chemicals.

Organic farmers must also develop an integrated pest management (IPM) plan that combines multiple strategies for crop protection, taking into account the specific needs of their farm and crops.

This requires careful monitoring of crops, identification of pests and diseases, and timely implementation of appropriate control measures. Organic farmers must also be aware of the regulations surrounding the use of botanical insecticides and other natural pesticides. The National Organic Program (NOP) sets standards for the use of such products in organic agriculture, and organic farmers must follow these standards to maintain their organic certification.

Organic farmers may also face some challenges in controlling pests and diseases. Organic methods may not be as effective as synthetic chemicals, and pests and diseases can quickly spread and cause significant damage to crops.

Organic farmers must also be diligent in monitoring their crops and implementing control measures in a timely manner to prevent pest and disease outbreaks. To overcome these challenges, organic farmers must be proactive in their approach to crop protection, using a combination of strategies to prevent pests and diseases and reduce their impact on crops. Organic farmers can also benefit from training and education programs that focus on integrated pest management, biological control, and other natural methods for crop protection.

In conclusion, crop protection in organic agriculture is a critical aspect of organic farming that requires a holistic and integrated approach. Organic farmers must rely on natural methods and practices, such as crop rotation, cultural practices, biological controls, physical controls, and botanical insecticides, to control pests, diseases, and weeds without the use of synthetic chemicals. By developing an IPM plan and being proactive in their approach to crop protection, organic farmers can contribute to a more sustainable and healthy food system.

Organic farmers also need to be mindful of the environmental impact of their crop protection strategies. The use of synthetic chemicals can have negative impacts on the environment, such as soil and water contamination, air pollution, and harm to non-target species. In contrast, organic crop protection methods can have positive impacts on the environment, such as promoting biodiversity, preserving beneficial insects, and reducing the use of harmful chemicals.

Organic farmers can also benefit from alternative methods for pest and disease control, such as biological control, where natural enemies of pests are used to control them. For example, the use of Trichogramma wasps can effectively control the European corn borer, a major pest of maize. Another alternative is the use of bio-pesticides, which are based on naturally occurring substances that are toxic to specific pests but harmless to other species.

Moreover, the use of companion planting can also be an effective strategy for crop protection in organic agriculture. By planting crops together that have complementary growth patterns, organic farmers can reduce pest and disease pressure and promote plant health. For example, planting marigolds near tomato plants can help to control tomato pests, while planting basil near tomato plants can improve the overall health of the plants and reduce the risk of disease.

It's also important to consider the economic impact of crop protection in organic agriculture. Organic farming can be more labor-intensive and require more time and resources compared to conventional farming methods, which can result in higher costs for organic farmers. However, by adopting integrated pest management and alternative methods for pest and disease control, organic farmers can reduce the impact of pests and diseases on their crops, minimize costs, and increase profitability.

Organic farmers must also be aware of the regulations surrounding crop protection in organic agriculture. The National Organic Program (NOP) sets standards for organic crop protection, and organic farmers must follow these standards to maintain their organic certification. Organic farmers must also be diligent in recordkeeping, documenting the methods and practices used for crop protection, and demonstrating compliance with NOP standards.

Crop protection is a crucial aspect of organic agriculture that requires a holistic and integrated approach. Organic farmers must rely on natural methods and practices, such as crop rotation, cultural practices, biological controls, physical controls, and botanical insecticides, to control pests, diseases, and weeds without the use of synthetic chemicals. By being mindful of the environmental impact, economic impact, and regulatory requirements, organic farmers can contribute to a more sustainable and healthy food system.

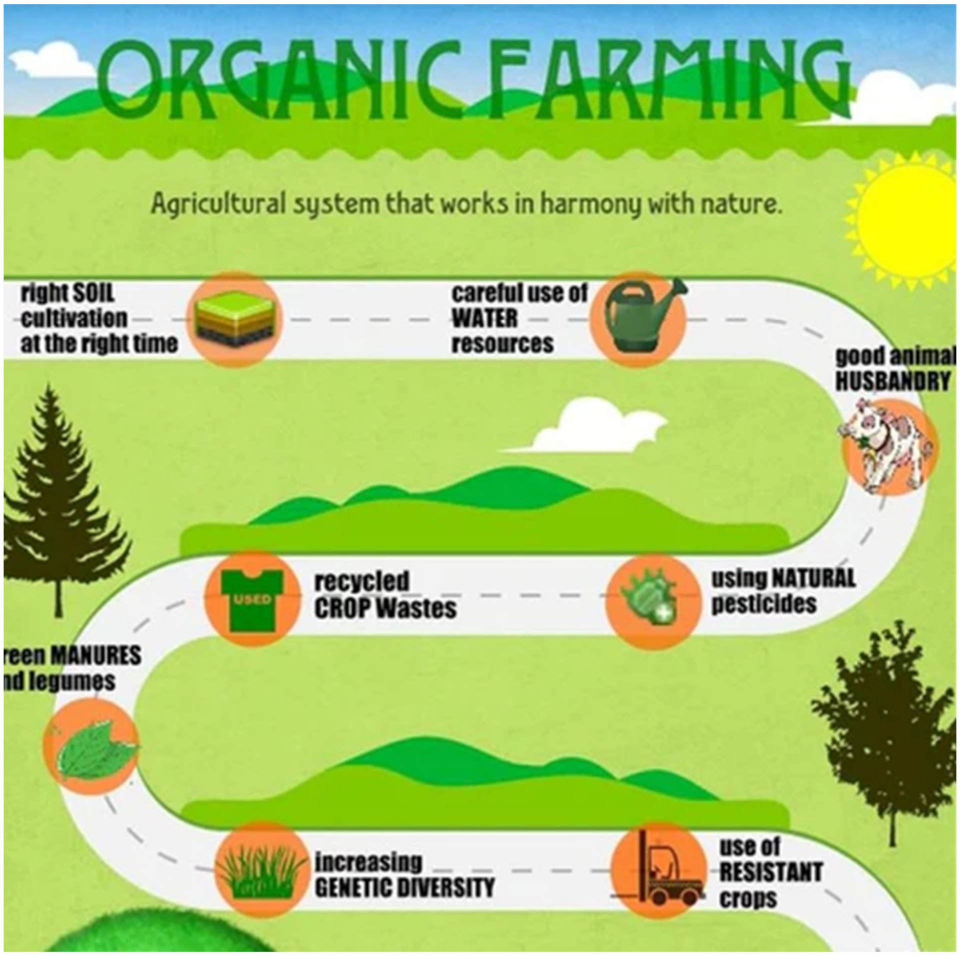

Figure 3.1 Shows the Major Benefits of Organic Farming.

Another consideration for crop protection in organic agriculture is soil health. Healthy soils support healthy plants and are more resistant to pests and diseases. Organic farmers can improve soil health through practices such as cover cropping, crop rotation, composting, and reducing tillage. Cover cropping involves planting crops that add organic matter to the soil, such as legumes, between main crops. These crops help to improve soil fertility and reduce erosion, as well as reduce pest and disease pressure by providing habitat for beneficial insects. Crop rotation can also help to reduce pest and disease pressure by breaking the life cycles of pests and diseases and reducing the buildup of pathogens in the soil.

Composting is another way that organic farmers can improve soil health. By composting organic waste, farmers can add nutrients and organic matter to the soil, improving soil structure, and enhancing soil fertility. Composting can also help to suppress pests and diseases by reducing the availability of food and shelter for pests.

Reducing tillage is another strategy for improving soil health in organic agriculture. Tillage can disrupt soil structure and increase erosion, but by reducing tillage, farmers can maintain soil structure, conserve moisture, and improve soil health. Reduced tillage can also help to reduce pest and disease pressure by preserving the soil's microorganisms and reducing soil disturbance, which can provide habitat for pests and diseases.

Organic farmers can also use crops that are naturally resistant to pests and diseases as a strategy for crop protection. These crops can help to reduce the impact of pests and diseases, as well as minimize the need for additional pest and disease control measures. For example, certain varieties of tomatoes are naturally resistant to certain diseases, such as late blight, and can help to reduce the impact of this disease in organic production systems.

Organic farmers can also benefit from the use of natural fertilizers and soil amendments. Natural fertilizers, such as compost, animal manure, and green manures, can help to improve soil health, fertility, and structure, which can in turn improve plant health and reduce the impact of pests and diseases. Soil amendments, such as lime, sulfur, and rock minerals, can also help to improve soil health and fertility, while reducing the impact of pests and diseases.

Lastly, it is important to remember that crop protection in organic agriculture is not a one-size-fits-all approach. Organic farmers must tailor their pest and disease control strategies to the specific needs of their farms, crops, and environmental conditions. By using a variety of strategies and techniques, organic farmers can effectively control pests, diseases, and weeds, while maintaining the health and integrity of their soil, crops, and environment.

In conclusion, crop protection in organic agriculture requires a holistic and integrated approach that considers the needs of the soil, the crops, and the environment. Organic farmers must rely on natural methods and practices, such as crop rotation, cultural practices, biological controls, physical controls, and botanical insecticides, to control pests, diseases, and weeds without the use of synthetic chemicals. By improving soil health, using resistant crops, and applying natural fertilizers and soil amendments, organic farmers can contribute to a more sustainable and healthy food system.

Organic agriculture is a method of farming that prioritizes the use of natural processes and inputs, with the goal of creating a self-sustaining and balanced agro ecosystem. One of the key aspects of organic agriculture is crop protection, as farmers aim to protect their crops from pests, diseases, and other stressors without relying on synthetic pesticides and fertilizers. Crop rotation is a common practice in organic agriculture, where crops are rotated between fields each year. This helps to reduce pest buildup, as certain pests are host-specific, and rotating crops makes it harder for them to build up in large numbers. In addition, rotating crops also helps to improve soil fertility, as different crops have different nutrient requirements and can help to maintain a balanced soil ecosystem.

Companion planting is another important aspect of crop protection in organic agriculture. This involves planting beneficial plants alongside crops, which can provide natural pest control and increase crop diversity. For example, planting marigolds near tomatoes can help to deter whiteflies and nematodes, while planting basil near tomatoes can help to repel aphids. Companion planting also has the added benefit of creating a more diverse agro ecosystem, which can help to increase overall resilience to pests and diseases.

Soil management is also crucial for crop protection in organic agriculture. Healthy soil supports healthy plants, which are more resistant to pests and diseases. Organic farmers aim to maintain a balanced soil ecosystem through practices such as cover cropping, composting, and the use of natural fertilizers. By focusing on soil health, organic farmers can create a supportive environment for their crops that helps to minimize the need for pest control interventions.

Encouraging the presence of natural predators is another important aspect of crop protection in organic agriculture. By creating a diverse agro ecosystem that supports beneficial insects and birds, farmers can help to control pest populations. For example, ladybugs and other beneficial insects can help to control aphids, while birds can help to control pests such as caterpillars and insect larvae. By working with natural predators, farmers can help to maintain a balanced ecosystem that reduces the need for synthetic pesticides.

Physical barriers, such as row covers, can also be used to protect crops from pests. Row covers are often made of a lightweight, permeable material that allows light and water to penetrate, while providing a barrier that prevents pests from reaching the crops. Physical barriers can be especially effective in the early stages of crop growth, when plants are most vulnerable to pests.

Biological control is another important aspect of crop protection in organic agriculture. This involves using beneficial insects and microorganisms to control pests, rather than relying on synthetic pesticides. For example, farmers may release ladybugs or lacewings to control aphids, or use microorganisms such as Bacillus thuringiensis (BT) to control caterpillars. By using biological controls, farmers can help to maintain a balanced ecosystem that supports natural pest control.

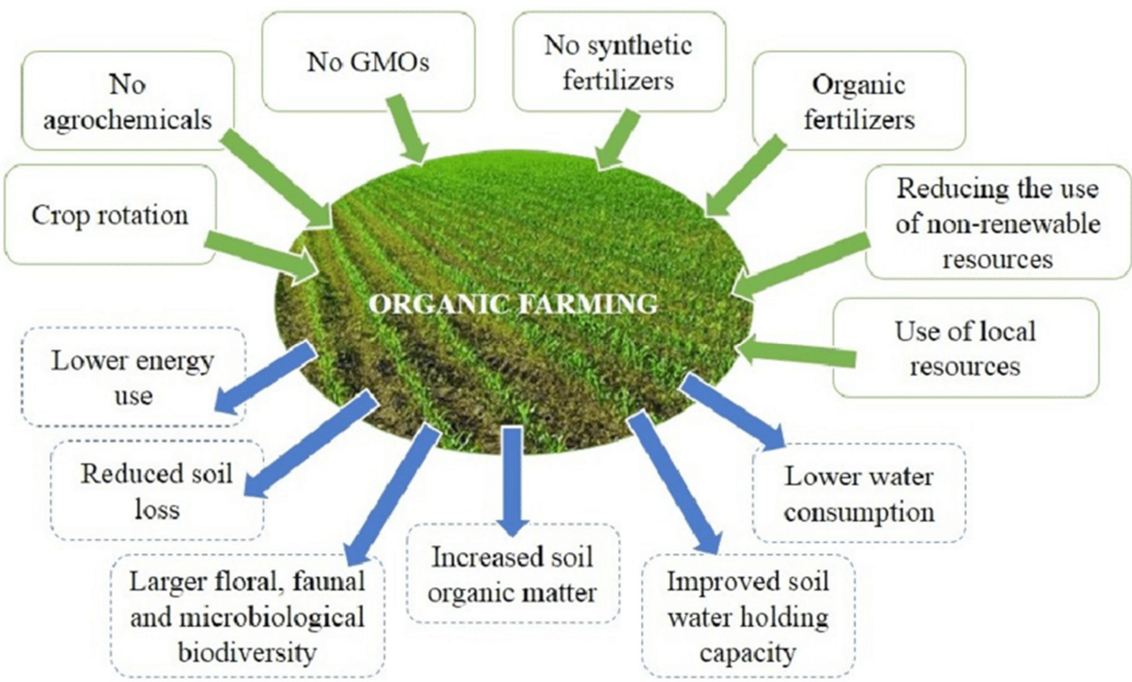

Figure 3.2 shows the main principles and effects of organic farming.

Finally, organic pesticides can also be used as a last resort in organic agriculture. Organic pesticides are made from natural ingredients, such as neem oil, and are designed to be less harmful to the environment and to human health than synthetic pesticides. However, organic farmers still aim to minimize the use of pesticides, as they can have negative impacts on the agroecosystem, even if they are derived from natural sources.

Crop protection in organic agriculture requires a comprehensive approach that focuses on preventative measures, natural pest control methods, and the responsible use of organic pesticides. By working with natural processes and inputs, organic farmers can help to create a self-sustaining and balanced agroecosystem that supports healthy crops and reduces the need for synthetic pesticides and fertilizers.

Organic agriculture is a farming method that aims to create a self-sustaining and balanced agroecosystem through the use of natural processes and inputs. Crop protection is a crucial aspect of organic agriculture, as farmers strive to protect their crops from pests, diseases, and other stressors without relying on synthetic pesticides and fertilizers. Preventative measures play a key role in crop protection in organic agriculture. This includes monitoring crop health and using cultural practices that promote plant health, such as proper irrigation and soil management. A healthy plant is more resistant to pests and diseases, so by focusing on plant health, farmers can minimize the need for pest control interventions. Crop rotation is another important aspect of crop protection in organic agriculture. By rotating crops between fields each year, farmers can reduce pest buildup and improve soil fertility. Certain pests are host-specific, and rotating crops makes it harder for them to build up in large numbers. Rotation also helps to maintain a balanced soil ecosystem, as different crops have different nutrient requirements.

Physical barriers, such as row covers, can also be used to protect crops from pests. Row covers are made of a permeable material that allows light and water to penetrate, while providing a barrier that prevents pests from reaching the crops. This can be especially effective in the early stages of crop growth, when plants are most vulnerable to pests. Biological control is another approach to crop protection in organic agriculture. This involves using beneficial insects and microorganisms to control pests, rather than relying on synthetic pesticides. For example, farmers may release ladybugs or lacewings to control aphids, or use microorganisms such as Bacillus thuringiensis (BT) to control caterpillars. This approach helps to maintain a balanced ecosystem that supports natural pest control.

Organic pesticides, made from natural ingredients such as neem oil, can also be used as a last resort in organic agriculture. Although these pesticides are less harmful than synthetic pesticides, organic farmers still aim to minimize their use, as they can have negative impacts on the agroecosystem. Crop protection in organic agriculture requires a comprehensive approach that emphasizes preventative measures, natural pest control methods, and the responsible use of organic pesticides. By working with natural processes and inputs, organic farmers can help to create a self-sustaining and balanced agroecosystem that supports healthy crops and reduces the need for synthetic pesticides and fertilizers.

Additionally, it is also important for organic farmers to monitor their crops regularly for signs of pest and disease problems, and to take early action to prevent these issues from becoming more serious. This can involve using integrated pest management (IPM) techniques, such as monitoring crop health, identifying pests and diseases, and selecting appropriate control measures based on the severity of the problem. One of the key components of IPM in organic agriculture is the use of beneficial insects and other natural predators to control pests. For example, ladybugs can help to control aphids, while lacewings can help to control thrips, whiteflies, and mites. Organic farmers can encourage the presence of these beneficial insects by planting flowering cover crops, providing habitat for predators, and avoiding the use of insecticides that can harm these beneficial species.

Another component of IPM in organic agriculture is the use of botanical insecticides, which are derived from plants and have a lower impact on the environment than synthetic insecticides. These botanical insecticides can help to control pests and diseases, while also reducing the need for more toxic chemical inputs. Some common botanical insecticides used in organic agriculture include neem, pyrethrum, and rotenone. Organic farmers can also use physical controls, such as row covers, screens, and insect exclusion netting, to protect their crops from pests and diseases. For example, row covers can help to protect crops from insect pests, while screens and exclusion netting can help to prevent the entry of diseases, such as powdery mildew, into greenhouse crops.

Organic farmers can also use cultural practices, such as pruning, training, and proper spacing, to improve crop health and reduce the impact of pests and diseases. For example, proper pruning can help to reduce the spread of diseases, such as fire blight, in fruit trees, while proper training and spacing can help to improve air flow and reduce the buildup of pests and diseases in crops. Organic farmers can also use biological controls, such as biological pesticides and biostimulants, to improve crop health and reduce the impact of pests and diseases. Biological pesticides, such as Bacillus thuringiensis (BT), are naturally occurring microbes that are used to control pests. Biostimulants, such as seaweed extracts, are used to improve plant health and increase the plant's ability to resist pests and diseases.

By using a combination of cultural practices, biological controls, physical controls, botanical insecticides, and beneficial insects, organic farmers can effectively control pests and diseases, while also reducing the need for synthetic inputs. By monitoring their crops regularly and taking early action to prevent pest and disease problems, organic farmers can ensure the health and productivity of their crops and contribute to a more sustainable and healthy food system.

Figure 3.3 shows the organic farming food and agriculture in India.

To improve sustainability, organic agriculture aims to make a positive impact. What, though, does sustainability entail? Sustainability in the aspect of agriculture refers to the effective management of agricultural resources to achieve basic needs while simultaneously preserving or improving the preservation of natural resources for subsequent generations and environmental quality. Therefore, sustainability in organic farming must be seen holistically, taking into account ecological, economic, and social factors.

Using different crops, organic manure, mulches, and fodder legumes to contribute nitrogen to a soil fertility cycle to improve soil fertility and structure. Preventing soil erosion and stress by growing relay and mixed crops to preserve the soil. Promoting biological diversity by using natural pest controls (such as biological control and crops with pest management properties) as opposed to synthetic pesticides, which are known to kill good bacteria (such as bees, earthworms, and natural pest parasites) and often pollute land and water when used improperly. Performing agricultural rotations, which promote a variety of food crops, fodder, and underused species; may help with the on-farm preservation of genetic resources of plants in addition to enhancing overall farm output and fertility. Utilizing renewable energy, integrating livestock, tree crops, and on-farm forestry into the system; recycling nutrients through using crop leftovers (straws, industry makes a significant and other non-edible portion) whether directly as composting and mulch or through animals as farmyard manure system. In addition to draught animal power, this increases revenue through the sale of organic meat, eggs, and dairy goods. The system's integrated tree crops as well as forestry supply food, money, fuel, and timber.

Equity between and among generations is another aspect of sustainability by lowering the loss of arable soil, water pollution, biodiversity erosion, GHG emissions, food loss, and pesticide toxicity, organic agriculture improves societal well-being. Traditional knowledge and culture are the foundation of organic agriculture. Its farming practices adapt to the specific biophysical, socioeconomic, and environmental limits and opportunities in the area. The economic climate and growth of rural areas may be enhanced by utilizing local resources, and local expertise, and establishing connections between farmers, consumers, and their markets. To enhance farm production, reduce farm susceptibility to weather whims, and ultimately improve food security, whether, through the food they create livelihood or the cash from the items they sell, organic agriculture places a strong emphasis on variety and adaptive management.

Additionally to supplying nutrition, soil organic matter enhances soil fertility by endowing soil with advantageous chemical and physical characteristics. Through the cation exchange process, organic matter in soil may bind nutrients. Calcium, magnesium, potassium, and ammonium are nutritional cations that are stored on organic matter's cation exchange sites. The cation exchange capacity (CEC) of soil organic matter can range from 20 to 70% of the total CEC of soil. The interaction of organic matter in soils with minerals to create aggregates has an impact on soil structure. The development of aggregates enhances soil structure, increases water infiltration, and increases water-holding capacity. These modifications enhance root development and offer the home to a variety of soil organisms. Organic matter in soil improves nitrogen cycling and offers a home for a variety of organisms.

Organic agriculture appears to increase employment in rural regions by 30%, and labor productivity is higher for each hour worked. Organic farming helps smallholder's access markets and generate revenue by better utilizing local resources. It also delocalizes agricultural production in the area locations with weaker markets. In wealthy nations, organic yields are typically 20%

lower than high-input systems, but in dry and semi-arid regions, they can be up to 180% greater. In humid environments, rice paddy yields are comparable while perennial crop output is lower, while agroforestry adds extra benefits. Operating expenses in sustainable farming are much cheaper than those in conventional farming, ranging from 50–60% for legumes and cereals to 20–25% for dairy cows (seeds, rent, maintenance, and labor) 10%–20% for horticultural goods and dairy cows. This is a result of decreased labor cash expenses, which include both paid and family labor, cheaper irrigation costs, and lower input prices for synthetic inputs. Total expenses, however, are only somewhat less expensive than conventional, as fixed expenditures (such as land, buildings, and machinery) rise as a result of additional investments made during conversion (such as new orchards, animal quarters), certification, and licensing.

New export potential is brought about by the interest in organic products. Exports of organic goods often command premiums of 20% or more over comparable goods grown on non-organic farms. The market return from organic agriculture may be attractive under the correct conditions. By raising household incomes, you may aid in ensuring local food security. It's difficult to break into this profitable sector. To ensure that your fields and companies uphold the organic criteria imposed by various trade partners, farmers must annually hire an agency that certifies organic products. Farmers cannot market their food as "organic" during the 2 to 3-year conversion phase to organic management and lose out on price premiums. Customers anticipate residue-free organic products, which is why this is the case. However, items produced on property under organic cultivation for at least a year but less than the two to three-year criteria might be sold as organic following the Codex Guidelines on Organic Food Production (2007). "Transition to organic," yet there aren't many marketplaces that have sprung up for these items.

While the majority of manufacturers in developing nations have focused on the EU or North American export markets, the local market potential for organic products is now expanding globally. Recognizing how domestic organic markets contribute to a thriving organic industry, around the world, alternatives to certification have evolved. Consumers and organic farmers have established direct routes in developed nations for the home delivery of non-certified organic products (such as community-supported farming). Small-scale organic producers are technically excluded from certification in the United States of America (USA). Participatory Guarantee Systems (PGS) are increasingly accepted as a replacement for third-party certification in poor nations. Recently, organic farming has emerged as a viable option to increase family food security or to realize. This behavior is being observed in industrialized nations as a result of the economic crisis. Farmers either consume their products or sell them on the open market at no premium because it is not approved. The goals of organic farmers frequently include maximization of interactions between the land, animals, and plants, preserving organic nutrient and energy flows, enhancing biodiversity, as well as protecting the health of family farmers, and advancing the overall goal of sustainable agriculture. Economic goals aren't the only motivation for organic farmers.

Many of the same crop protection challenges that face conventional agricultural methods also affect organic farming. Growers worldwide and in different regions use quite different approaches to crop protection in organic agriculture. On one end of the range, organic producers utilise large-scale operations with substitution-based strategies to command premium pricing in a specialised market. On the other hand, resource-poor farmers growing crops for sustenance automatically. Using traditional knowledge to control pests In contrast to those producers who have formed the conceptual core of organic agricultural movements across the globe, organic growers at both ends of the spectrum are less driven by environmental and public health concerns. These farmers see fundamental differences between organic and conventional farming, not only in terms of the pest and disease issues that crop production must deal with, nor just in the variety of producers' solutions, but in the conceptual frameworks that support crop management practises.

Too often, depictions of the conceptual philosophies used in conventional and organic agriculture are oversimplified. Conventional pest management is no longer defined as the use of routine applications of broad-spectrum pesticides (biocides, insecticides, fungicides, and herbicides). Choosing cultivars that are resistant to insects and diseases, crop rotation, and crop residue destruction are just a few of the cultural controls that are incorporated into best practises in conventional agriculture.

Other methods include pest monitoring, selective pesticide use and timing, cultivar selection, and pest monitoring. Likewise, organic farming goes beyond traditional farming by using natural fertilisers and pesticides rather than synthetic ones. While some organic growers do simply substitute manure for fertiliser and botanically derived pesticides for synthetic pesticides, more frequently organic practises involve a wide range of soil management and cropping practises that maintain ecosystem health and foster ecosystem services.

For the purposes of this chapter on pest and disease management, organic agriculture is defined as the management of plant and animal production systems with a focus on sustainable and renewable biological processes: Through the breakdown of nitrogen (N)-fixing green manures and plant- or animal-based soil amendments, nutrients are given at rates necessary to maintain nutrient balances. Pest control strategies mainly depend on boosting plant health, vegetation management, and biological control. Application of microbials, botanicals, soaps, oils, minerals, and augmentative releases of predators are examples of curative pest treatments; synthetic fertilisers or pesticides are often not used, unless exemptions are permitted.

Global perspectives on organic farming

Based on some of the concepts from invasion ecology, we shall utilise a theoretical approach to the characterization of pests and diseases in agricultural systems. The topic of alien plants, animals, and birds is often the centre of the intricate and active intellectual discussion known as invasion ecology. In this case, any disease or pest species that aren't already present in a crop during a certain growing season are also considered invaders in addition to alien species. We analyse three invasion phases: 1 colonisation, 2 establishment, and 3 population outburst in order to apply some fundamental invasion ecology principles to crop security.

We investigate if distinct invasion tendencies for nematodes, fungus, bacteria, and herbivorous arthropods can be identified in organic vs conventional agricultural settings. We may analyse how organically maintained crops may provide barriers against the invasion by pests and diseases by borrowing the term "invasibility" and, when feasible, comparing them to conventionally managed crops. Depending on the scale of observation, low invasibility has often been linked to high biodiversity in natural ecosystems, and this association may also apply for managed agroecosystems. Agroecosystems that are maintained organically are often more diversified than those that are managed conventionally. This has been shown for both above-ground natural plant and crop species, insects, and birds, as well as for below-ground arthropods, nematodes, fungi, and bacteria. The reasons for this difference in biodiversity are numerous, but in particular, the following factors:

1) Absence of herbicides reduces detrimental effects on various microbial species;
2) Absence of synthetic nematicides and insecticides reduces broad-spectrum effects on beneficial fauna;
3) Absence of general fumigants reduces broad-spectrum activity on all soil life;
4) Absence of readily available plant nutrients reduces the selective enhancement of fast-growing microorganisms; and
5) Absence of general fumigants

Additionally, organic farmers typically plant strips of managed wild flora on purpose, which has an impact on both soil and above-ground biodiversity. We may anticipate less pest and disease transmission on organic farms than on conventional ones if enhanced biodiversity in agroecosystems limits invasiveness. While there are certain outliers, we contend that this assumption is often satisfied.

We contrast the variety of pests and illnesses that threaten crop output in organic and conventional agricultural systems worldwide. Although the focus of this article is on arthropod pests and illnesses, we also provide some findings on pests that affect vertebrates and other invertebrates. The three components of pest and disease control, including organic and conventional techniques, are then discussed. They are: 1 avoidance of colonisation or establishment; 2 population regulation via biological processes; and 3 curative treatments.

We critically review comparative research projects on conventional and organic pest control conducted in numerous regions of the world to illustrate these aspects of pest and disease management in action. We also highlight the opportunities and limitations of organic crop protection in various farming contexts. We finish by making recommendations for more study.

Crop protection in organic farming 95 recommendations that will improve our understanding and ability to safeguard crops effectively in organic agriculture.

Pests and illnesses in organic vs conventional agriculture

The same pests and illnesses that affect conventional farming operations, reducing yields or necessitating the use of expensive inputs, can pose a problem for organic farmers growing the same crops. One notable distinction is that organic producers refrain from using broad-spectrum synthetic pesticides, which significantly disrupt the system's natural controls and encourage the appearance of secondary pests. Well-known secondary pests in pesticide-intensive systems include spider mites in temperate orchards treated for codling moth, rice brown planthopper in pesticide-treated tropical paddy rice, Rhizoctonia black scurf in potatoes following nematicide applications that reduce fungi-feeding collembola, and apple scab as a result of the fungicide benomyl decimating earthworm populations (slowing down decomposition of infected leaves). Because of the preservation of their natural adversary complex, a sizable number of important pests in conventional systems are thus controlled at low levels in organic systems.

In organic agricultural practises, natural pest and disease management are not only maintained but actively encouraged. According to, organic farms tend to have lower prevalences of soilborne plant pathogens that cause root and foot rots in older plants. This kind of disease suppression has often been linked to increased microbial activity and diversity, higher microfaunal populations and variety, and/or lower soil and crop N concentrations in organic soils compared to conventional soils. Due to lower nitrogen concentrations in foliar tissues or phloem on organic farms compared to conventional farms, attacks by various airborne diseases in particular several powdery mildew and rust diseases and sucking insect pests (aphids and whiteflies) may also be less severe in organic crops.

However, some arthropods are favoured in organic farming practises, particularly below-ground pests that are nourished by abundant organic matter, such as garden symphylan, cutworms, wireworms, and slugs; or hardy pest insects that have few biological controls and are ineffectively controlled with permitted organic inputs, such as the strawberry weevil or Lygus bug. Similarly, pathogens that cause damping-off, such as Pythium species, may ruin organic crops because they can swiftly grow in newly added organic soil elements. In humid areas, some foliar diseases, such as potato late blight and onion downy mildew, which may spread fast and are managed by regular fungicide applications in conventional farms, can be deadly to organic crops. Since synthetic pesticides are forbidden in organic agriculture, stored goods pests should also present a particularly difficult issue. However, it seems that pests from stored goods are a widespread issue that presents difficulties for both conventional and organic farms. The outlines several issues with synthetic chemical tactics that have been used in the previous few decades to manage pests in long-term storage facilities and suggests brand-new breakthroughs in alternative control methods. These prevention techniques include those used by organic farmers.

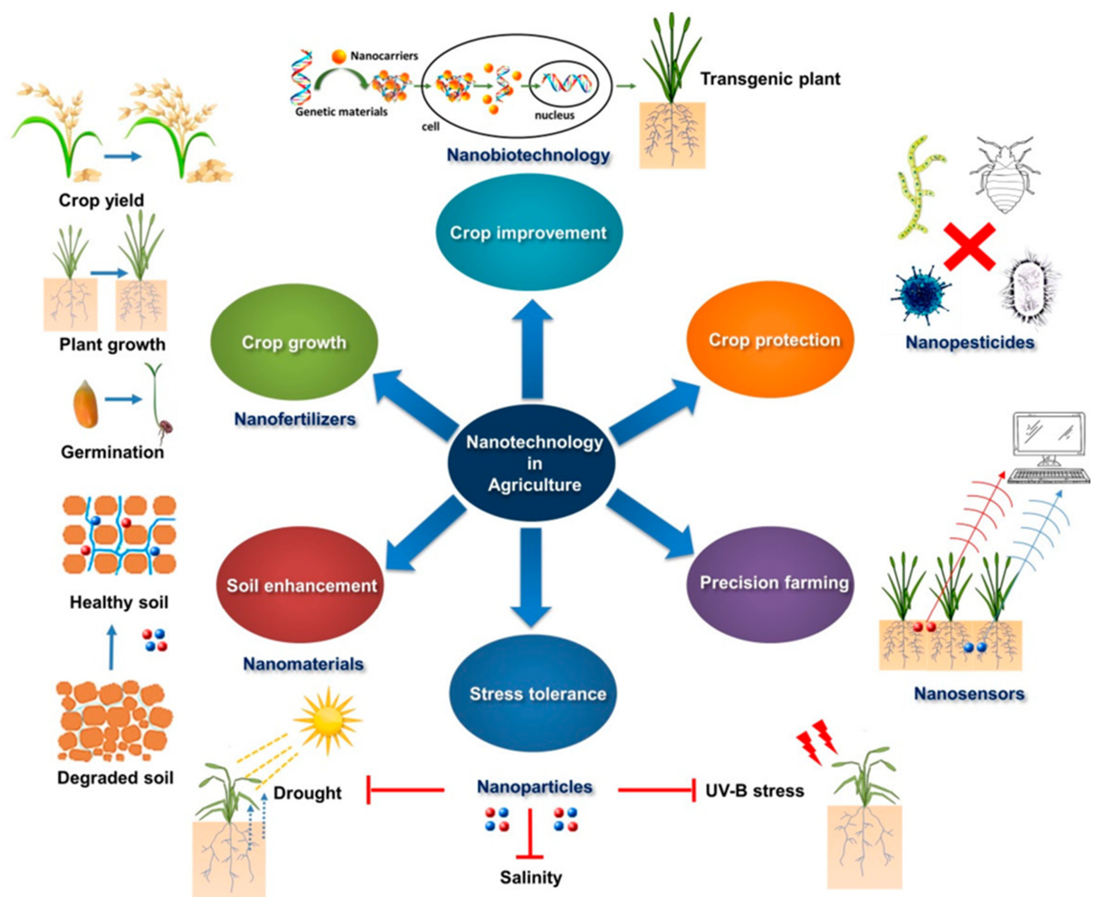

Figure 3.4 shows the Applications of Nanotechnology in Plant Growth and Crop Protection.

Vertebrate pests, such as deer and other ungulates, fruit- and seed-eating birds, rats, rabbits, and squirrels, colonise or sometimes visit both organic and conventional farms, thereby lowering yields and/or impacting food quality. Some of the practises that are more prevalent on organic farms, like cover cropping, farmscaping with non-crop vegetation, and mixed cropping, encourage beneficial fauna and deter some vertebrate pests, but they may also improve the habitat for other vertebrates, like gophers, voles, and noxious birds. For the management of certain pests, organic farming methods overlap with conventional farming methods.

CHAPTER 4

ORGANIC PLANT BREEDING AND SEED PRODUCTION

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Organic plant breeding and seed production are practices aimed at developing and producing plant varieties that are adapted to organic farming systems and are free of genetically modified organisms (GMOs). The aim is to produce crops that are well-suited for organic growing conditions, have improved yields and quality, and are resistant to pests and diseases.

The process of organic plant breeding starts with selecting plants with desirable traits. These traits could be agronomic, such as high yield, disease resistance, or drought tolerance, or they could be related to the quality of the end product, such as improved flavor or nutritional value. Next, the selected plants are cross-pollinated to create new varieties. This process is repeated over several generations, and the most desirable plants are selected for further breeding.

Organic seed production involves the cultivation and harvest of seeds from the selected plant varieties. The seeds are produced in a way that avoids the use of synthetic pesticides, herbicides, and fertilizers, and the plants are grown in a way that conserves soil health and biodiversity. The seed production process also involves rigorous quality control to ensure that the seeds are free of contaminants and have a high germination rate. One of the key differences between organic and conventional seed production is the use of synthetic inputs. Conventional seed production often relies heavily on the use of synthetic pesticides, herbicides, and fertilizers to control pests, diseases, and weeds. Organic seed production, on the other hand, relies on agroecological practices such as crop rotation, intercropping, and the use of beneficial insects to control pests and diseases.

Organic plant breeding and seed production are also distinct from GMO breeding and seed production, which involves the use of genetic engineering techniques to introduce new traits into crops. Organic breeding and seed production rely on traditional breeding techniques and the use of naturally occurring genetic variation. Organic plant breeding and seed production have a number of benefits for farmers, consumers, and the environment. For farmers, organic seed production provides access to high-quality seed that is well-adapted to organic growing conditions. This can lead to improved yields and better crop quality, which can increase the profitability of their operations. For consumers, organic seed production ensures that the crops they consume are free of GMOs and grown in a way that conserves soil health and biodiversity.

From an environmental perspective, organic seed production is a more sustainable approach to agriculture. By avoiding the use of synthetic pesticides, herbicides, and fertilizers, organic seed production helps to reduce the amount of pollution in the environment. It also helps to conserve soil health and biodiversity, which is essential for maintaining the long-term productivity of the land.

Organic plant breeding and seed production are important practices that play a key role in promoting sustainable agriculture. By developing crops that are well-suited for organic growing conditions and producing seeds in a way that conserves soil health and biodiversity, organic plant breeding and seed production provide a more sustainable approach to agriculture. Organic Plant Breeding and Seed Production is the process of developing new plant varieties for organic agriculture by using traditional breeding methods that do not involve genetic modification or the use of synthetic chemicals. The goal is to create plants that are well adapted to organic growing conditions and that meet the needs of organic farmers and consumers.

There are several key steps involved in organic plant breeding and seed production:

1. **Selection:** The first step is to select plants with desirable traits, such as high yield, disease resistance, and improved nutritional quality. This can be done by observing plants in the field and collecting data on their performance.
2. **Cross-pollination:** The next step is to cross-pollinate the selected plants to create new varieties. This is done by transferring the pollen from one plant to the pistil of another.
3. **Selection of offspring:** The offspring of the cross-pollination are then evaluated for their agronomic performance, and the best ones are selected for further breeding.
4. **Repeat steps 2 and 3:** The process of cross-pollination and selection is repeated several times over several generations until a new variety is created that has the desired traits.
5. **Seed production:** The final step is to produce seed of the new variety for commercial use. This is done by growing the new variety in a seed production field and harvesting the seed when it is mature.

Organic plant breeding and seed production is important for several reasons:

1. **Sustainability:** Organic agriculture is based on the principles of sustainability and aims to maintain the health and productivity of the soil, water, and air for future generations. Organic plant breeding and seed production supports these principles by creating plants that are well adapted to organic growing conditions and that do not require the use of synthetic chemicals.
2. **Health:** Organic foods are often preferred by consumers because they are believed to be healthier and free from harmful chemicals. Organic plant breeding and seed production can contribute to this by developing plants with improved nutritional quality.
3. **Biodiversity:** Organic plant breeding and seed production can help to conserve biodiversity by creating new plant varieties that are adapted to local growing conditions. This can help to reduce the dependence on a small number of crop varieties, which can be vulnerable to disease and environmental changes.
4. **Economic benefits:** Organic agriculture can provide economic benefits for farmers, particularly in developing countries, by reducing their dependence on synthetic inputs and increasing their access to markets for organic products. Organic plant breeding and seed production can contribute to these benefits by creating new plant varieties that are well adapted to local growing conditions and that meet the needs of organic farmers and consumers.

Organic plant breeding and seed production is a long-term process that requires careful planning, attention to detail, and patience. However, the benefits of creating new plant varieties for organic agriculture can be substantial and can contribute to the sustainability and health of our food systems.

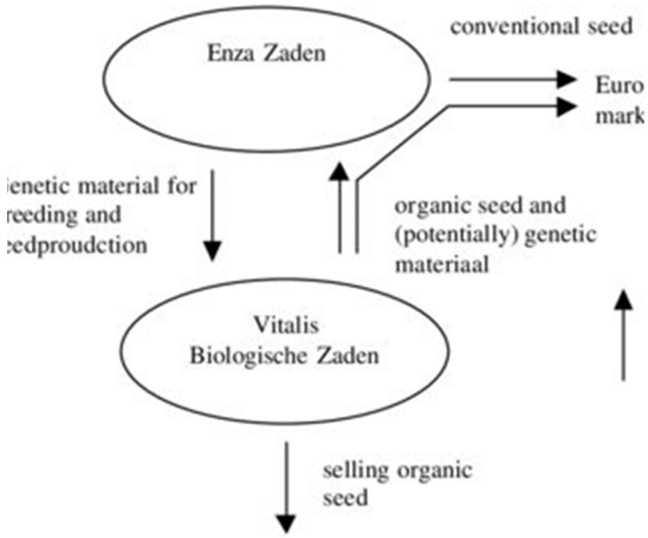

Figure 4.1 shows the organizational forms in organic plant breeding and seed production.

Organic plant breeding and seed production are critical components of sustainable agriculture and food systems. These practices play a key role in promoting agroecology, which is a holistic approach to agriculture that emphasizes the interdependence of plants, animals, people, and the environment. In organic plant breeding, the focus is on selecting plants with desirable traits and cross-pollinating them to create new varieties that are better suited for organic growing conditions. In organic seed production, the focus is on producing high-quality seed that is free from contaminants, has a high germination rate, and is produced in a way that conserves soil health and biodiversity.

Organic plant breeding and seed production also contribute to food security by providing farmers with access to high-quality seed that is well-adapted to local growing conditions. This helps to improve crop yields and quality, which in turn increases the profitability of farming operations. Furthermore, organic seed production helps to conserve genetic diversity and preserve traditional knowledge, as well as promoting the use of local seed varieties that are better suited to local growing conditions.

Another important benefit of organic plant breeding and seed production is their contribution to food safety and the reduction of pesticide residues in the food supply. By avoiding the use of synthetic pesticides and herbicides, organic seed production reduces the amount of these chemicals in the food supply, which is especially important for populations that are particularly vulnerable to the health effects of these chemicals, such as pregnant women, infants, and children.

Organic plant breeding and seed production also promote environmental sustainability by reducing the use of synthetic inputs and conserving soil health and biodiversity. By relying on agroecological practices such as crop rotation, intercropping, and the use of beneficial insects, organic seed production helps to reduce the amount of pollution in the environment and conserve soil health and biodiversity, which is essential for maintaining the long-term productivity of the land.

However, there are also some challenges associated with organic plant breeding and seed production. One of the main challenges is the lack of funding and research support for organic breeding and seed production programs. Organic breeding and seed production often receive less funding and resources compared to conventional breeding and seed production programs, which can limit the development and availability of organic seed varieties.

Another challenge is the lack of access to seed that is well-adapted to organic growing conditions. While there is a growing demand for organic seed, there is still a limited availability of seed that is specifically adapted to organic growing conditions. This can make it difficult for farmers to find seed that is well-suited to their growing conditions, which can limit the success of their operations.

Organic plant breeding and seed production can also help to address the challenges facing modern agriculture, such as climate change and the loss of pollinators. Organic breeding can create varieties that are more resilient to environmental stress and can help to conserve habitats for pollinators. This can help to ensure that future generations have access to a diverse and healthy food supply.

Another benefit of organic plant breeding and seed production is that it can lead to the creation of new crop varieties that are better suited to local growing conditions. For example, in regions where water is scarce, breeders can develop drought-tolerant varieties that require less water and are more resilient to water stress. This can help farmers to grow crops more efficiently and can contribute to food security in regions where water is a limiting factor.

Organic plant breeding and seed production is also important for preserving the heritage and cultural significance of traditional crops. Many traditional crops are grown by indigenous communities and have been passed down from generation to generation. By developing new varieties of these crops that are well adapted to modern farming practices, organic breeders can help to preserve these crops for future generations and maintain the cultural heritage of these communities.

Organic plant breeding and seed production is also essential for ensuring the quality of organic seed. Organic seed must meet strict standards for purity and must be free from genetically modified organisms (GMOs) and synthetic chemicals. Organic breeders must take great care to ensure that their seed is produced in accordance with these standards, and that the seed they produce is of the highest quality.

Organic plant breeding and seed production also has the potential to help address global food security. By creating new crop varieties that are well adapted to local growing conditions and that have improved nutritional quality, organic breeders can help to ensure that people in developing countries have access to a diverse and healthy food supply. This can help to reduce malnutrition and food insecurity, and can contribute to the sustainable development of communities in these regions.

Finally, organic plant breeding and seed production can play a critical role in creating a more sustainable food system. By developing new crop varieties that are well adapted to organic growing conditions, and that require less synthetic inputs, organic breeders can help to reduce the environmental impact of agriculture and support the principles of sustainability. This can help to ensure that future generations have access to a healthy and diverse food supply, and that the environment is protected for generations to come.

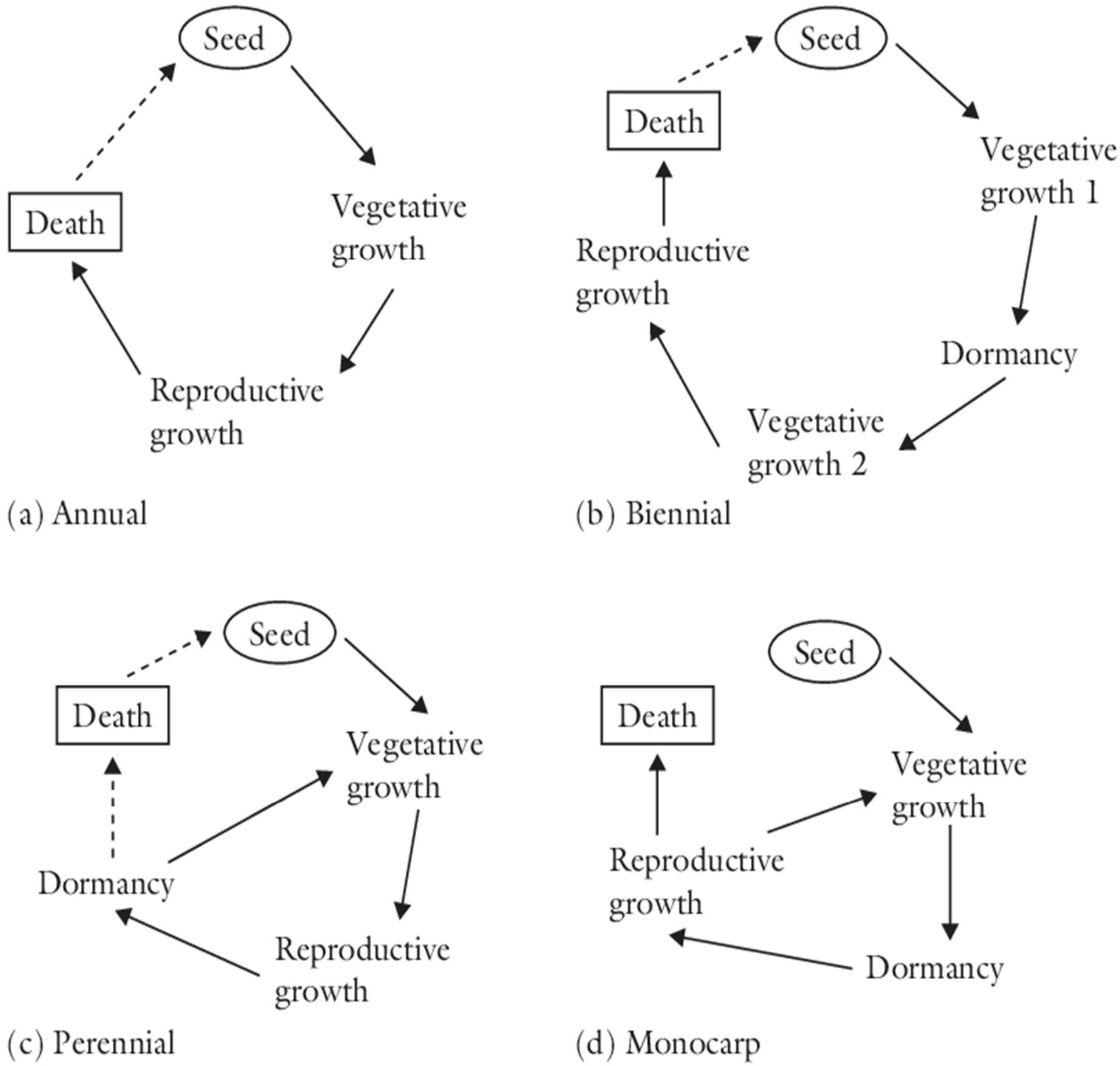

Figure 4.2 shows the Principles of plant genetics and breeding.

The latter includes substituting synthetic chemical inputs used in traditional crops after pest or disease levels start to grow. The first two options are often preventative management strategies. Because organic systems' prophylactic crop protection is based on ecological. The crop is seen as a host in these processes, the crop field and surrounds as a biotic community with its abiotic circumstances, and the pest or disease as an invader that colonises the crop habitat, establishes itself, and then manifests itself. Various techniques for separating the crop from pest/pathogen source pools and managing pest and pathogen populations after they have been established via community resistance are barriers to pest outbreaks. Community resistance includes elements like resource depletion, competition, and predation that make the ecosystem unsuitable for the spread of intruders. The use of synthetic pesticides in traditional agriculture is offset by community opposition. Community resilience above ground entails the preservation and improvement of beneficial fauna, either directly or via a variety of flora. The soil food web may be activated by adding organic elements that break down slowly in order to improve community resilience.

The main goal of these activities is to increase biodiversity. When pest or pathogen populations start to increase, remedial actions are conducted, such as the use of biocides that have been authorised for use organically, the use of substances that alter behaviour originating from natural sources, or the release of other organisms at a high rate (competitors, predators, or parasites). In traditional agriculture, curative treatments may replace synthetic pesticides and may support other strategies, such as biodiversity enhancement. Prophylactic methods that stop pest and pathogen colonisation, establishment, or buildup are essential for successful crop protection in organic systems, often in conjunction with therapeutic interventions when necessary. Pests and diseases from colonising or taking hold in organic agriculture

Sanitation, source isolation, and other preventive measures stop pests and diseases from colonising the crop field, orchard, vineyard, storage facility, or other agricultural environment. Sanitation, clean seeds or vegetative propagating materials, crop rotation, timing adjustments, removal of specific weeds, fencing or netting against vertebrates, sealing or repelling against storage pests are practises to prevent colonisation and establishment of pests and pathogens that apply to both organic and conventional farming. They are much more crucial for organic farming, however, since there are less options for treatment. The employment of different crop protection techniques to avoid pests and diseases colonising the crop is at least as frequent in conventional agriculture as it is in organic agriculture. We look at seed sanitation and crop rotation as examples of some of the specific issues organic producers face.

All agricultural inputs, including seeds and vegetative materials, must come from the organic production chain wherever possible, according to EU directive 2092/91 for organic farming Seeds and vegetative material that has been officially registered must be true to type, pure, and healthy (in terms of percentage germination and absence of pests and plant diseases). There is no scientific support for the belief that seed grown under organic settings would have more "vitality" than seed grown under conventional ones. It is more probable that the pathogens that get associated with the seeds throughout the seed production phase and during seed storage are what essentially affect the germination and emergence capabilities of seeds. Organic seeds are still commonly produced by small businesses without the resources that are used to test seed samples for pathogen infection and cull contaminated seed batches so that seeds may be certified as disease-free. As a result, seed-borne illnesses may cause issues for organic producers as long as organic seed production is subject to less rigorous regulation than conventional seed production.

Protection of crops in organic farming

By altering the crop planting season or rotating crops that harbour various infections and pest species, pathogens and pests may also be avoided (temporal isolation). In comparison to conventional field crop production, organic field crop production often has longer intervals between crop rotations (5–8 years v. 2–3 years). The EU's organic regulations prohibit successive planting of the same crop, although rotation durations are kept to a minimum in organic greenhouse production since only high-value crops with comparable cultural practices such as tomato, sweet pepper, and cucumber can be cultivated there. When growing these high-value commodities in soil-bound production with short crop rotations in greenhouses, root knot nematodes may cause serious issues for organic producers. By planting sensitive crops during periods of the year when certain pests are less prevalent, organic gardeners may prevent illnesses and pests. For instance, organic farmers plant early maturing potato types early in the growing season to ensure that tubers have developed to an acceptable size by the time late blight becomes widespread in order to prevent serious damage from late blight.

Around the globe, producers that utilise organic and conventional methods often use the strategy of asynchronizing insect pest dispersal and sensitive crop stages. For instance, the Hessian fly (Mayetiola destructor), which has a short adult life span, may be avoided by timing the production of winter wheat in the northern US. For producers growing types that are otherwise vulnerable to the insect, the US Department of Agriculture publishes forecasts of fly-free days. By planting after the first rain, Malawian subsistence farmers save their bean harvest from being destroyed. Later harvests are severely attacked by bean flies, such Ophiomyia spencerella, which may cause plant death. Crops may be planted earlier in the growing season to prevent viral contamination in US lettuce harvests. The aphid generation after that is often wingless and less likely to travel from plant to plant. Planting dates may also be employed to minimize damage from vertebrate pests. For example, sunflower crops in India were planted in January to avoid having developed seeds and emerging plants coincide with the presence of dangerous birds like house crows and rose-ringed parakeets.

According to invasion biology and metapopulation theory, when there is a great distance between patches, organisms cannot expand into patchy islands. Therefore, by maintaining a great distance between fields that are growing the same crop, crop fields may be separated from source pools. Due to the limited output of this specialised crop in northern California, kiwi fruit organic farming is successful. Patch sizes fields with a specific crop are often lower than in conventional agriculture in organic agriculture with longer rotations. Furthermore, in organic farms, fields are often divided by swaths of uncultivated vegetation. Thus, by situating fields far from coloniser pools, agricultural plants may be free of pathogens and herbivores (Letourneau 1999). However, since all plots may be situated close together, small-scale organic farmers are not always able to benefit from this technique to prevent pests and illnesses. For instance, some small-scale organic farms arrange their fields into circular "piepieces" where all crops are rotated until the next season.

The passage of viruses and pests from plant wastes to nearby seedlings of the same species increases the danger of pest and disease issues, despite the fact that this circular arrangement is attractive to consumers who purchase goods at the farm. Lastly, by eliminating weeds that serve as transporters or alternative hosts for crop pests and diseases, the source pool itself may be eliminated. Around farming areas, weeds and natural plants may harbour a variety of diseases, including bacterial and viral illnesses. Additionally, poplar trees might be home to lettuce root aphids, which spread to nearby lettuce fields. However, non-crop vegetation may support a variety of parasitoids and predators that help manage insect pests, thus weed control must be done carefully. To prevent the introduction of pests and illnesses into their crops, many organic farmers eliminate weeds judiciously and carefully preserve the surrounding environment.

A worldwide view of organic farming

Storage pests are a particularly challenging problem because, despite the fact that storage facilities are frequently patchy, pests and pathogens frequently move or reside in storage facilities with produce, making isolation difficult for many pest taxa in both organic and conventional farming operations.

Control of persistent pests and diseases in organic farming

Several steps take place to either increase a pest or pathogen's abundance and spread inside a system (this is called invasion) or to inhibit its abundance and spread after it has gotten established in a crop, field, or storage facility (persistence at low levels). These procedures either include the quality of the host or product or the existence of suppressive chemicals in the neighbourhood that inhibit the disease or pest's ability to reproduce in the agricultural environment. Additionally, physical barriers or increased distances between hosts reduce the ability to spread by a virus or pest. It is possible to maximise host plant quality to minimise disease severity or herbivorous insect success. Indeed, a key component of organic farming is crop tolerance to viruses and pests. Selecting varieties with genetically based resistance traits, managing the phenotype, health, and nutrient concentration to reduce its suitability for pests and pathogens, or managing crop and non-crop vegetation to reduce the concentration of food plants for herbivores are some methods for achieving resistance to pest and pathogen exploitation (see Community resistance). Competitors (neutral herbivores and virulent but less harmful microorganisms for the crop) and natural enemies are examples of suppressive agents (predators and parasitoids of the pestiferous and pathogenic organisms). This crop defence arsenal contains strategies that may be used in tandem to shield the crop from yield loss either in the field or in the storage facility. Integrative approaches are essential to effective crop protection in organic farming. The following sections examine the strategies used in organic agriculture, their efficacy, and their drawbacks.

Resistance in host plants

In order to maintain adequate nutrient status for plant productivity and health without excess nutrients or imbalances that support high levels of herbivores or pathogens, and when toxic or repellent properties are sufficient to directly reduce pest or pathogen exploitation and survival, the host plant quality is optimal for crop protection. The first strategy is fairly adaptable and enables a producer to react to disease and pest dynamics. The choice to utilize a resistant cultivar is predetermined for the season, however. The likelihood of invasion, the severity of the pest or pathogen, any resulting loss in yield quality or quantity, marketability, compatibility with other crop protection techniques, and the potency of the resistant cultivar against the intended pest and other potential exploiters will all influence its use. One exception to these generalisations is that "one organism's hunger is another organism's feast," meaning that very high nitrogen levels may attract insects while discouraging nematodes that parasitize plants if ammonia is released from the nitrogen source. High levels of mustard oil both attract and repel insects that are specialized in eating crops from the mustard family.

By controlling the kind and amount of nutrients and moisture delivered to the crop, plant quality-based resistance may be developed depending on the target pests or diseases. When potassium (K) is abundant, for instance, the quantity of soluble N circulating in the phloem tissue is decreased, which delays aphid fecundity. For example, high N levels may promote the population expansion of certain aphids (van Emden 1966). In contrast, a lack of water speeds up protein breakdown and mobilisation and improves the nutritional quality of the phloem for aphids, whilst an abundance of moisture may make the crop more susceptible to diseases that cause root rot.

Protection of crops in organic farming when organic gardeners employ certain nutrient sources, their crop plants might develop mineral balances that make them less attractive to pests and vectors like the European corn borer and the bean fly. Therefore, management techniques may alter host plant resilience by altering the quality of an insect or pathogen's food supply. Similar to this, some physiological factors may be managed to lessen the occurrence and severity of illness. For instance, excessive N levels in the soil and plant tissues may make a crop more susceptible to ailments like powdery mildew, rust, and certain infections that cause root rot. However, certain element deficiencies may also make people more susceptible to specific illnesses. For instance, calcium (Ca) and potassium (K) deficits make people more susceptible to Pythium root rot and Verticillium wilt in cotton, respectively.

For several crops, naturally resistant cultivars have been created that provide protection against nematode, bacterial, viral, fungal, and insect pest illnesses. Physical characteristics like stiff leaves, hairy or waxy tissues, and poisonous or deterring secondary plant chemicals in the foliage, fruits, or seeds are only a few of the processes underpinning resistance. Some of the resistance traits are based on numerous genes and exhibit wide action against a variety of pathogens and pests. For instance, in many crops, leaf hardness creates a considerable barrier to pathogen ingression and insect herbivore feeding. Numerous plant diseases are also poisonous to alkaloids, including nicotine, glucosinolates, and cyanogenic glycosides, which are present in tobacco, cabbage, and cassava, respectively. The inhibitory substances may always be present constitutive resistance or they may be brought on by stress, insect feeding, or pathogen and symbiont infection.

A specific pathogen or pest elicitor will often start a cascade of biochemical processes that will lead to robust resistance if a single gene controls resistance to pest exploitation. As a result of strong selection pressure, a disease or pest population may often adapt to this kind of resistance rather readily, but counter-resistance is more difficult to select against a variety of weak resistance variables. Because of this, organic farmers favour using animal breeds and plant cultivars with wide resilience based on several genes. Although this might result in a low level of infection or feeding, organic producers don't think twice about it since they appreciate increased genetic diversity and the stability it brings to yields. Many organic gardeners choose open-pollinated types over hybrids for the same reason. Additionally, even when modest resistance based on several genes is inadequate to manage a disease or pest on its own, it may still be beneficial when paired with additional strategies like biological control of pests, pathogens, or vectors.

Plant resistance characteristics may function indirectly by influencing natural adversaries. For instance, many maize plants (Zea mays) emit a combination of volatile substances when caterpillars feed on them, attracting parasite wasps. Varieties that are known to emit these induced odours would probably maximise biological control by drawing parasitoids in particular. Biological control is still in its infancy, and varietal selection is often used to find gene sequences that may be transmitted to conventional cultivars. In recent years, the manufacture of varieties specifically adapted to organic production methods has advanced, although the selection is still restricted as compared to types for conventional circumstances.

Adaptation by the community - vegetation

The genetic and phenotypic variety of wild plant populations is an important feature. Due to genetic diversity and induced reactions, individual plants may appear in natural settings with a mosaic of resistance levels.

A worldwide view of organic farming

Heterogeneity naturally decreases the possibility of counter-resistance in quickly developing diseases and phytophagous arthropods, and boosts the longevity of plant defences throughout time. Insects and diseases that specialise on a subset of the plants or varieties planted in the mixture have less access to food plants thanks to a mixed cropping or mixed varietal strategy. Under these circumstances, herbivores, especially specialised feeders, are less likely to identify their host plant and are more likely to abandon the field than when appropriate hosts are gathered in monocultures. However, the effectiveness of parasitoids in their search may also be decreased (Bukovinszky 2004), and crop mixing effects on herbivore suppression may also be indirectly influenced by plant quality and volatile emission. Plant pathogen spread is prevented by resistant ingredients in the mixture creating barriers and traps. In contrast to monoculture, 56% of herbivores had lower population densities in polyculture, 16% had greater population densities, and 28% had comparable or variable densities, according to analyses of the literature on pest population densities. Although intercropping is a crucial component of many traditional, low-input cropping systems in the tropics, it is seldom employed to produce goods for the organic market, particularly in temperate areas.

Herbivores and pathogens that cause community resistance

It is debatable to what extent competition between herbivores or between bacteria ultimately lessens plant damage in natural systems. It is feasible that guilds of plant exploiters may be changed to include more neutral invaders and avoid the buildup of the few most harmful species in agroecosystems, where the decrease of target pest populations is often the aim. The 'dilution effect' of the pestiferous species may theoretically be produced by organic methods that support the community's diversity of plant-supported microorganisms and herbivores, hence lowering crop damage levels and yield loss. Innovative methods targeted at certain species haven't always been a success, however. For instance, additional feeding of rodents in Canada to boost the population of rival, non-pest species failed to lower vole concentrations or repair damage.

Biological control in the face of community opposition

The cultivation of organic crops depends on the introduction, conservation, or increase of predators to control infections and pests (or parasitoids). By using disruptive cures sparingly and managing vegetation, organic systems that promote and sustain biodiversity may improve natural biological controls of pests and diseases (. In addition to providing resources for natural enemies like alternate prey or hosts, pollen or nectar, plants growing in and around crop fields also provide microhabitats that are absent from weed-free monocultures or extensive cropping operations with little non-crop vegetation. The potential for ecosystem services to benefit producers is increased by non-crop vegetation, which helps to boost faunal biodiversity. Vegetation management and farmscaping have developed into important crop protection measures in certain regions because organic producers depend more on ecosystem services for crop health than growers who utilise chemical input heavy schemes. Encouragement of natural enemies is difficult to do without unduly favouring pest organisms.

The development of vegetation management plans for biological control and biodiversity preservation may benefit from in-depth understanding of animal behaviour, resource usage, and movement patterns in relation to non-crop vegetation. Studies of bird populations in riparian strips in Quebec, for instance, revealed that woody vegetation enhanced the richness of certain insectivorous birds but did not boost pestiferous red-winged blackbird counts in nearby agricultural fields. Compared to simpler systems maintained with limited vegetative cover, microbial communities in soils that have been organically managed are often more varied. Crop protection in organic agriculture, chapter three: synthetic chemical inputs and tional diversity. As a result, regular soil amendment with recalcitrant organic materials like mature composts and manure leads to increased microbial complexity and activity in organic farming systems, which frequently suppresses plant pathogens

Curative management

According to country-specific organic agricultural regulations, there are only a few possibilities for curative control. Inputs to the crop production system known as "curatives" are added after a pest or disease has been established in the crop and has threatened to lower yields if no action is taken. A sample list of naturally occurring insecticides, microbiological agents, and other substances commonly permitted under organic standards. The degrees of toxicity and side effects that are non-target for these materials vary.

Many nations permit the use of copper fungicides to treat enduring issues like downy mildew on grapes and late blight on potatoes. Similar to how scab (Venturia inaequalis) is controlled on apples and pears, powdery mildew is managed on a variety of crops using sulphur fungicides. Even while sulphur sprays used in traditional apple production may be used more often than synthetic fungicides, their potential negative effects on the environment may still be less severe. Given its wide range of effects and propensity to persist in soil, copper may have a substantial influence on the environment. As an exception to the norm, certain synthetically created curatives, such pyrethroids, are permitted for specific applications. Curative uses are also becoming increasingly limited as a result of ongoing adjustments to the organic standards. For instance, several nations have already outlawed the use of copper fungicides.

Most organic regulations permit the use of different plant extracts as long as they are not combined with petroleum-based synergists or transporters. But they are mostly utilised as pesticides and are very sometimes used today, professionally prepared compost extracts are employed more commonly. Depending on the initial material, the composting and fermentation processes, and the ultimate microbial activity, they may be quite successful at controlling illness. By releasing certain biocontrol agents in a flood, curative biological control may be achieved. Relatively few species have been registered for field use, primarily parasitoids and predators for insect and mite control and some fungi and bacteria for insect and pathogen control, despite the fact that numerous specific biological control agents against plant pathogens, insect and nematode pests have been identified.

Under controlled environmental circumstances, using simple potting mixes, biocontrol of soilborne diseases has proven effective; but, when chosen microorganisms have been applied to field soil, it has often failed Due to the increased exposure to the elements, this is also true, maybe even more so, for foliar microbial biocontrol agents. Recent research revealed that Pseudomonas fluorescens, a bacterial biocontrol agent, did not thrive as well in organically managed soil as it did in conventionally managed soil. According to invasion biology theory, it can be more challenging to develop a biocontrol agent in an organic soil with a diversified microbial community than in a conventional soil with a depleted microbial population.

Although surveys show that biological control agents are rarely used on organic farms, with the exception of Bacillus thuringiensis (Bt) for caterpillar control and various parasitoids and predators in greenhouse production, one might expect that organic growers would use biological control proportionally more than conventional growers. The majority of nations have organic standards that permit the use of biological control agents as long as petroleum-based transporters or synergists are not included in the formulation. It's likely that higher biodiversity in organic agroecosystems (outdoors) could lead to intraguild rivalry or predation, which will lessen the efficiency of invasive biological control agents.

A worldwide view of organic farming

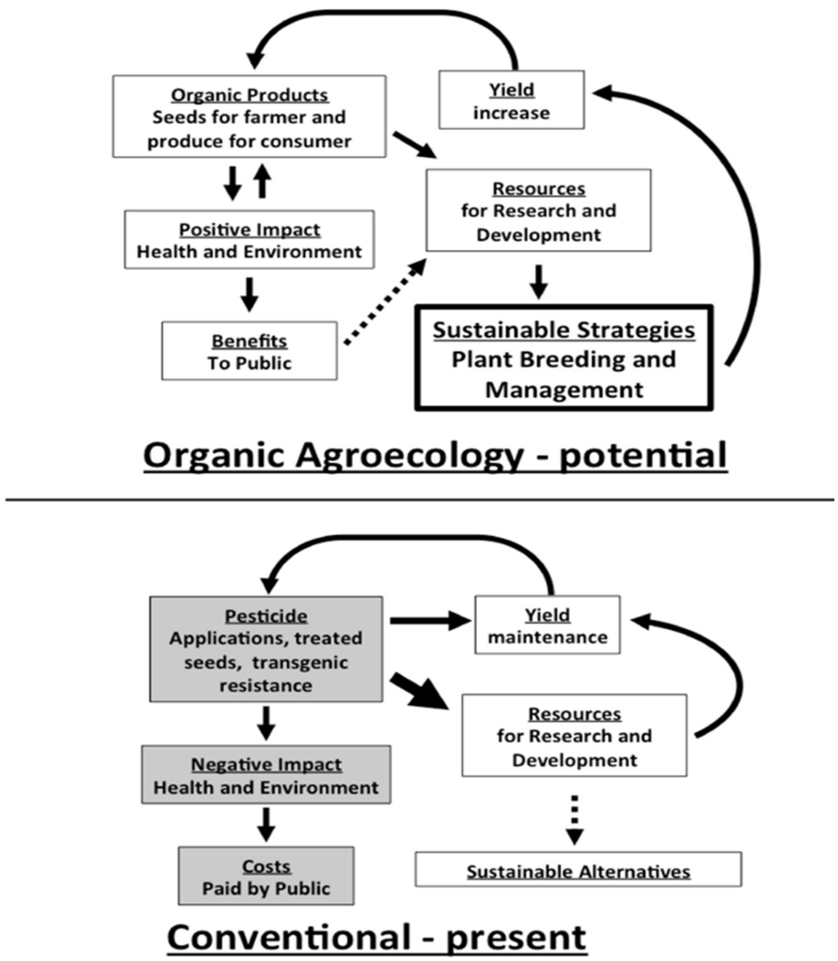

Figure 4.3 shows the Sustainable Agricultural Future Relies on the Transition to Organic Agro ecological Pest Management.

Pest and disease control case studies in organic versus \conventional agriculture. The relative efficacy of organic and conventional crop protection techniques is contrasted in a dearth of repeatable, on-farm research. This is especially true with pest vertebrate species. They provides instances of recent field comparisons between organic and conventional farming in various locations and crops. These studies demonstrate that there are some exceptions to the general rule that biodiversity is greater on organic farms and that pests and diseases are often controlled by organic measures. Only a few studies track pest populations and associated yield losses. There are even fewer studies that monitor diseases and pests simultaneously for integrated crop protection. To demonstrate certain limitations and advantages of organic agricultural approaches, we provide two comprehensive, integrated case studies drawn from European agriculture and commercial operations in the western United States. Many of the broad principles mentioned above are shown by these instances.

The process of studying and implementing adjustments on the farm toward a more sustainable and natural style of farming is referred to as conversion to organic agriculture. The procedure can take many different forms depending on the local conditions and the farmer's or community's preferences between farms. The transition to organic agriculture will be simpler for a farmer if they are more familiar with its principles and methods. Even while organic farming doesn't require certain land conditions, to begin with, if the soil is depleted, for instance, it could take more time and work to set up a long-term production system and provide satisfactory harvests. Here are the elements to take into account.

Farm-Related Conversion Obstacles:

Larger farms represent the majority most intensive agricultural farms in Asia, Latin America, and Africa that heavily rely on outside inputs. These farms mostly cultivate a small number of annual or perennial revenue crops, intensively using fertilizer for plant nutrients and herbicides and insecticides for pest, disease, and weed suppression on these farms, farm animals are frequently not included in the nutrient cycle and crops are frequently planted without a scheduled rotation. On these farms, diversification is typically minimal. To allow for considerable automation, trees and shrubs are typically cut down, and crops are typically produced on their own. It often takes many years to establish a varied, balanced agricultural system with a built-in capacity for self-regulation it could take significant work to regain natural soil quality.

To reestablish natural soil fertility, significant amounts of organic matter may need to be added to the soil in the initial years after discontinuing high-input external fertilizer, and yield depression occur. New approaches and practices typically need a lot of learning and extensive monitoring of crop growth, as well as dynamics of pests, diseases, and natural enemies. This observation of crop development is necessary before the fertility of the soil is restored and yields rise again. Develop a diverse farming system: Choose the best crop production for the region, then rotate them in a predetermined order. Include legume crops in the rotation to supply nitrogen to the following crops, such as beans or green manure feed crops. To promote natural predators and to keep pests under control, plant bushes and flower strips. Start recycling priceless farm waste.

Commence recycling priceless agriculture byproducts establish a composting operation on the farm using harvest waste and, if available, manure, and combine the compost with topsoil. This will increase the soil's structure and ability to nourish the plants by adding stable organic matter to the soil and keeping water. A lot of plant material may be found in green manures, which can feed soil organisms and improve the soil's fertility bringing animals into the equation. Animals raised for farming provide extra animal products and supply essential manure to cultivate cover crops. The soil is protected by using cover crops or mulching perennial crops.

On the same plot of land, farmers using traditional methods and minimal outside assistance may cultivate a wide variety of crops in a highly mixed system, switching crops at random. There may be a small number of animals kept, including chickens, pigs, cattle, and/or goats, which spread the manure while feeding locations, therefore giving the gardens relatively little manure. To make charcoal and firewood, these trees may be drastically chopped. Burning rubbish and bushes could be a common practice, especially while preparing the land. Due to unpredictable and inadequate precipitation, harvests are low and getting harder. The crops could just be enough to feed the family, leaving little to be sold to make money. Traditional farmers already adhere to some organic agricultural techniques.

Create a mechanism for gathering animal waste for composting and implement strategies to stop soil from eroding and to keep it from washing out. Pay close attention to meeting the farm animals' nutritional and medical needs. Avoid harvest and store losses by avoiding disease-infected seeds, learning about disease cycles, and taking preventative actions. In this system, several conversion techniques include. Put intercropping and planned crop rotation into action leguminous organic manure cover crops and a mix of annual and perennial crops are required.

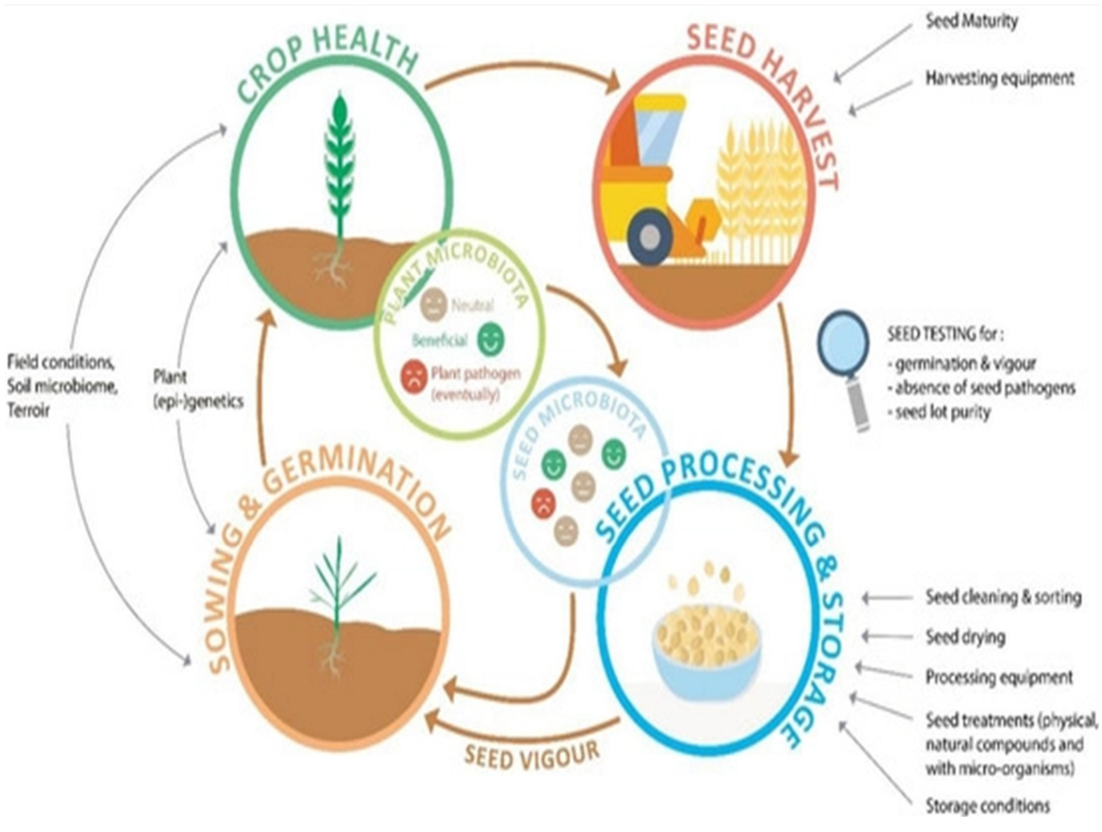

Figure 4.4 Sustainability Breeding and Seed Sector Innovations for Organic Food Systems.

Traditional farmers already adhere to certain organic farming principles by using farm-owned resources, cultivating many crops at once, and rearing livestock. Nevertheless, there are still several methods that set such farms apart from organic farms. The following difficulties must be overcome to avoid burning agricultural waste after harvesting since this is typically not a practical option because it destroys priceless organic material and harms soil organisms. Establish well-organized intercropping and crop rotation systems as part of your diversification strategy. Amass knowledge and expertise in the management and enhancement of soil fertility, particularly concerning compost production. Refrain from indiscriminately chopping down trees for fuel and charcoal to create a mechanism for gathering animal waste for composting.

Crop and soil conservation will be made easier by correctly chosen or upgraded crop types with heavy tolerance to plant diseases and pests. Proper animal integration into agriculture, as well as nitrogen row planting and fixing trees in the intervals between yearly crops, will enhance growing conditions, promote greater growth, and provide additional fodder for ruminant animals. Better housing is also required to make it easier to gather animal excrement for use in fields. Increasing soil fertility, for instance, by adding high-quality compost to the soil. In organic gardening, compost is a very important fertilizer. After harvest, gather the crop wastes for composting or incorporate them into the soil instead of burning them. The plant materials and animal waste.

The plant matter and animal manure should be routinely gathered for composting another way to nourish the soil are to plant nitrogen-fixing legumes between annual crops. Additional steps should be taken to limit soil erosion, such as trenching, planting trees along the slope, and covering its soil with live or dead plant matter. Agriculture and domesticated animals may coexist on mixed farms, where the animal waste is collected and used in the gardens after rotting for a few weeks. There are a few soil conservation techniques that may be used, such as mulching perennial crops and digging trenches to stop erosion. Weeds can occasionally be controlled in the production of fruits and vegetables by using herbicides, insecticides, and treated seeds. The farmers of these mixed farms are conversant with some organic farming techniques. These farmers will have no try organic techniques over their whole farm and learn new techniques from other farms or a trainer. Due to shifting agriculture, excessive grazing, over-cultivation, deforestation, salinity from years of extensive groundwater irrigation, or poor drainage and flooding, land may become degraded. On the ground, creating favorable growing conditions can need more time and effort. Additionally, organic techniques are a great way to salvage such soils. To halt soil erosion and restore soil fertility, particular actions can be necessary. These techniques include creating terraces or planting a leguminous organic manure crop in an intense fallow that thrives on rocky soils.

CHAPTER 5

BIODYNAMIC AGRICULTURE

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Biodynamic agriculture is a method of farming that emphasizes holistic, spiritual, and ecological approaches to agriculture. It seeks to integrate the spiritual and ecological dimensions of agriculture and to promote a self-sustaining and closed system, relying on compost, crop rotations, and livestock to maintain soil fertility. Biodynamic farming originated in the 1920s, when Austrian philosopher and scientist Rudolf Steiner gave a series of lectures on agriculture. These lectures formed the basis for biodynamic farming, which emphasizes the use of compost, crop rotations, and other techniques to maintain soil fertility. Biodynamic farmers aim to create a self-sustaining and closed system, relying on compost and livestock to provide nutrients for the soil. They use cover crops and green manures to add organic matter to the soil and improve its structure, and rotate crops to reduce pest and disease pressure and maintain soil health. Biodynamic farmers also use herbal and mineral preparations, such as fermented compost and silica, to enhance the life forces in the soil and crops.

The biodynamic approach also includes spiritual and ethical principles, such as working in harmony with the natural rhythms of the earth, treating all farm creatures with respect and care, and taking a holistic view of the farm as a living organism. This holistic approach is reflected in the use of lunar planting calendars and other cosmic rhythms, as well as in the use of biodynamic preparations made from herbs, minerals, and animal parts. In terms of environmental impact, biodynamic farming is seen as a more sustainable alternative to conventional agriculture. It emphasizes soil health, biodiversity, and the use of on-farm resources to maintain soil fertility, rather than relying on synthetic fertilizers and pesticides. This can result in lower levels of soil erosion, improved water retention, and better soil structure. Additionally, biodynamic farmers often use less energy and fewer resources than conventional farmers, as they rely on manual labor, draft animals, and alternative energy sources.

Biodynamic farming is practiced around the world and is growing in popularity, particularly among consumers who are looking for environmentally friendly and sustainably produced food. However, biodynamic farming can also be more challenging and time-consuming than conventional agriculture, and it can be difficult for farmers to make a living solely from biodynamic farming. In conclusion, biodynamic agriculture offers a holistic, spiritual, and ecological approach to farming that emphasizes soil health, biodiversity, and the use of on-farm resources. While it can be more challenging and time-consuming than conventional agriculture, it is seen as a more sustainable and environmentally friendly alternative.

Biodynamic agriculture is a holistic and spiritual approach to farming that seeks to balance the health of the soil, plants, animals, and human communities. It was developed in the early 20th century by Austrian philosopher Rudolf Steiner and is based on his spiritual-scientific ideas. In biodynamic farming, the farm is viewed as a self-contained, interrelated system where the health and well-being of the soil, plants, animals, and human communities are all connected. The principles of biodynamic agriculture include:

1. Holistic understanding of the farm as a self-contained system
2. Use of compost and preparations made from local materials to enhance soil fertility
3. Attention to lunar and celestial rhythms in planting and harvesting
4. Use of cover crops, crop rotations, and intercropping to build soil health and reduce pest pressure
5. Minimal use of synthetic fertilizers and pesticides
6. Integration of livestock into the farming system
7. Attention to the spiritual dimension of agriculture and the interconnectedness of all life.

The preparations used in biodynamic agriculture are unique to this approach and include compost preparations, herbal preparations, and horn silica preparations. These preparations are made from locally sourced materials and are applied to the soil, seeds, and plants to enhance the health and vitality of the farm system. One of the key principles of biodynamic farming is the use of lunar and celestial rhythms in planting and harvesting. Proponents of biodynamic agriculture believe that the position of the moon and planets affects the growth and development of plants and that planting and harvesting at certain times can enhance crop quality and yields.

In addition to these principles, biodynamic farmers also focus on building soil health through the use of cover crops, crop rotations, and intercropping. By planting diverse crop species and rotating crops, biodynamic farmers aim to improve soil structure, increase organic matter, and reduce pest pressure. Biodynamic agriculture also integrates livestock into the farming system, recognizing the important role that animals play in maintaining soil fertility and supporting a diverse, interrelated ecosystem. Livestock are managed in a way that supports their health and well-being, and waste products are used to enrich the soil through the production of compost.

The spiritual dimension of biodynamic agriculture is also an important aspect of this approach. Biodynamic farmers view their work as a spiritual practice and seek to cultivate a deep connection to the land, the plants, the animals, and the other living beings with whom they share the land. Biodynamic agriculture has been practiced for nearly a century and has been adopted by farmers around the world. Although it is a relatively small movement compared to conventional agriculture, biodynamic agriculture has gained increasing attention in recent years as consumers become more concerned about the environmental impact of food production and seek out alternative, sustainable agriculture methods.

While biodynamic agriculture has many benefits, there are also challenges to its widespread adoption. For example, biodynamic farming can be more labor-intensive and requires a higher level of expertise and knowledge compared to conventional farming methods. Additionally, the unique preparations used in biodynamic agriculture can be difficult to obtain, and the use of lunar and celestial rhythms in planting and harvesting may not be well understood by all farmers.

Biodynamic agriculture is a holistic and spiritual approach to farming that seeks to balance the health of the soil, plants, animals, and human communities. By focusing on the interconnectedness of all life and using unique preparations, lunar and celestial rhythms, and the integration of livestock, biodynamic farmers aim to produce healthy, high-quality food while maintaining the health of the land and the environment. Although it is a relatively small movement, biodynamic agriculture has gained increasing attention in recent years and has the potential

A complete agricultural system on mixed farms, which must always include both crops and cattle, might be characterised as biodynamic agriculture. The foundation of the system is respect for and attempts to become aware of the spiritual aspect of all living things as well as the inorganic surroundings. Rudolf Steiner provided insights into this spiritual dimension, including in-depth explanations of the spiritual nature of animals, plants, and physical components as well as planetary repercussions.

In 1924, Steiner (Steiner 2004) Farmers should use these descriptions as a guide to help them behave and be aware in a way that advances the agricultural system. Steiner also suggested the creation of specialised preparations as a brand-new aspect of agriculture. Landscape and environment are integrated into biodynamic agriculture as integral components of the whole. Through effective legume crop management, it reduces fertiliser inputs from outside the farm.

Fundamentals of biodynamic farming

Figure 5.1 Shows the Biodynamic Preparation.

Around 3270 estates with a combined area of 104,000 hectares are certified under the Demeter label globally. This indicates that they abide by both the relevant international Demeter Regulations as well as the national organic agricultural standards. On Demeter farms, there are a wide range of businesses, including temperate arable farming, French winemaking, Egyptian cotton production, and Chinese silkworm rearing. One of the fundamental principles of biodynamic agriculture is the farmer's deliberate individual design of life processes as defined by site circumstances. This concept emphasises that, beyond economic objectives and the principles of descriptive ecology, people have a responsibility for the evolution of their natural and social environments.

The holding's unique design within the framework of the intricate interactions between all influencing elements serves as the foundation for this idea. The natural foundation is comprised of the pedosphere, ecosphere, and terrain, as well as the atmosphere and cosmic environment (which, apart from the sun, mostly consists of the moon and planets). Crop plants, animals, the farmer, as well as the overall socioeconomic environment, all have an impact on and are impacted by all layers of this natural environment, forming a complex web of interrelationships. Consequently, a farm develops a "individuality" in which the numerous components, similar to 142 Organs, which have distinct roles and are connected via feedback loops, are the focus of organic agriculture from a global viewpoint. By using a range of management techniques, biodynamic farming attempts to actively form these interrelationships into directed processes.

Always, encouraging healthy living circumstances is the main goal. Designing the various farm businesses and activities properly will help maintain and continually enhance soil fertility, plant and animal health, as well as product quality in a mostly closed system. On the aforementioned goal, the following tenets are built. They indicate unstated goals for applying the biodynamic technique to the assets (Demeter International 2003). Produce that bears the Demeter International label has been cultivated and prepared in accordance with their guidelines. Demeter as an organisation does not have affiliations with all biodynamic farms or gardens. The aforementioned guidelines must be followed by all farms that produce under the Demeter brand. These guidelines, although useful for other farms producing biodynamically, are not necessarily mandatory.

Various holdings

A need for biodynamic management is the raising of animals and cultivated land together. Perennial crops and horticulture businesses are subject to certain rules. A vital farm organism is thought to need a diversity of businesses that counteract each other's one-sidedness. The care of animals, particularly ruminants, is crucial. The main goal of management is closed nutrient cycles. Mineral nitrogen (N) fertilisers cannot be used. Application of Demeter-compliant mineral fertilisers including calcium, potassium, phosphorus, and magnesium is allowed. Such management techniques have been consistently shown to be sustainable.

Crop rotations that are suitable for each place

The foundation for good plant development and a rich soil is a well thought-out crop rotation. In areas where crop rotation is not possible (such as with perennial crops like fruit or grapevine), blooming cover crop strips are planted. a rhythmic alternation between plants that fix nitrogen (like legumes) and consume it (like brassicas), are shallow-rooted (like cereals) and deep-rooted (like lucerne), construct soil (like root crops) and deplete it (like cereals), or produce humus (like fodder plants) and destroy it (like cereals) (root crops) utilises the effects of each previous crop, improves soil structure creation, and protects against crop rotation illnesses. To supply the necessary nitrogen, legume cultivation for feed, whether as a grain legume or as green manure, is an essential component of crop rotation (25–30%). Keeping a year-round green cover, enhancing soil fertility in the most sustainable way, and avoiding nutrient losses are all characteristics of the optimum crop rotation.

Intensive Use of Organic Fertiliser

The main goal of fertilisation is to energise the soil, not to feed the plants. This fundamental principle of biodynamic farming necessitates thorough fertilisation utilising composts, liquid manure, green manure, and other fertilisers. Farm-generated fertilisers are used to cultivate high-quality crops, and their application varies depending on the crop being farmed. For instance, whereas vegetables exclusively get well-rotted composts, potatoes are given farmyard manure. Standard procedure calls for treating organic fertilisers with biodynamic compost preparations (see

Biodynamic preparations) in order to energise both the soil and the fertiliser. Utilizing organic fertilisers on a regular basis helps to close and accelerate nutrient cycles.

Biologically Based Remedies

Steiner suggested six alternative preparations that should be used along with the manure in order to support and enhance the processes in the organic manure and in the soil (Sattler and v. Wisting Special subject 2 - Biodynamic agriculture today 143 hausen 1992, Steiner 2004 5th lecture). Additionally, two fieldspray preparations were produced by Steiner (2004), and they are used to boost fertility and plant development at certain growth phases (Steiner 2004, 4th lecture). The medicinal herbs used to make the compost preparations (preparations 502–506) include yarrow (*Achillea millefolium*), chamomile (*Chamomilla recutita*), stinging nettle (*Urtica dioica*), oak (*Quercus robur*), dandelion (*Taraxacum officinale*), and valerian flowers (*Valeriana officinalis*). The majority of the time, they are kept in certain animal organ "sheaths" (intestine, peritoneum, and bladder) and fermented for a predetermined amount of time while being buried in the ground or exposed to air. Cow dung (also known as "horn manure," previously preparation 500) and quartz meal (also known as "horn silica," formerly preparation 501) are the two field sprays; horn manure is applied in the winter and horn silica in the summer. These compounds are sprayed on plants and soil after being dissolved in water and stirring regularly for an hour

Techniques for raising livestock that adhere to animal welfare standards

Animals are seen as having souls in livestock management, which leads to tougher criteria than are often used. For instance, it is forbidden to dehorn cows; breeding for individual performance criteria is discouraged; and the goal is to breed for longevity and lifetime production. Ruminants, for instance, are seen under this kind of livestock management as animals whose main function is to consume roughage. High milk output breeding, which can only be maintained with high concentrate inputs, is seen to be detrimental to the needs of the animals' wellbeing. Heifers, for instance, should be allowed enough time to mature before being placed in calf for the first time from the perspective of maturity.

Food quality is essential to life

A hidden goal of the biodynamic approach is the development of high-quality food for both humans and animals. Both practitioners and scholars find it difficult to define food quality, which has prompted much study and development of methodologies for evaluating food quality. In the manufacturing and processing of food, differentiation and ripening processes are highly valued.

Creating agricultural plant kinds that are locally appropriate

Only biodynamic farming now has its own organic plant-breeding initiatives, which seek to produce varieties that are effective in their management and suitable for biodynamic agriculture. An important problem for biodynamic agriculture is this area of operation. Priorities for breeding goals include good food quality and production, plant health, environmental appropriateness, the capacity to conserve seed and propagate plants on-farm, and environmental suitability.

Keeping plants healthy

Biodynamic farming employs additional specialised preparations after using plant protectants and management agents in line with biodynamic principles. In addition to the "stimulating" preparations, suggested spraying horsetail tea (*Equisetum arvense*) to protect crops against fungi.

The ashes of pest species specimens that have been burned are to be employed for pest management.

Cosmic beats

When sowing, planting, and harvesting as well as sometimes when applying fertiliser, the yearly rhythms, the lunar rhythms, and those of the planets are taken into consideration (Steiner).

A worldwide view of organic farming

Spiess 1990ab, Goldstein and Barber 2000, Spiess 2000, Thun and Thun 2004, first and sixth lectures.

Sustainable soil management

Increasing soil fertility and soil processes, as well as weed control, are the main goals of soil cultivation strategies. Biodynamic farming employs a variety of soil cultivation techniques, from ploughing to no-till agriculture, depending on the region and crop being grown.

Including the environment

In biodynamic farming, landscape design has always been taken into account as a component of farm management. The importance of landscape design at the farm level is becoming more widely recognised.

The social and economic environment's design

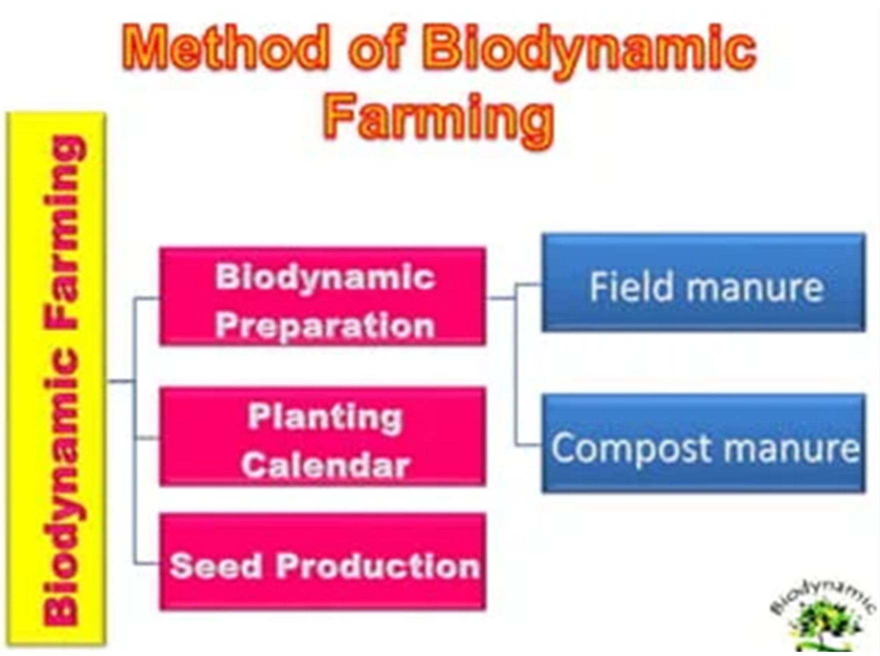

Figure 5.2 shows the method of biodynamic farming.

On biodynamic farms, the idea of land ownership is being questioned more and more, and the land is no longer always seen as private property. Frequently, money is given to trusts for philanthropic purposes or organisations like these. Pioneering efforts are being made to create economic connections between producers and customers that are founded on the ideas of respect and mutual responsibility. Working in agriculture is also seen as a therapeutic opportunity, and those who are mentally or spiritually sick, troubled children, addicts, and prisoners are often incorporated into farm communities. The education of apprentices is given top attention, and several nations have extensive training programmes or agricultural universities that focus on teaching biodynamic farming techniques. Another area that receives a great deal of attention is the regular training and seminars for farmers in the field.

The farm uniqueness, to which considerable weight is given, arises from this precise design, and is much permitted by these rules to each particular farm to work out its own strategy in conformity with the living circumstances in its surrounds. The way the land is cultivated, the precise layout of crop rotations, fertilisation schedules, variety selection, distribution of animal categories, enterprise balance, social dynamics on the farm, and business interactions with clients are all up to the farmers and unrestricted. They are, nonetheless, recorded as a result of the national Demeter inspections, and they are analysed and debated in specialised publications, at regular association meetings, and at an annual worldwide conference in Switzerland.

What are the historical origins of biodynamic farming?

The principles of biodynamic farming are particularly related to the spiritual brilliance of all natural phenomena, including that of the cosmos and the inorganic pedosphere. The formation of the spiritual world, which has a variety of structures and is expressed in the physical-sensory reality, is said to occur via physical-world activities. This concept of growth, however, is not purely teleological since it sees people as active makers of the future, both in a good and a bad sense. As a result, the biodynamic ecological paradigm is one of development rather than conservation.

These ideas are based on anthroposophy, a diverse worldview that was developed by Rudolf Steiner (1861–1925) and holds as its central tenet that everything and everything that occurs in the world has its origins in a spiritual world that is both present and can, at its core, be an object of human awareness. Insofar as it relates to how we see nature, anthroposophy sees itself as adding a second dimension the spiritual one that in no way would negate or replace any fundamental natural rule. The best method to cultivate the capacity to learn about this spiritual realm

Steiner provided a detailed account of this spiritual world's behaviour and appearance in several publications and talks under the special theme 2: biodynamic agriculture today. Steiner (1997) and Steiner (2002) are two key pieces (1999). When Steiner visited with roughly 60 farmers in Koberwitz, close to Wroclaw (Poland), in June 1924, he offered eight lectures on a new agriculture based on spiritual science (Steiner 2004). These eight lectures still serve as the cornerstone for biodynamic farming today, while many of its components have been refined and developed over the previous 80 years by extensive research and practical application. These lectures were given by Steiner at the request of farmers who were interested in the growth of anthroposophy, and when he delivered the Koberwitz lectures, he did so in accordance with his audience.

To provide reasonable, realistic recommendations for the frequency and timing of their use, research on the efficacy of biodynamic preparations must be advanced. However, since these practises were suggested as a component of a comprehensive farming system, the idea behind which is based, in particular, on a holistic understanding of agricultural processes, discussions are necessary to determine whether it makes sense to assess the impact of individual biodynamic practises in isolation from the overall method. Biodynamic farming would benefit from a comprehensive, integrated, systematic form of science, but this has not yet been realised. What would constitute comprehensive research is not quite obvious. Without a doubt, phenomenological descriptions of the general surroundings have been extensively explored during the last 80 years in the framework of anthroposophic study. However, does comprehensive research imply that each 146 In order to evaluate organic agriculture from a global viewpoint, must the study be based on multidisciplinary research and an overall analysis of the findings from several, potentially isolating investigations. How can the experience of the farmer be successfully incorporated (Baars *et al.* 2004)? How can observations collected under very unique and geographically distinct circumstances be generalised? The discussion with traditional science must address these issues since they are crucial areas for future study.

Special subject 2: Biodynamic farming in the present

Last but not least, biodynamic researchers are tasked with creating an ongoing conversation between their field and the traditional natural sciences. The challenges at hand include crucial paradigmatic concerns, different worldviews, and value systems that need for clear communication. There are times when individual scientists vehemently disagree with biodynamic research and dismiss its validity. These objections, albeit they are likewise based in an unresolved conflict of world views, are unfounded since they ignore significant areas of biodynamic management and study. To explain and effectively address this issue will be one of the challenges for biodynamic science.

Like all farmers, organic farmers seek for the finest cultivars for the circumstances of their farms. The variety pool available to pick from often comprises of 'conventional' types that were produced for traditional agricultural systems that heavily rely on synthetic fertilisers and agrochemicals to regulate or outweigh environmental conditions. Typical agricultural practises for these systems

Plant breeding may be used to maximise output while using high input. It seems sense that the criteria for varieties appropriate for organic farming systems should be centred on optimising output at lower input and stabilising yields under less predictable situations as organic farmers abstain from using such chemical inputs. The majority of variety studies, however, demonstrate that the organic industry may benefit from plant breeding advancements and that current varieties can adequately address some of the key objectives of organic farmers. Variety production potential has grown, but certain crops, like tomatoes, have also seen improvements in disease resistance.

Modern cultivars are not always the best for organic farming, despite the fact that many organic farmers in wealthy nations utilise them. Farmers that practise organic farming have long come to terms with their reliance on conventional breeding since effort is often directed on improving other agronomic aspects of their agricultural systems. However, how to create types that are more suited for organic agricultural methods is now receiving greater focus. Being reliant on traditional plant breeding would no longer be an option, making this matter even more pressing. Genetic engineering has become crucial in conventional plant breeding. The organic industry realised that it is not only concerned with the characteristics of the varieties themselves but also with how varieties are bred and propagated, and therefore whether breeding and propagation techniques adhere to both the ecological and moral principles in organic agriculture.

The idea of "naturalness," which includes three approaches the non-chemical approach, the agroecological approach, and the ethical approach in which the integrity of life is taken into account can embody these principles as they are implemented in the organic sector. In the near term, the first step is to specify desirable qualities and choose the best-performing kinds from the available selection. Stimulating the production of organic seeds of the aforementioned chosen types is the second stage in completing the organic production chain. This is required in Europe by EU Regulation 2092/91, which prohibits the use of conventionally propagated seed beginning in 2004 and prohibits any further derogations (i.e., the formal replacement of an organic input with a conventional input if no organic input can be obtained).

This applies to crops that already have a large enough variety of organically acceptable cultivars. In the United States of America (USA), similar laws have been implemented as part of the National Organic Program (NOP) (Sundrom 2004). Influencing national protocols and processes for evaluating varieties for value for cultivation and use (VCU) and the release of new varieties is a crucial step in enhancing the likelihood that varieties with attributes crucial to the organic industry will access the market. The long-term phase is creating breeding programmes for the enhancement of varieties appropriate to the needs of the production of organic food. All stakeholders (farmers, traders, breeders, and policy makers) should be actively involved in (research) projects in order to develop appropriate concepts and strategies and overcome practical challenges in order to make quick and balanced progress in all of these steps.

A worldwide view of organic farming

In this chapter, we outline the need for better suited varieties, discuss potential ecological and moral development strategies, and outline efforts to create organic propagation of varieties in an effort to complete the loop and avoid using conventionally generated inputs.

Features of variety

In organic farming, variety selection is a crucial component of effective production. On the other hand, nothing is known about how different kinds fare in organic environments. The traditional variety testing selects for excellent performance under high input settings, much as conventional plant breeding attempts to optimize yields under high inputs. The organic farmer is more interested in varieties that can perform well with stable yields in different years at the specific site due to the large diversity of organic farming systems and conditions, which results in a larger genotype-environment-management (G E M) interaction than in conventional agriculture. There are organic variety trials in several countries, although not for every crop and every year. Some are carried out by farmer organisations, while others are by research facilities or private seed corporations.

Plant health and yield stability

Long-term studies reveal that compared to conventional agriculture, yields in organic agriculture vary substantially more. A higher coefficient of variance reflects this. This volatility from year to year has emerged as one of the most significant reasons limiting the expansion of the organic market share for various crops. The organic farmer's primary goal is system stability in order to decrease risks and maximise yields. This may be accomplished by choosing the right cultivars and improving agronomic techniques. The appropriateness of the available varieties is one of the variables that limits how stable a crop's production may be. Instead of a variety that promises better yields but generally fails to deliver on that promise due to, say, disease susceptibility, organic farmers would prefer to have a variety with an acceptable yield and strong stress tolerance. Those kinds that can survive adverse weather and soil conditions are reliable ones (e.g. fluctuating mineralisation rate of nutrients, assessed over several years). To assist the ability of the organic farming system to self-regulate, farmers opt for varieties that are generally more resilient and adaptable.

In contrast to what conventional breeders often believe, tolerance or partial disease resistance might frequently be adequate for organic farmers. Organic farmers often utilise a range of solutions (at the farm, crop, and variety levels) to avoid risks. They also use this approach while looking for the best combinations of supporting variety traits. Various variety traits contribute to production and yield stability via ideal plant health. The following elements contribute to plant health and may be characterised as follows: A crop can exhibit one of four traits: escape, which means it is not exposed to a particular pest or disease; resistance, which means it is exposed to the pest or disease but is unaffected; tolerance, which means the crop is affected by the pest or disease but only to a limited extent in terms of yield; and ability to recover, which means the affected crop can recover to some extent.

Product Excellence

The non-chemical method also affects characteristics of product quality in the organic industry, such as long-term storageability without chemical sprouting inhibitors for onions. Production of organic seeds and plant breeding: ecological and moral considerations potato and 127. Fruit may benefit from prolonged storage when their skin is sufficiently thick with natural wax, as opposed to when it is covered with synthetic materials. Organic bakeries strive to create bread without synthetic additives, but they still need varieties with great baking quality and enough production under reduced input circumstances. Taste is another component of quality. Taste is a sensory quality that is influenced by genetic effects in addition to environmental and managerial variables. Although carrot organic breeding program now include sensory quality, genetic diversity for quality attributes has not yet been thoroughly investigated.

Ideotypes of crops

For each crop and market segment, different features are prioritised. Crop ideotypes should be developed and created for each crop in order to increase communication between farmers, dealers, and breeders. In the near term, these crop ideotypes may help with a better selection of acceptable varieties from the range of conventional varieties already available. However, they are also required to meet the selection criteria for novel cultivars from breeding initiatives especially geared toward organic and low-input farming. The selection criteria for organic crop ideotypes are quite similar to those for conventional crop ideotypes, including disease resistance and high producing capacity. The distinction is that types for organic farming must function effectively in low-input environments. Another distinction is the presence of extra plant health and yield-supporting traits, such as long stems, ears that are elevated above the flag leaf, and ears that are not too compact. To increase photosynthesis during the latter stage of grain filling, a trait like a long stay green index for the upper leaves of wheat is also crucial.

Mechanism features of variety

Escape In order to escape the key infection time or to have adequate yield before the infestation becomes too severe (potato/late blight; onion/downy mildew; carrot/carrot fly), the crop's growth cycle must be shorter and/or it must ripen earlier. Resistance One or more monofactorial and multifactorial, long-lasting resistance qualities to pests and diseases that impair yield and/or quality (yellow and brown leaf rust on wheat, late blight on potatoes, downy mildew on lettuce, and scab on apples); weed competition by an allelochemical capacity. Tolerance Such morphological or physiological characteristics as for cereals: long stem, ear high above flag leaf, ear not too compact; leaf erectness/onion; hairy and tougher leaves against aphids/potato; wax layer on leaves against fungi/onion/cabbage; etc., support reducing the risk of a rapid expansion of the infestation.

The ability to deal with fluctuating N-dynamics, efficiently capture water and nutrients, have deep and dense root systems, interact with beneficial soil microorganisms like mycorrhizae and atmospheric N-fixing bacteria, and have efficient nutrient uptake and high nutrient use efficiency all contribute to overall stress tolerance. A more light-competitive plant architecture for early soil cover. Excellent mixing skills in species and variety mixes. Recovery skills High seedling vigour, rapid and high germination percentage, deep and intense root architecture, good capacity to rebound from mechanical harrowing/cereals. It is crucial that farmers participated in the creation of the crop ideotypes in order to include as much real-world knowledge as feasible.

Variety evaluation

Trading in seeds of different arable crop varieties is restricted in many nations, particularly in Europe. As a result, varieties must be registered on a national variety list, a European variety list, or a list of another nation. A recognised institution must evaluate the variety following the so-called VCU methodology and determine that it performs better than other kinds in order for it to be listed. A standard procedure like this one might make it difficult to introduce new varieties with particular low-input features that are not covered by it since it is developed for evaluating varieties under conventional farming circumstances. Another crucial point is that some characteristics necessary for organic farming systems, such the effective utilisation of nutrients in organic fertilisers, do not manifest themselves under conventional circumstances.

Recent efforts by research organisations in some nations, including Austria, Germany, Switzerland, and the Netherlands, have been successful in influencing the protocol for testing cereal varieties for the organic sector by incorporating traits critical to the evaluation of organic farming systems and criteria to determine research sites (Bonthuis *et al.* 2004; SUSVAR 2004). Such a technique has been accepted by the appropriate authorities, who are now working to enable VCU to test grain types under organic circumstances. The future of this VCU testing is questionable since the majority of it is being funded as a research initiative that seeks to compare the findings with those obtained under traditional testing.

Manufacture of seeds the chain involved in the production of organic food still mainly lacks organic seed production. The process of creating new selection criteria for new varieties, from plant breeding through maintenance to release and propagation of variations, includes establishing organic seed production. Despite several small-scale farmer efforts to grow varieties organically, the usage and production of organic seeds on a broad scale are still in their infancy.

Although several businesses have joined this sector, not all kinds that are now available or sought may be propagated organically for technical or financial reasons. Which types should be propagated, and how, are the two problems related to the generation of organic seeds. The first issue is mostly covered in the preceding paragraph, and the second question will be addressed by talking about diversity, technical considerations, and criteria for seed quality.

Variety of species

Regulations in Europe and the USA no longer provide exception for the use of conventionally propagated seeds of crops for which there is already a sufficient selection of organically propagated cultivars and seed available. The variety of types that may be employed in the organic sector is immediately impacted by the fact that this seed selection often only includes a small number of varieties, and this produces conflict between short- and long-term objectives in the organic sector.

Not only does the organic food supply chain need to be shut down as quickly as possible to promote consumer responsibility, but it also has to have a variety of kinds to fulfil the needs of various market sectors and agricultural environments. About two groups of farmers are active in this challenging terrain. The first category consists of small-scale farmers who use regional and traditional cultivars and concentrate on the local market.

Production of organic seeds and plant breeding: ecological and moral considerations 129 so-called heritage or conservation cultivars. Such farmers often retain an ancient variety that is ideal for low-input circumstances or participate in a community-based, participatory seed production and exchange system. Because many of those local or conservation varieties are not legally recognised and/or are not propagated organically, these growers face constraints from the new rules. Farmers who wish to store their own seeds from contemporary variety must contend with onerous laws that limit their ability to do so.

The second category consists of large-scale farmers who supply supermarkets and must adhere to strict quality and uniformity standards. These farmers rely heavily on commercial seed firms' modern, hybrid cultivars and their breeding practises. Not all businesses are ready to join the comparatively tiny organic industry and produce all desired kinds organically for financial reasons. The choice is restricted compared to the greater selection of conventionally propagated cultivars since those who do participate in organic seed production only generate a small variety. It was acknowledged during the inaugural World Conference on Organic Seed, or IFOAM 2004, held in Rome in 2004 that there are significant variations between nations with and without a strong critical mass of organic goods and seeds. For instance, it may impose restrictions on the export of seeds from poor nations to European nations that have stringent laws governing the use of seeds grown organically, while organic seed is not commercially viable and seed certification is nonexistent. For the move from conventional to organic seed, a cautious transitional time is required.

Specialised Elements

High-quality seed and planting material are even more crucial since they serve as the foundation for crop production in organic farming systems that do not utilise chemical pesticides. The creation of high-quality propagation material requires the acquisition of specialised knowledge in areas related to seed production, such as technical ability, site selection, and variety selection. Nutrient management, disease and pest management, and weed control are the three key issues with organic seed production. Particularly among the illnesses transmitted by seeds, extra consideration is needed. Optimal climatic conditions, and hence the site for seed production, might be vital to limit the danger of disease infestation. In certain circumstances, seed production should be situated far from the regions of origin and destination in warmer and drier climates.

The above-mentioned adaptation of cultural methods is necessary, but optimising the production of organic seeds also calls for paying close attention to variety attributes during seed development. This is particularly true for biennial vegetable crops, which may experience a rise in disease pressure during seed germination the following year after experiencing a rise in disease pressure the previous year. The fact that certain parental lines of hybrids have less growth vigour and are consequently more vulnerable to biotic challenges, including diseases, is another factor that affects the effectiveness of organic seed production. This suggests that in the development of organic seeds, growth vigour as a variety trait is even more crucial than in the production of conventional seeds.

Seed Quality Requirements

The challenge for seed producers is to develop organic seed without the use of chemicals. Organic seed must meet the same standards for quality as conventional seed, including physical and genetic purity, the absence of weed seeds, and a low threshold for germination. In certain circumstances, it is impossible to generate seeds without a certain level of disease contamination. The seed quality may be increased using a variety of techniques. One approach is to grade and separate unhealthy seeds from seeds that are healthy based on seed weight or size, as is recognized 130 A Worldwide View of Organic Farming.

The Fusarium contamination of cereal seeds. Additional post-harvest, non-chemical treatments, such as hot water or hot air treatments, are required for several seedborne illnesses. However, additional study is required to improve such procedures and lower the possibility of seed damage. In addition to these physical therapies, natural disinfecting coatings using organic acids (such as mustard powder) or essential oils (such as thyme oil) are also being explored. Treatments against Rhizoctonia solani in seed potatoes show promise when combined with the antagonist Verticillium biguttatum. In certain instances, the thresholds for seedborne illnesses are modified, although for particular crops, it is not a difficulty to achieve the quality criteria necessary for conventional seeds. The suggested thresholds or tolerances for specific illnesses are decreased in some nations. For example, in Austria, the Fusarium nivale threshold has been reduced from 20% in conventional agriculture to 10% in the organic sector. The allowable amount of contamination for organic seed potatoes in the Netherlands has been reduced from 25% (conventional) to 10%. Other diseases have reduced thresholds as well; for instance, in Austria, Septoria nodorum in wheat is now authorised at 10%, down from 20% before.

Crop breeding

Biological variety

Modern cultivars were created with the intention of achieving high input productivity and consistent product quality. For organic agricultural systems, the G, E, and M interaction scenario and the purpose of breeding programmes are distinct. The E is high due to many factors, including the fact that farmers must manage more biotic and abiotic challenges as well as more environmental diversity within and across farms when input levels are low. The M is low because an organic farmer has fewer tools at his disposal to counteract that volatility. As a result, the demands on varieties are greater (see Yield stability and plant health). This has an impact on the genetic input (G). To boost production stability under low-input, organic settings, organic farmers look for novel cultivars that have a mix of necessary traits. It is unclear how breeding, through enhancing the farm system's natural capacity for buffering and consequently output stability, might help crops and varieties adapt to the organic, lower-input environment.

Modern wheat cultivars, for example, often lack the capacity to adapt to various and shifting conditions, including arid and less fruitful locations like southern Australia (Kitchen *et al.* 2003). In traditional breeding, there is a tendency to select for single genotypes that are generally adapted to a wide range of conditions where environmental variance may be substantially overcome by high inputs. These types are "generalists" and are not always better in or more suited to a particular habitat. Because there are fewer tools available to organic farming systems to combat agrodiversity, environmental circumstances vary more, necessitating a wider range of so-called specialised cultivars. But it's challenging to create specialised cultivars inexpensively. The performance of crops, like wheat, in organic agriculture may be restricted by traditional pedigree line breeding since organic types need a specific amount of buffering capacity. In addition to that issue, the present new varieties are genetically similar to one another since they are mostly descended from a small number of parental lines.

An organic breeding programme should have a fresh, broader genetic foundation. When looking for adaptation to organic farming, this feature of extending the foundation is even more crucial. By building composite cross populations and then selecting them under organic farming circumstances, a wider genetic basis may be attained. Crosses using composites

Production of organic seeds and plant breeding: ecological and moral considerations 131 different carefully chosen cultivars are crossed, and the resulting hybrids are bulked up for propagation. Those chosen as crossing parents may include current high-yielding varieties as well as cultivars developed before to 1960 (during the era of heavy inputs) that are better able to absorb nutrients under low-input circumstances and historic landraces as a source of adaptation. This method may serve as the starting point for further selection of superior genotypes and lines as prospective sources of new and better suited varieties. Additionally, we may anticipate choosing certain lines for variety combinations that have a strong propensity to combine.

A quick and easy technique to improve genetic diversity within a crop and yield stability is to create variety mixes from three or four current varieties or from composite cross populations. By mixing, for instance, high yielding varieties with varieties that have superior baking quality and weed control in wheat, mixtures may solve a number of agronomic issues. According to conventional scientists' research, organic and conventional plant breeders share an interest in some features linked to crop competitiveness against weeds and the avoidance of soil-borne diseases.

The legal and administrative structures must be reevaluated and adjusted for any breeding plan that aims to restore and expand functional genetic diversity. The registration rules continue to be based on the pure line of practise. The market must be ready to embrace diverse crops and goods, however.

Genetic Resource Preservation in Situ and On Farms

It is important for local and national breeding programmes to have access to seeds from both formal (institutionalised or commercial) and informal (farmer-based) seed systems in order to maintain greater genetic diversity in situ and a large gene pool to improve genetic resources for the organic sector. Identification of suitable genetic resources, either for direct use or as possible parental lines in breeding programmes, is urgently needed. There are well-run programmes addressing in situ genetic resource conservation in relation to organic agriculture, such as ProSpecieRara in Switzerland Arche Noah in Austria the Seed Savers Exchange in the United States, or the Seed Savers' Network in Australia. The benefit of genetic resource conservation in situ is that accessions may coevolve and adapt to the needs of organic farms. Because necessary traits, such low-input tolerance and deep or intense root architecture, may have been lost to selection under contemporary, high-input circumstances, evaluating and using gene bank material may be useful. This technique for creating valuable accessions is quite inexpensive.

Selective Participation

Alternative strategies should be devised to increase varietal variety since the formal seed industry finds it difficult to begin breeding programmes for the little amount of land used for organic agriculture. In developing nations, decentralised and farmer-participatory systems are well-known and might provide a chance to integrate the knowledge and skills of formal breeders with organic farmers. Farmers may participate in the selection of new crosses or base populations as well as existing open-pollinating types (see Genetic diversity). Farmers may be involved in the breeding process in a variety of ways (Ceccarelli 2000; Morris and Bellon 2004). In the conventional farmer breeding paradigm, farmers handle every step of the process, including:

1. Source germplasm selection;
2. Trait identification (prebreeding); and
3. Breeding.

A worldwide view of organic farming

In a fully participatory breeding paradigm, farmers work alongside breeders with a background in business or institutions to participate in all four processes. On the other hand, there is the formal breeders' fully controlled scientific breeding paradigm. Morris and Bellon (2004) described two additional strategies: the participatory varietal selection model, in which farmers are only involved in varietal evaluation; and the efficient participatory breeding model, in which formal breeders involve farmers in both the initial phase of selecting source germplasm and the final phase of evaluating potential varieties. In the Netherlands, farmer breeders and the official potato breeding industry have a long history of working together. Together with the formal breeders, farmer breeders are engaged in choosing the germplasm for novel combinations based on their daily practical experience and refined intuition (farmer's eye).

The official breeder carries out the intricate cross-breedings between wild relatives and contemporary types and provides the interested farmer breeders with the seedlings for three years of further selection. The breeding firm or official breeder receives the most promising phenotypes, who are then subjected to further testing to see if they can develop into a variety (Van der Zaag 1999). This participatory potato breeding method includes organic growers as well.

Farmers' newly developed varieties must be protected by a common ownership legal framework that permits fair access and profit sharing. Examples of networks of organic farmers and breeders that provide such a system may be found in various nations. Genetic engineering is the topic that receives the greatest attention when discussing the use of contemporary biotechnology advances from an ethical standpoint. Extrinsic arguments, which address the effects of creating genetically modified organisms (GMOs), are distinguished from intrinsic arguments, which focus on the technology itself. The significance and viability of the inherent reasons, which are important in the organic sector's rejection of GMOs, are often discussed.

The focus is on the so-called extrinsic concerns: the hazards to human health, animal welfare, and the environment, in ethical committees and public discussions. Most risk assessment techniques only consider the ramifications and impacts of genetic engineering in the context of a utilitarian ethics (weighing costs and benefits). The inherent worries relate to the technology itself rather than its effects. The fundamental argument against genetic engineering is that it is "unnatural" and violates the worth and integrity of plants and animals. Particularly for those scientists and ethicists who believe extrinsic reasons to be more value-neutral and objective, these arguments are far more contentious.

Non-utilitarian ethicists, who emphasise human values, are more sympathetic to the fundamental concerns (virtue ethics). These qualities, including humility and reverence for (the inherent worth of) nature or life, are crucial in determining people's fundamental views toward the natural world. This ethics of integrity is connected to the biocentric ethical theory, which holds that every living thing has a value (good) tied to its species-specific or defining "nature." To suggest that a living thing has inherent value is to imply that it has worth beyond what humans can use it for. Never should a living being be treated as just an item for human use, as if it had no moral obligations. For a summary of these many hypotheses, see Verhoog *et al.* (2004). We shall discuss the reasons why biocentric ethical philosophy and

Production of organic seeds and plant breeding: ecological and moral considerations The main reasons why organic agriculture rejects genetic engineering are 133 fundamental issues.

Why GMOs are not used in organic farming

In light of the extraordinary threat that genetic engineering poses to the whole biosphere and the unique economic and environmental concerns it creates for organic farmers, the International Federation of Organic Agriculture Movements (IFOAM 2002) is opposed to its use in agriculture. Three categories might be used to categorise the reasons provided by IFOAM:

Risks to human health and the environment, include unacceptable dangers to human health, harmful and irreversible environmental effects, the release of previously undiscovered and unrecallable creatures, and contamination of organisms found outside of farms. Socio-ethical factors: tainting the gene pool of domesticated plants, animals, and microbes; denying farmers and customers the opportunity to make their own decisions; violating farmers' basic property rights; and endangering their ability to support themselves. Incompatibility with sustainable agriculture's guiding principles risks to the environment and human health

The rejection of GMOs in organic agriculture is more driven by a difference in risk perception than by the existence or lack of scientific evidence for an objective danger. An organic perspective on risk is founded on a wholistic understanding of life. "We also see this technology as intrinsically hazardous, since it is founded on the reductionist scientific concepts that have been demonstrated to be incorrect and are becoming rejected," the IFOAM EU Group (2003) said. Supporters of organic agriculture see genetic engineering as a hazardous technique for a number of reasons, including: The employed gene constructs are artificial constructions. Pure DNA would be rejected by the recipient organism if it were introduced. To have any impact, artificial constructions must be created. They are trial-and-error tested to see whether they function or not.

Genetic engineering is inspired by the notion of genetic determinism, which is just a partial fact, as is the risk analysis that scientific committees now use. Nongenetic, epigenetic impacts have been demonstrated to be as important as or even more significant in certain situations than the influence of DNA throughout the development of the organism as a whole. Contrary to earlier theories, the expression of DNA in the genome is far more dynamic. Reductionist solutions to agricultural issues are seen as band-aid fixes.

Insect resistance to insecticides used in conjunction with GMOs or to Bacillus thuringiensis, which is employed in insect-resistant GMOs. Unpredictability and unexpected repercussions are caused by the organism or ecosystem as a whole's dynamic complexity. The controllability and longevity of the gene constructs 134 Organic farming. It’s impossible to ensure a worldwide view of the technology. Genetic engineering is founded on a manner of thinking that is typical of the physical sciences from a global perspective. The argument shifts from being extrinsic to being intrinsic by framing the risk issue in terms of holistic risk perception.

Contradiction to the tenets of sustainable agriculture

As long as these ideas are not stated explicitly, this argument is flawed. Different perspectives on how people relate to nature are behind various definitions of sustainability. In organic agriculture, it is believed that applying the industrial technique to biological systems is "unnatural" and unsuited to their nature. The industrial method has a propensity for total anthropocentric control over nature, which in some ways eliminates nature. Pure nature, or nature that has not been affected by humans, is its antithesis. However, it is difficult to discuss "pristine nature" in relation to agriculture since all forms of agriculture include meddling with the natural world. The philosophy of organic agriculture may be summarised by saying that nature and culture are considered as the two poles of a polarity relationship, and both poles need to be taken care of. This recognises the independence, inherent worth, and autonomy of nature and all living things. We may refer to it as the merger of nature and civilization or agri-culture (biocentric approach). Numerous manifestations of this provide further reasons against genetic engineering:

Using natural ingredients rather than artificial ones. GMOs are created by inserting artificial, not natural, gene constructions into living things. The most significant variation from conventional breeding is the forced introduction of artificial and synthetic gene constructs which can only be produced in an artificial environment in vitro into the genomes of plants and animals. These gene modifications were created by humans. Additionally, the gene constructions often include genes that would never be transported naturally during non-evolutionary time periods (transgenesis).

The use of natural processes to encourage organisms and the environment to self-regulate. Genetic engineering is seen in organic agriculture as a technique that coerces organisms into doing what people desire rather than evoking a response in which the natural entity maintains its relative independence as a collaborator. The way humans handled reproduction throughout the domestication of cows (and other domestic animals) is instructive. Artificial selection, artificial insemination, embryo transplantation, genetic alteration, and cloning are all methods that gradually take an animal's reproductive autonomy away from it and place it under human control.

Honoring the distinctive qualities (the "nature") or inherent worth of various plant and animal species, (agro-) ecosystems, and landscapes. Another allusion to the acceptance of nature's autonomy, but this time on a moral plane. The term "integrity" is employed in this moral sense as well. The integrity of plants refers to their nature or way of being, their wholeness, completeness, their species-specific traits, and their harmony with the environment that is unique to that species. Different degrees of integrity may be identified when referring to the particular "nature" of plants (or animals): integrity of life, plant-specific integrity, genotypic integrity, and phenotypic integrity. The authors have evaluated several plant breeding and propagation methods using this moral instrument to see if they respect the integrity of plants. The end result is that DNA-level procedures (such protoplast fusion and genetic editing) violate every aspect of a plant's nature (integrity). The conclusion is that genetic engineering and the inherent worth of plants are incompatible.

Ecological and moral considerations in organic plant breeding and seed production

Our finding is that the organic agricultural industry often employs inherent arguments against genetic engineering. These arguments often centre on a particular understanding of the interaction between human nature and cognition, emotion, and volition. A holistic (non-reductionist) perspective of living things is referred to as having cognitive components. Emotive components describe a biocentric perspective on existence in which living things are seen as partners who should be valued and as having inherent worth. In organic agriculture, the volitional aspects allude to moral judgements about what should or shouldn't be done while taking other factors into consideration.

Application of various contemporary breeding and propagation methods for organic breeding and propagation programmes may suffer as a result of respecting the integrity of plants. It may imply that: sterility, such as cytoplasmic male sterility, will not be accepted in the final product (variety) without including restorer genes; patents on life are not accepted; reproductive barriers between species will be respected and not violated; in vitro techniques are not compatible with organic principles. These factors have only been included in draught standards for the years 2002 to 2005 of the International Federation of Organic Agriculture Movements' Basic Standards for Organic Production and processing.

The use of molecular markers in organic breeding programmed does not include genetic alteration since DNA diagnostic tools allow selection at the DNA level. The approaches, which are often based on biochemical and molecular markers, might therefore be used in organic breeding programmes to enhance trait selection procedures in the field, although their applicability for organic agriculture has not yet been shown. In organic plant breeding, the interplay between genotype and environment is crucial, and markers may help determine how well genotype characteristics behave in different environments in addition to field selection. The methods employed for DNA diagnostics should draw particular attention, since some of them make use of (cancer-causing) chemicals and radioactive isotopes, which are neither appropriate nor allowed in organic farming.

More study is required to examine and improve plant breeding ideas, tactics, selection criteria, and breeding methodologies for more dependable and better-adapted cultivars for the organic industry. How under organic growing circumstances do traits like nutrient absorption and use efficiency, weed control, disease tolerance, crop growth dynamic, and yield stability interact with one another, and to what degree are these traits genetically determined? However, it is also unclear how these traits might be used as field selection criteria or what function molecular makers could play in organic breeding efforts.

Conventional breeding firms would want to know what the advantages of choosing under organic growing circumstances are due to the logistical issues. Do organic farmers need generalists with less G–E interaction or specialists with adaptations to particular geographical conditions? Economic interest in creating specialist breeding programmes for organic farming systems would be hampered by the restricted area under organic agriculture, especially in regard to.

Organic farming:

A worldwide view, with a focus on small, vital crops with modest yields, such cereals and grain legumes. Public prebreeding efforts and research should be supported by governments. International collaboration is also necessary for this. The demands of conventional agriculture will eventually be met by the variety requirements for the organic sector, which will reduce the dependence on high chemical inputs and expand the breeding industry's emphasis in a low-input path for contemporary agricultural growth. Nutrient absorption and crop protection methods are frequent topics of study for both organic and conventional plant breeders.

Despite its holistic approach and spiritual dimension, biodynamic agriculture is still a scientific method of farming. Many scientific studies have shown that biodynamic farming can improve soil health, increase crop yields and quality, and enhance the health of the ecosystem. For example, research has shown that biodynamic farms have higher levels of soil organic matter, increased soil biodiversity, and improved soil structure compared to conventional farms.

Biodynamic farming also has the potential to address some of the environmental challenges facing agriculture today. By minimizing the use of synthetic fertilizers and pesticides and using compost and other organic matter to improve soil fertility, biodynamic farms can reduce soil degradation, increase soil carbon sequestration, and improve water quality. Additionally, by integrating livestock into the farming system and using them to fertilize the soil, biodynamic farmers can reduce the need for synthetic fertilizers, improve soil health, and enhance the fertility of the land.

One of the key advantages of biodynamic agriculture is its ability to adapt to local conditions and to produce food in a sustainable way. Unlike conventional agriculture, which often relies on monoculture crops and standardized practices, biodynamic farming is a flexible system that can be adapted to the unique conditions of each farm. This allows biodynamic farmers to produce food that is well-suited to local climates and ecosystems, and to produce food in a way that is sustainable over the long term.

Another advantage of biodynamic agriculture is its potential to increase food security in developing countries. By using local materials and traditional knowledge to enhance soil fertility, biodynamic farmers can increase crop yields and improve food security for local communities. Additionally, by focusing on soil health and reducing the need for synthetic fertilizers and pesticides, biodynamic farming can help to conserve resources and reduce the environmental impact of agriculture.

Despite these benefits, there are still challenges to the widespread adoption of biodynamic agriculture. For example, the unique preparations used in biodynamic farming can be difficult to obtain, and the use of lunar and celestial rhythms in planting and harvesting may not be well understood by all farmers. Additionally, biodynamic farming can be more labor-intensive and require a higher level of expertise and knowledge compared to conventional farming methods, which may pose a barrier to adoption for some farmers.

Another challenge facing biodynamic agriculture is the lack of recognition and support from governments and the broader agricultural community. Despite its potential to address many of the challenges facing agriculture today, biodynamic farming is still a relatively small movement and is not widely recognized or supported by governments or the broader agricultural community. This can make it difficult for biodynamic farmers to access resources, such as funding and technical support that are needed to support the development of their farms.

In conclusion, biodynamic agriculture is a holistic and spiritual approach to farming that has the potential to address many of the challenges facing agriculture today. By improving soil health, increasing crop yields and quality, and enhancing the health of the ecosystem, biodynamic farming can help to conserve resources and reduce the environmental impact of agriculture. Although there are challenges to its widespread adoption, biodynamic agriculture has the potential to play a significant role in addressing the challenges facing agriculture today and in ensuring a sustainable and secure food future for generations to come.

Biodynamic agriculture also incorporates principles of anthroposophy, a spiritual philosophy developed by Rudolf Steiner, the founder of biodynamic agriculture. Anthroposophy views the farm as a living organism and considers the interactions between the soil, crops, and livestock as well as the cosmic and spiritual forces at work. Biodynamic farmers use spiritual practices, such as meditation and visualization, to enhance their connection to the land and to the farming process.

One of the key features of biodynamic agriculture is the use of biodynamic preparations, which are made from fermented herbs, minerals, and animal parts. These preparations are used to enhance the life forces in the soil and crops, as well as to improve soil health and fertility. Biodynamic farmers also use lunar planting calendars to time their planting and harvesting activities in accordance with the lunar and cosmic rhythms.

Biodynamic farming is different from organic farming in that it goes beyond simply avoiding synthetic chemicals and genetically modified crops. It is a holistic approach to agriculture that emphasizes the interrelationships between the soil, crops, and livestock, and the spiritual and cosmic forces at work. Despite its many benefits, biodynamic farming is not without its challenges. It can be more labor-intensive and time-consuming than conventional farming, and it can be difficult for farmers to make a living solely from biodynamic farming. In addition, some consumers may be skeptical of the spiritual and holistic aspects of biodynamic agriculture, and the lack of scientific evidence for the effectiveness of the biodynamic preparations may also be a barrier.

Despite these challenges, biodynamic agriculture is gaining in popularity, particularly among consumers who are looking for environmentally friendly and sustainably produced food. Many biodynamic farmers are also involved in community-supported agriculture programs, which provide a direct connection between consumers and farmers and allow consumers to support local and sustainable agriculture. In addition, biodynamic farming is also attracting interest from researchers and scientists, who are exploring its potential benefits for soil health, biodiversity, and environmental sustainability. For example, studies have shown that biodynamic farms have higher levels of soil organic matter, better soil structure, and increased biodiversity compared to conventional farms.

Biodynamic farming is a unique and holistic approach to agriculture that emphasizes the spiritual, ecological, and interrelationships between the soil, crops, and livestock. It offers many potential benefits for soil health, biodiversity, and environmental sustainability, and is growing in popularity among consumers and researchers. While it can be more challenging and time-consuming than conventional farming, biodynamic farming offers a truly sustainable and environmentally friendly alternative.

It will be more difficult to convert a farmer to organic agriculture in a region with low rainfall, high temperatures, or strong winds than in an area with widespread rainfall and comfortable temperatures. However, the benefits that result from implementation in contrast to optimum humid circumstances, and drier conditions will make organic techniques more visible. For instance, adding compost to the topsoil or planting holes would improve the soil's ability to retain water and raise the tolerance of the crop to water shortage. Water is lost through evaporation from plants and soil evaporation at significant rates in hot, dry climates. Strong winds may further increase these losses by accelerating soil erosion the organic matter level of the soils is often low.

Strong winds may further increase these losses by accelerating soil erosion. Because biomass output is often low and the organic matter content of the soils is generally low, there is a significant reduction in the nutrients that are available to the plants. Protecting the soil from intense sun and wind, as well as boosting the quantity of organic matter and water that the soil receives, are the keys to enhancing crop yield under these circumstances. Composting or growing green manure crops may enhance the amount of organic matter in the soil. Increasing the output of biomass production, which is required for compost manufacturing, is the issue in the case of compost production.

High aboveground biomass output and quick breakdown of soil organic matter suggest that nutrients are readily available to plants in warm, humid climates. However, there is a significant chance that the nutrients will be lost and readily washed away. In these circumstances, a balance between preventing soil depletion, and organic matter must be produced and broken down. Combining several methods to safeguard the soil and provide it with organic material turns out to be the most fruitful course of action. These techniques include planting a variety of crops in many layers, preferably including trees, cultivating ammonia-covering crops in orchards, and adding compost to the soil to improve its organic matter content and hence boost its ability to hold onto water and nutrients.

To encourage and preserve healthy soil tilth (a collective name for a soil's total physical properties, including texture, structure, permeability, consistency, drainage, and water-holding capacity) Primary cultivation opens and loosens tilled or packed soils, improving air, gas, and water relations and facilitating easier root penetration. By vertically dispersing organic matter (such as cover crops, compost, and soil additives), which gives nutrients and energy to the soil microbes responsible for soil aggregate production, cultivation promotes soil particle agglomeration. As soil particles are rearranged, chemical linkages are encouraged to develop, which in turn helps to build soil aggregates. To create a good seedbed, secondary cultivation reduces the size of the soil particles on the surface to eliminate or lessen soil hardpan Physical fracture can result from deep cultivation.

To more thoroughly aerate the soil, incorporate soil additives, and otherwise improve soil quality, deep cultivation might physically shatter compacted and otherwise impermeable soil layers or "hard pans." Easier growth of roots Soil hard pans can be either naturally occurring or manmade. Clay pan: A distinct, thick soil layer is created as clay particles seep downward and settle Plow pan: Produced by repeated, similar-depth mechanical tillage Traffic pan: This type of surface is created by continual foot or animal grazing, particularly in damp soils. To promote soil air/gas exchange with the atmosphere.Timed cultivation occurs when beds are properly made.

Soil air/gas interaction with the atmosphere is increased by cultivation the instant increase in soil pore volume and aeration caused by timing cultivation to occur when beds are properly wet (50%-75% of field capacity) enables the fast passage of atmospheric nutrients into the soil gases. These essential soil air gases, which comprise ammonia, oxygen, plus carbon dioxide, are necessary for plant development. Good crumb structure may be developed by using appropriate cultivation methods, organic matter additions, and soil amendments. As a result, a more durable network of pore spaces is created, facilitating the continuous, passive interchange of ambient and soil gases, the ease with which plant roots may plow through the soil, and the infiltration, precipitation, and drainage of water. Nitrogen (N_2): Increasing soil nitrogen (N_2) concentrations.

Oxygen (O_2): Elevated soil oxygen levels may boost soil biological activity, improve soil biological diversity, and increase soil fertility when paired with organic matter inputs the speed at which soil organic matter is broken down by microbes. The oxygen that is continuously being drawn up by plant roots for respiration is replenished by soil aeration Carbon dioxide (CO_2): Through cultivation, CO_2 may be removed from the soil and replaced by oxygen and nitrogen. Improve the features of infiltration of water, percolation, retention, and drainage. Proper tillage increases the porosity of the soil, allowing water to gently trickle downward and permeate the soil at rates that are best for crop plants and soil bacteria. The speed of mineralization is accelerated by soil aeration.

Soil aeration accelerates decomposition as well as the release of nutrients that are readily absorbed by plant roots into the soil solution to raise the springtime warmth of cold soils compared to soil water and the soil's solids, soil air heats up faster. In contrast to soils with fewer pore spaces, those with well-developed aggregations and sufficient pore space have more favorable drainage properties and, as a result, dry out and warm up more quickly. At higher soil temperatures, bioactivity and biogeochemical reactions intensify; at soil temperatures below 50–55°F, soil microbial activity rates and plant development drastically drop down add amendments to the soil Compost and other soil additions, such as mineral and non-mineral fertilizers, can be easily incorporated during cultivation.

Incorporating cover crops, agricultural leftovers, and both mineral and non-mineral fertilizers. To boost short- or long-term access to crucial fertilizers or to enhance the physical, biological, and chemical properties of the soil, cultivation may be employed to integrate soil to desired soil depths. The soil's biological and/or chemical characteristics. Composts, manures, and fertilizers: To prevent the loss of carbon and reactive nitrogen compounds via surface oxidation, tillage and cultivation practices are required to integrate organic matter additions under the soil surface. Additionally, tillage can be employed to equally spread organic matter additions for overall soil development or to strategically lay fertilizers for a crop's short-term nutritional needs. Adding mineral supplements and other soil additives, such as fish meal and bone meal.

CHAPTER 6

ORGANIC LIVESTOCK HUSBANDRY AND BREEDING

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Organic livestock husbandry and breeding is a farming practice that seeks to promote the well-being of animals and the environment. It involves using methods that do not harm the health of animals, such as using feed made from natural ingredients, avoiding antibiotics and growth hormones, and providing animals with adequate living conditions. In addition, organic livestock breeding emphasizes genetic diversity and the preservation of heritage breeds.

The principles of organic livestock husbandry and breeding include providing animals with access to pasture and outdoor spaces, minimizing stress and promoting natural behaviors, and avoiding the use of harmful chemicals and antibiotics. Organic feed must be free of genetically modified organisms (GMOs) and made from organic ingredients such as grasses, legumes, and other crops grown without synthetic fertilizers or pesticides. Animals must also be free from growth hormones and antibiotics.

Organic livestock breeding focuses on preserving genetic diversity and heritage breeds, which are often threatened by industrial-scale breeding practices. This helps maintain a healthy gene pool, which is essential for the long-term health and resilience of livestock populations. In addition, organic breeding often involves the use of traditional breeding techniques, such as selective breeding, that rely on natural traits and behaviors, rather than artificially selected traits.

Organic livestock husbandry and breeding also have benefits for the environment. By using natural methods and avoiding harmful chemicals, organic farming reduces the amount of pollutants that can leach into the soil and groundwater. In addition, pasture-based systems that allow animals to graze can help to promote healthy soil, prevent soil erosion, and increase biodiversity.

Despite the many benefits of organic livestock husbandry and breeding, there are also some challenges. For example, organic feed can be more expensive than conventional feed, and organic farming can require more land and labor than conventional methods. In addition, organic farmers may face difficulty in finding certified organic feed or breeding stock, as these are often in short supply.

Organic livestock husbandry and breeding is a method of farming that prioritizes the well-being of animals and the environment. By using natural methods, avoiding harmful chemicals, and preserving genetic diversity, organic farming can promote healthy livestock populations and protect the environment. However, organic farming can also come with challenges, such as increased costs and difficulties in obtaining certified organic feed and breeding stock.

Organic livestock husbandry is a method of raising animals for food production that emphasizes the use of natural and sustainable practices. This approach to animal husbandry is based on the principles of organic agriculture, which seeks to produce food in a way that is environmentally friendly, humane, and healthful.

Organic livestock husbandry practices include:

1. Providing animals with access to pasture, sunlight, and fresh air.
2. Using natural methods to control parasites and diseases, such as rotating pastures and using herbal remedies.
3. Feeding animals a diet that is free from genetically modified organisms (GMOs) and synthetic additives.
4. Avoiding the use of antibiotics and growth hormones.
5. Providing animals with a humane living environment, including adequate space, shelter, and bedding.

Organic breeding is also an important aspect of organic livestock husbandry. This involves selecting and mating animals that are well-suited to the organic production system, with a focus on traits such as fertility, hardiness, and disease resistance.

The benefits of organic livestock husbandry and breeding include:

1. Improved animal welfare and health.
2. Enhanced soil and water quality.
3. Reduced greenhouse gas emissions.
4. Increased biodiversity.
5. Improved food safety and quality.

Organic livestock husbandry and breeding can be more labor-intensive and require a greater investment of time and resources than conventional methods. However, many farmers and consumers believe that the benefits are worth the extra effort.

Organic livestock husbandry and breeding offer a sustainable and humane alternative to conventional animal agriculture. By prioritizing the well-being of animals, the environment, and public health, organic livestock husbandry and breeding can help to promote a more sustainable food system for future generations.

At both the gardening and field scales, soil tillage should only be done when the soil moisture is between 50 and 75 percent of the field's capacity. Tillage carried out at moisture levels higher than 75% of field capacity, whether with a spade and fork or tractor-drawn tillage equipment, can increase soil compaction, damage soil structure, increase surface crusting, and enhance erosion potential. When soil tillage is performed, aggregates in the soil may be crushed, resulting in poor healthy soil and an increased risk of wind-driven soil erosion. Classification of soil texture sandy soil: Soils containing sand that has relatively big particles.

Sandy soil: Sandy soils naturally tend to be well-drained, aerated, and friable due to their comparatively high particle size and extensive pore spaces. These characteristics provide soil conditions where organic matter can grow because of the comparative inertness of the sand particles. Rapid oxidation causes the formation of unstable soil aggregates. Although less prone to compacting when tilled outside of the optimal moisture range, sandy soil tillage techniques must typically be conservative to preserve soil aggregates and preserve desirable soil physical qualities. Clay soil: Clay-rich soils (>40%) have a lot of microspore gaps and frequently have issues with gas exchange and drainage. Heavy clay soils sometimes require a lengthy period of regular, thorough plowing.

To integrate enough organic matter and mineral soil amendments to achieve the desired soil physical characteristics. Clay soils need to be handled at the best soil depth clods, which are massive, compacted soil masses that result in poor soil physical qualities and should be avoided by using moisture (50–75 percent of the field capacity). Arctic, tropical, temperate, and dry climates all tend to create various types of soil due to the substantial influences of temperature, absorption, and precipitation on soil development. Temperature, evaporation, and rainfall all have an impact on how much and how long seasonal soil biological activity lasts. This affects how quickly soil organic matter is mineralized and how much organic matter accumulates in a particular soil. In general, the more days that the soil is below 50 degrees Fahrenheit and the higher methods.

The more precipitation that falls each year, the more organic matter accumulates in the soil. Low yearly precipitation causes scant flora and little organic matter in arid areas buildup of materials. Soil organic matter should be preserved by limiting cultivation. Arid soils are frequently capable of being highly fruitful with the introduction of irrigation or organic matter inputs because of the low precipitation and less nutrient leaching. Temperate climates: Lower temperatures and significant buildup of organic debris. To raise soil temperatures and aerate the soil, spring tillage is frequently required. High yearly temperature, precipitation, and humidity contribute to maintaining biological activity in soils and the ongoing oxidation of organic matter in soils. Tropical climate vegetal cover frequently holds an excessive amount of nutrients and organic materials reduce cultivation as much as possible.

For the crop output of a particular season, the nutrients released when cover crops break down might be a substantial source of vital plant nutrients to eradicate plants effective way to eliminate annual plants and weaken the crowns and rhizomes of permanent weeds is through cultivation. Multiple cultivations may be required during the crop cycle and before transplanting or direct sowing to diminish the soil weed seed bank and, as a result, the weed competition with cultivated crops. This is because cultivation promotes the germination of annual weed seeds.

In temperate regions, spring is when farming is at its most intensive. Deep tillage is frequently used to aerate & warm cold soils, mix organic and mineral matter soil supplements, remove cover crops, make sowing beds either seed or transplants, and more transplants. Summer: A time of little surface cultivation and tillage for subsequent crops. Fall: In mild regions with high yearly winter rainfall, deep cultivation is typically readied utilizing soil for fall and winter dormancy crop production.

Deep cultivation prevents the cumulative impacts of precipitation from compacting the soil and aids in ensuring proper winter drainage. Before planting cover crops in the fall, tillage is frequently employed to add organic and mineral soil nutrients winter is A time when there is little or no agriculture System of cropping Annual cropping.

Cropping system Yearly cropping method: Annual cropping systems involve intense planting of nutrient-demanding plants, which calls for frequent soil tillage and causes losses of both plant nutrients and organic materials. To offset losses, annual cropping systems require significant inputs of organic material and mineral supplements. Perennial cropping system: After the initial planting, perpetual farming systems require little to no-tillage and only sometimes surface cultivation or cutting to control competing plants. Take notice that the information in this handbook mostly pertains to annual row crop systems. Soil quality Well-titled soils: These soils often require less rigorous tillage and are managed by adding soil amendments to the top inches of soil.

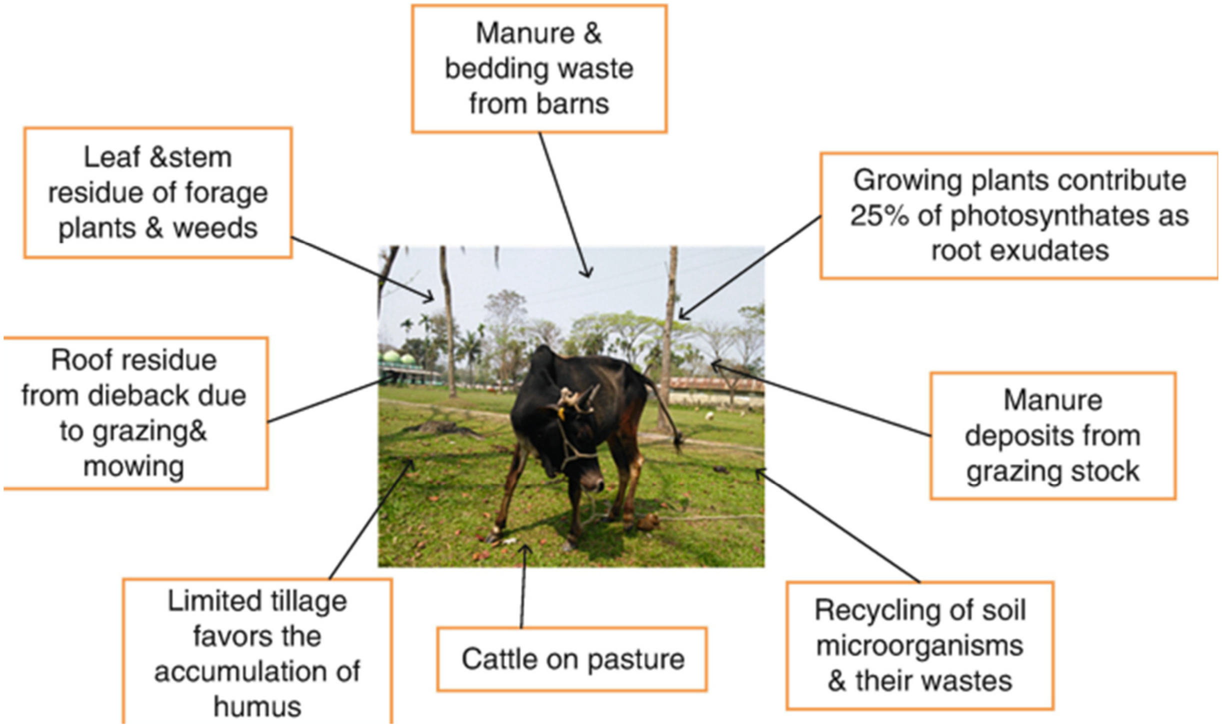

Figure 6.1 shows the organic animal husbandry.

Such soils' physical characteristics (structural and bulk density) should be observed, and when necessary, they should be regularly thoroughly tilled to prevent soil compaction and provide organic material soil amendments that promote soil fertility creation of aggregates. Low-quality soils with poor physical characteristics: Each year, tilled land and soil with surface or sub-soil compression are first deeply tilled employing triple digging on a gardening scale and manual spading or chisel plowing on a field scale. Deep tillage encourages the production of soil aggregates and lowers soil bulk density by fracturing compacted soil layers and dispersing soil amendments across the soil profile. Deep tillage is also paired with growing deep-rooted cover crops. Less intense tillage techniques may be utilized for upkeep once the physical attributes of soil have indeed been established or enhanced.

Potential Consequences of Continual and Intense Soil Cultivation numerous detrimental effects on soil can result from frequent and vigorous soil cultivation, excess tractor, and foot movement, especially when done only when soil is excessively moist structure. One of the potential effects is a reduction in soil organic carbon because intensive farming on irrigated soils accelerates and maintains soil organic matter oxidation. Without regular replenishment of organic matter, intensively tilled soils will exhaust their active humus reserves, degrading the biological, mechanical, and chemical characteristics of the soil.

Reduced biological variety and activity in the soil over time: Many soil organisms get their energy from the soil's organic materials. Large numbers or a wide variety of soil microorganisms, which are important for many ecosystem functions, cannot exist in soils with little or depleted soil organic matter for the creation and maintenance of specific soil physical qualities, including aggregation and general granular/crumb structure, as well as for the release of nutrient elements, disease prevention, and disease suppression. Degradation of soil aggregates: During tillage, soil aggregates can also be crushed, compressed, or subjected to oxidative degradation. The organic content of the soil will eventually be lost due to excessive or continual tillage without the replacement of organic matter. A decrease in the soil's ability to keep both water and nutrients organic matter in the soil is a source of everything necessary.

The objectives of this chapter are to provide a brief review of organic animal husbandry in general and to go into further depth on issues related to organic animal housing and breeding. Animal husbandry might be seen as the whole of the animal agricultural industry. In a smaller housing for animals is taken into consideration. Peer-reviewed journal articles on organic animal husbandry are rather hard to find. They found that just 9% of the 472 refereed papers uncovered between 1981 and 2000 dealt with animal-related subjects. In the 10 years starting in 1991, Lund and Algers (2001) only discovered 22 works on health and wellbeing. These authors also note that comparisons with conventional farms have not always been made and that sample sizes included were sometimes rather small.

The majority of the scientific literature on organic animal husbandry comes from North America or Europe (mostly the UK and Scandinavia). Due to few resources and the accessibility of contemporary technology, many agricultural systems in developing nations are often organic. However, due to a lack of precise definitions, information regarding such systems is not included in this study. The majority of certified organic production in developing nations is export-focused and consists mostly of items with a plant origin (such as coffee, tea, chocolate, oil, citrus fruits, bananas, tropical fruits, and spices).

Although the notion of organic animal farming is still relatively new in Asia, certain Latin American nations are beginning to export organic meat products. However, Australia's organic farming is mostly built on vast grazing grounds. Argentina also fits this description Livestock products were among the top five organic goods in 14 of the 16 European nations.

Between 1999 and 2001, the Network on Animal Health and Welfare in Organic Agriculture (NAHWOA), which was funded by the European Union (EU), held five workshops on topics like the variety of livestock systems, human-animal relationships, feeding and breeding, and health management. The workshop's final recommendations and conclusions were published online at www.veeru.reading.ac.uk/organic. The network has published a scholarly book titled Animal Health and Welfare in Organic Agriculture. Sustaining Animal Health and Food Safety in Organic Farming (SAFO) is another Concerted Action Project financed by the EU with an emphasis on food quality. The primary activity, similar to the NAHWOA network, is scientific interchange, which is aided by five workshops conducted between 2003 and 2005.

Additional conferences on specific aspects of organic livestock production have been organised throughout Europe Worldwide organic agricultural information is provided. The majority of the data, however, relates to the number of farms, their sizes, and the proportion of their land that is managed organically. There is a shortage of data on the amount of animal production. Although not in connection to farm sizes, Foster and Lampkin (2000) provided some information concerning certified organic livestock in Europe between 1993 and 1998 (dairy cows, other cattle, pigs, poultry, sheep, and goats).

At least in nations with significant animal production, the percentages of animals raised organically are likely different for different animal species. For instance, fewer than 2% of pigs or other poultry species were raised organically in Germany in 2002, compared to 17% of all beef cows, 8% of sheep, and 7% of geese. Similar trends were discovered for other European nations in 1998. More pigs and chickens are raised in close quarters in traditional farming (e.g. stocking densities, housing conditions, feed origin). Therefore, switching these farms to organic agriculture is more challenging. Farms that raise beef or sheep are often maintained rather intensively to make conversion easier.

The criteria of the International Federation of Organic Agriculture Movements (IFOAM) apply to all of its members and the farmers who are members of those organisations (IFOAM 2002). These requirements include basic guidelines, minimal specifications, suggestions, and derogations (such as the formal replacement of an organic input with a conventional input in cases when an organic input is not available). Because of the foundation for regulation provided by the IFOAM standards, member organisations are able to adopt stricter regulations. The Codex Alimentarius of the Food and Agriculture Organization (FAO) of the United Nations is another form of more generic standard (Joint FAO-WHO Food Standards Programme 1999). All producers in EU nations who wish to market their animal products as "organically produced" must adhere to the EU legislation regulating organic livestock production (EUR-Lex 1999, 2003). All nations wishing to export organic goods to the EU must adhere to these standards.

The organic movement has not given as much thought to organic animal husbandry standards as it has to organic plant production standards. The organic movement's origins in soil and plant production ('grow healthy plants on healthy soils') may help to explain this.

Housing

The term "livestock housing" refers to "how animals are housed on a farm." Both grazing systems and stables may be included in this. In a wider sense, housing refers to all aspects that could have an impact on the animal, such as human treatment, transportation, and killing. Additionally, the effects of animal housing on the environment, particularly pollution, are taken into account.

Vonne Lund has provided an overview of animal welfare in organic farming elsewhere. High concentrations and a lack of stimulants, such straw, diminish animal wellbeing in typical intensive housing systems, which may result in behavioural problems, accidents, or certain illnesses. On organic farms, livestock housing should take into account the behavioural needs of various farm animal species, ease effective management, and employ ecologically friendly building materials and construction techniques.

It is feasible to infer certain conclusions about the best housing options from the natural behaviour of farm animals. Most breeding strategies make use of selection indices. Economic elements are multiplied by various production qualities, and these partial indices are totaled up to a total value. Additionally, despite their low heritability, functional traits like health, fertility, or longevity have become more important in several conventional breeding programmes for dairy cows in recent years.

The ranking of the available sire animals might be altered by adding more weight to some of these features, which would be a viable strategy for organic selection indices. Performance qualities often get a lesser emphasis than functional ones like lifespan or health. For instance, a flatter lactation curve and a lower milk output in the initial lactation may both be goals, as well as greater milk performance persistence throughout lactation. In traditional breeding strategies, neither feature is often taken into account.

Until particular animals raised for organic farming are available, ecological breeding indicators could be a viable stand-in. Examples of applications of this technique (such as ecological total breeding value and ecological index). For instance, a list rating breeding bulls from various breeds is issued in Germany twice a year. Ecological indices are included in the catalogues of traditional breeding businesses in Switzerland. The drawback is that only the qualities for which data are obtained may be utilised. No information is currently available concerning additional possible beneficial characteristics for organic agriculture (e.g. conversion ability of roughage). Additionally, bulls with high rankings were often bred for strong unidirectional performances.

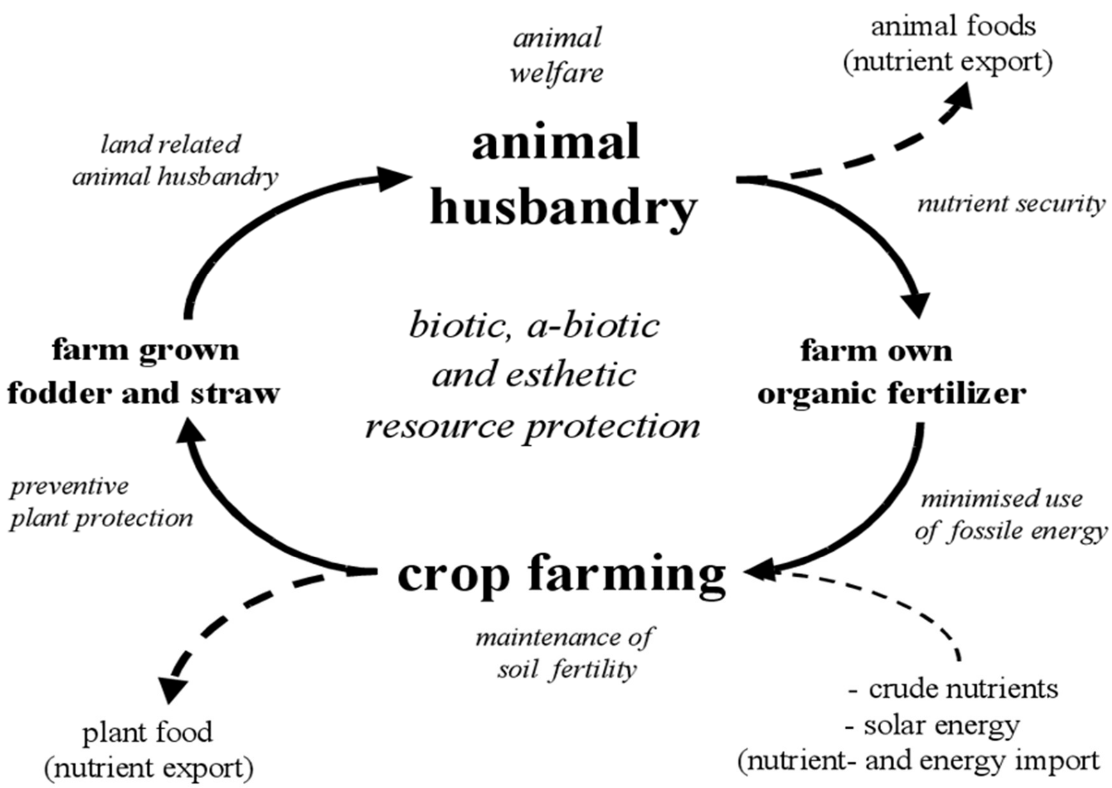

Figure 6.2 Organic Fodder Production in Intensive Organic Livestock Production.

The idea of breeding for lifelong performance was established by Professor Bakels in Munich, Germany. A dairy cow with a high lifetime milk performance is thought to also be healthy and fruitful. Rotational breeding and a little amount of inbreeding are used to identify and produce families within a breed that have extremely good lifetime performances. High lifetime performance has economic benefits in that raising expenditures are distributed over many cows, and selection opportunities are greater since there are more potential offspring. Only traditionally raised AI bulls, often from North America, are employed, nevertheless. According to Günter Postler's personal communication from 2005, there are farmer organizations dealing with lifetime performance in Germany, the Netherlands, Switzerland, and Austria. Every year, they provide catalogues of recommended bulls, 90% of which were bred specifically for organic farming or lifelong production. The concept of lifetime production may also be applied to sows and laying hens, who would produce a certain number of piglets or eggs over the course of their lives.

The Dutch farmer Dirk Endendijk is credited with creating the idea of family breeding. Using the original Dutch Friesian cattle, he successfully developed cows that produced more than 10,000 kg every lactation. In such method, the majority of the animals present at a farm are employed for breeding. The use of many bulls at once for natural mating is another common trait. Similar to the idea of lifetime performance, high lifetime output cow families are utilised, again using some inbreeding.

Some nations employ crossbreeding to produce dairy cows, such as the Holstein Friesian Jerseys in New Zealand. Cross breeding, which often combines the benefits of native and high-yielding European strains, is widespread in the tropics. Thus, heterosis effects might be used (higher performance in offspring than in the parental generation). Examples include increased milk production, resistance to illness and parasites, climatic adaption, or progeny survival rates. Crossbreeding, however, requires more inputs (one portion of the herd must be maintained pure bred, for example). What should be done with the F1 animals is another concern (first generation of crossbreeding). The F1 generation may either be constantly generated or rotated via crossbreeding 161 Pigs are raised and bred organically

Compared to dairy cows, alternative breeding techniques are far less popular in pigs and poultry.

The (very small) organic pig industry offers a wide range of options, from typical lean meat for retail chains to rather fat breeds for sausage manufacture. As a result, it might be challenging to establish acceptable breeding objectives for all potential organic marketing objectives. At traditional slaughterhouses in nations like Germany and Austria, just the quantity of lean meat is paid for.

The intramuscular fat percentage (IMF) is also taken into account in other nations, such as Switzerland or Denmark. As IMF is closely associated to sensory qualities like flavour, tenderness, and juiciness, it is crucial for meat quality. Pigs' IMF and PSE meat have decreased as a result of breeding for more muscular animals (e.g. Hörning 1997). Another factor is fat quality, which is crucial for making sausages, for instance. Lean meat is also popular among buyers of organic products. It will be essential to persuade those customers of the benefits of meat with a higher IMF since there is a conflict of interest.

Some breeding businesses aim for characteristics in mother breeds like fertility or lifelong performance. Alternately, conformation criteria may be taken into account, such as how the limbs are positioned in relation to their susceptibility to lameness. Additionally, some businesses take into account behavioural qualities like mothering prowess or compatibility for group dwelling. For instance, Grandinson *et al.* (2003) discovered a connection between piglet mortality and sows' avoidance of the farmer.

This is crucial in the loose farrowing sow housing that organic agriculture prefers. Similar to cow breeding, there is a lack of appropriate measurement techniques for specific characteristics, such roughage conversion. Breeds produced for outdoor pig rearing in the UK are one example of breeds designed specifically for certain living situations.

Poultry

The development of hybrid breeding has resulted in completely distinct strains of fowl for the production of meat or eggs. Numerous health issues, such as sudden death syndrome, limb issues, or ascites in broilers, have been made more prevalent by selection for extremely high performances. The EU law for organic agriculture, at least for meat poultry, takes this into consideration by prescribing minimum slaughter ages that are substantially higher than for conventional farming.

Male layer chickens are often murdered as soon as they hatch since it is not cost-effective to fatten them. This is a significant ethical issue. Additionally, standard laying hens are typically only utilised for one laying season (about one year). Once again, this can be seen as unethical. The feeds authorised for organic farming make it exceedingly difficult to feed high-yielding chicken breeds in accordance with their nutritional needs. Given the variety of protein diets available, providing poultry with critical amino acids is especially challenging.

Because of the aforementioned factors, organic agricultural performance levels should be decreased. For birds in alternative housing systems, vitality and adaptability will be particularly crucial since current layers have been chosen under cage-like settings. Under different housing circumstances, many hybrid strains may experience feather plucking and cannibalism. However, since there is considerable heredity, it may be beneficial to choose against certain behavioural disorders.

At least for laying hens, the majority of organic poultry producers employ common hybrid breeds. For meat fowl like turkeys or broilers, there are several breeds that grow more slowly that were developed, for instance, in France for the manufacture of the free-range designation. The fact that these birds are hybrids, however, also means that the farmers are unable to breed their own livestock. Purebred layers produce far fewer eggs than current hybrid strains, according to tests conducted in Germany and Denmark.

A worldwide view of organic farming

Previous 30 years these purebred breeds have been chosen mainly for looks. As a result, it seems that there is not yet an ideal breed for organic agriculture. Purebreds produce at an unacceptably low rate, while contemporary hybrids are prone to cannibalism and feather plucking. In the long term, creating breeds that can produce both meat and eggs could be the answer for organic farming. However, the performance of both meat and eggs will be inferior to that of current hybrid breeds. Customers must thus be persuaded to purchase these more costly goods. Organic meat and eggs are rather expensive. Additionally, organisations or organic farmers' efforts will be required. The organic market is too tiny for the large breeding corporations to establish an organic breed in the near future.

Utilizing performance information is further complicated by genotype-environment interactions (G-E). Generally speaking, G E interactions imply that animals of the same origin may behave differently in various settings. It might be challenging to evaluate animal performance in significantly diverse situations since the G E interactions are more significant in extremely varied contexts. For instance, Sorensen (2001) demonstrated that a purebred laying hen (Danish Skalborg) performed similarly in cage-style and other types of housing. However, the evaluated hybrids produced less in cage systems compared to other systems. In Bangladesh, a native breed

(Sonali) performed better than Lohmann Brown chickens in semi-scavenging circumstances. There is currently no data on G-E interactions that contrast conventional and organic agriculture. It requires a lot of data to estimate G E interactions, which is a crucial prerequisite. Another issue is that testing labs often use animals, preferably pigs or chickens, in a traditional manner. For instance, only concentrates are utilised in intensive feeding and housing systems, which is prohibited in organic farming. Results produced under such circumstances could also not translate to biological circumstances.

Breeding techniques

Breeding procedures should respect the animals' natural behaviour, per IFOAM guidelines and EU legislation. Natural mating is thus desired. Methods that rely on sophisticated technology need to be avoided. Cloning and embryo transfer are forbidden. AI is allowed, however the use of hormones to stimulate ovulation and childbirth is illegal unless strictly necessary for medical reasons.

Farmers may become increasingly reliant on breeding businesses as a result of invasive procedures like artificial intelligence (AI) or embryo transfer that disregard an animal species' natural behaviour. Additionally, since fewer breeding animals are utilised using these approaches, the genetic foundation of a breed will be diminished. Organic livestock management strives to use natural breeding practises. With some animals, AI is still widespread. For instance, most organic dairy producers in Germany continue to utilise AI, although most beef farmers rely mostly on natural mating.

It is not permitted to transfer embryos (ET) in organic farming. Breeding bulls, however, are often created by ET. In many nations, standards for bulls should be established for natural mating. Rotating breeding animals across farms is another way to promote natural mating, as does paying certain farmers to maintain male breeding animals. Because the sire is more adept at spotting oestrous females, natural breeding often has a greater success rate in reproducing offspring. However, many offspring will be impacted if the father inherits health issues that don't manifest right away.

Another query is whether quantitative trait loci (QTL) approaches are appropriate for organic farming (Pryce *et al.* 2004). Gains may be enhanced by identifying the genes responsible for certain breeding features. These molecular methods, such as screening for the malignant hyperthermia syndrome, are becoming more prevalent in traditional breeding. Using natural livestock care and breeding the 163 (MHS) gene in pigs may lessen their vulnerability to stress. However, since the use of genetically modified organisms is prohibited in organic agriculture, these experiments use genetic engineering techniques that are dubious. Sections pertaining to housing may be found in both the EU rules and the IFOAM standards. The organic requirements generally demand that housing conditions must satisfy the livestock's typical biological and ethological demands (IFOAM 2002). The animals must be housed together.

Since they are sociable living creatures, dwelling. For enjoyment and other uses, they must contain biological substance (e.g. lying on soft ground). Therefore, it is prohibited to utilize housing systems like crates for sows, completely slatted pens for growing pigs or cattle, or battery cages for laying hens that are often employed in traditional agriculture. Additionally, the animals must have access to outside spaces, such as a pasture or an outdoor run. This provides more room and exposure to environmental stimuli (sun, rain, wind). The majority of solutions for intensive housing prevent farm animals from ever having access to the outdoors. The EU legislation specifies the stable's and the outside area's minimum sizes. Animals in industrial animal production may sometimes undergo mutilation (such as beak trimming, tail docking, teeth cutting, and dehorning) to lessen the harmful consequences of the circumstances in which they are housed.

Although the reasons of dense housing are still present, the symptoms are gone. Mutilations should be avoided or kept to a minimum (and only permitted as an exception) in organic agriculture. However, others contend that under alternate housing arrangements, certain mutilations are required. Pigs rooting in pastures, for instance, might obliterate the vegetation. Ringing the nose lessens pasture damage. However, nasal ringing seriously interferes with the species-specific behavioural need and may even cause harm. In large flocks of laying hens, which are typical in alternative housing arrangements, feather picking may be a more serious issue. Beak clipping is a serious intervention that affects the animal's physical integrity. Therefore, it's crucial to take the right management precautions to prevent such mutilations in alternate housing systems.

The aforementioned organic livestock housing standards set up favourable circumstances for animal welfare. They might be seen as strong principles, comparable to the prohibition of pesticides in plant cultivation, and this should be conveyed to customers. There is a dearth of literature on the distribution of housing systems in organic agriculture throughout various, mostly English-speaking nations. However, it seems that housing arrangements vary widely amongst nations.

For instance, organic pigs in Austria are often kept inside with access to an outside run (typically with a solid concrete floor) for fattening pigs and gestating sows, but not for far-reaching breeding 155 rowing sows and weaners are raised and bred using organic methods (Baumgartner *et al.* 2003). Similar circumstances occur in Germany or the Netherlands. A tiny sample from England, however, revealed that organic pigs were kept outside. According to, tying stalls are still the most common kind of housing for dairy cows in Switzerland and Finland. In South Germany, where smaller farms predominate, tying stalls are increasingly prevalent.

To evaluate animal welfare at the farm level, a number of scoring systems and methodologies are available. The animal needs index (ANI 35), one of these approaches, is significant in Austria. For registration as an organic farm, a specified minimum number of points must be obtained. The similar approach was used on 26 Finnish dairy farms. Although many scientists are increasingly advocating for the addition of more animal-based factors for on-farm evaluation methods the ANI scores are now predominantly computed on the environment of the animals rather than on animal-based data. Studies have shown that farmers often fail to maintain acceptable conditions for keeping animals For instance, in Germany, some farmers did not adhere to all the requirements of the country's laying hen legislation. So it makes sense to provide training to those working for organisations that certify organic products so they are aware of the requirements and can make sure they are met.

Numerous optional options or derogations are included in the aforementioned rules. In certain circumstances, it seems that the exceptions are taken to be the norm. For instance, in Germany, organic advisors often advise against utilising loose housing systems for cattle in the winter if the animals have access to a pasture in the summer. There may be further challenges with interpretation. After 2010, an exception from the EU law permits tethering stalls for cattle in small herds. Therefore, a definition of a "small herd" is necessary in order to implement this exemption. These uncertainties raise the possibility that some farmers would strive to meet the bare minimum and, as a result, fall short of customer expectations. When purchasing organic goods, consumers in the majority of European nations give animal welfare a high priority.

In certain circumstances, the EU rule permits transitional measures, such as loose housing for cattle or access to the outdoors until 2010. On smaller farms, stanchion barns are still prevalent. High investment expenditures are often associated with reconstruction for vacant homes. As a result, many farmers seem to hold off until the derogation period is through. In the meanwhile, they will market their goods as organic. Once again, this may undermine consumer confidence. Regulation observance alone does not ensure animal wellbeing. Again, the rules provide the prerequisite for welfare. There are many more variables that affect good wellbeing and might be governed in the standards. As a result, achieving high animal welfare requires competent management, and farmers need to be schooled in the necessary management practises to do so. There are reliable scientific approaches for evaluating animal wellbeing at the farm level.

While farmers in some nations struggle to change their intensive housing systems, issues with more extensive systems might arise in other nations. For instance, cattle or sheep may have issues with water supply, protection from harmful weather impacts (heat, wind), or even against predators in broad grazing systems like those in Australia or Argentina. Alternative housing systems are sometimes somewhat new, hence knowledge is scarce. The typical education of farmers sometimes excludes housing systems because they are seen to be too "exotic." To fill these knowledge gaps in practise, therefore, efforts should be undertaken.

Health dangers

Animal welfare, human health, production, and environmental conservation may all be at odds with one another. The principles for organic livestock production are designed to provide animals the chance to satisfy their behavioural needs. Alternative solutions, however, can come with added health hazards. On many organic farms, health issues including endoparasites, feather pecking, and mastitis in dairy cows are prevalent. For instance, organic bedding components could encourage the development of mastitis bacteria. Many species may be more likely to get endoparasitic infection if they have access to organic materials like bedding in their resting space or on the ground outdoors. The danger of feather plucking may increase when chickens are housed in big groups. Due to the possibility of behavioural issues developing, the best course of action may not be to completely eradicate these risk factors but rather to mitigate them with suitable interventions such high-quality bedding, pasture changes, or recreational opportunities. For instance, discovered that the presence of cocks and the upbringing of pullets in outdoor runs at the farm decreased the danger of feather pecking in layers on Dutch organic farms. Herd management and interactions between people and animals have a significant impact on lowering the risk of injuries in loose housing for horned dairy cows.

Environmental Damage

Farm animal housing arrangements may result in air pollution from gases, dust, and odours. Slurry or liquid manure is produced by every dense housing scheme. A lot of straw-based systems also produce solid manure. The stable may emit gases as a result of manure distribution and storage. Systems based on straw have greater stable dust concentrations and hence higher emission rates. However, slurry systems produce more odour emissions. If the storage facilities for liquid manure are covered, the emissions of ammonia (NH3) from solid manure storage are greater. Spreading slurry instead of solid manure will result in increased ammonia emissions if the slurry is not applied to the soil immediately. Slurry-based systems have greater methane emissions as well. However, solid manure systems such as deep litter and straw yards seem to emit more nitrous oxide. Covered yards may produce more ammonia emissions. Additional ammonia emitting places include covered yards. Additionally, additional outside yard space or pens will result in higher emissions. Again, the answer may be to reduce possible emissions inside the existing system for instance, by lowering temperatures or increasing cleaning frequency rather of going back to traditional housing systems.

Profitability

Welfare-friendly systems often result in greater labour or investment costs. There are often considerable investment expenses associated with converting dense housing to welfare-appropriate accommodation (e.g. conversion from stanchion barns to loose housing systems for cattle). However, within a certain area, acceptable systems which lack slurry channels, sophisticated equipment, and insulation could be less costly than intensive systems. However, this gain might be offset since suitable systems have more room per animal than intensive systems. However, as straw-based systems take more labour than systems without straw due to the collection, transportation, and rebedding of the straw, energy costs may be lower reduced heating and/or ventilation in non-insulated, straw-based systems. Exercise yard cleanup also means more labour is needed. Lower energy expenses, improved performance, and greater health might offset the increased investment or labour costs. However, organic livestock production methods often have poorer productivity than conventional systems due, for instance, to a lower stocking rate relative to arable land. Therefore, in order to maintain profitability at a reasonable level, greater prices or subsidies will be required.

Organic animal care and breeding

Breeding

Breeding involves selecting animals to achieve breeding objectives, combining performance information in appropriate ways (for as using a selection index), and using the appropriate breeding strategies (e.g. natural mating, artificial insemination [AI]). There isn't much information available about organic animal breeding. It have provided overviews of the topic, and some of the problems with breeding were discussed at a NAHWOA workshop (Hovi and Baars 2001). In 2003, the Gesellschaft für kologische Tierhaltung (Society for Ecological Animal Husbandry), a network on organic animal breeding, was established in Germany. This network has produced three workshops for research on cattle, pigs, and poultry. The findings of a debate on organic animal breeding in the Netherlands were published. The majority of theories on alternative breeding techniques, according to these writers, were created for dairy cows. There has been much study on conventional animal breeding, and some of the findings may be applied to organic farming.

The need of preserving and sustaining genetic variety is emphasised in IFOAM guidelines and EU laws. These recommendations state that native breeds and strains should be preferred since they are better suited to regional circumstances. Breeds should have strong disease resistance, according IFOAM guidelines. With regard to disease resistance, the EU regulation is more specific: "Selection should avoid specific diseases or health problems with some breeds or strains used in intensive agriculture" (EUR-Lex 1999), including problems like sudden death, difficult births, and pale, soft, exudative (PSE) meat in pigs.

The origin of animals is a further issue related to breeding. Livestock acquired off-farm should come from organic farms, in accordance with organic standards. Since many breeding businesses or hatcheries operate in a traditional manner, this might be challenging. To diversify the genetic pool, some animals may yet originate from traditional farms. According to EU regulations, "a maximum of female nulliparous animals of 10% of equine and bovine species and of 20% of adult porcine, ovine and caprine species per year are allowed to supplement natural growth and renewal of the herds (up to 40% when a major extension is undertaken or a breed is changed or endangered)" (1999, EUR-Lex). In reality, whether it comes to ruminants or pigs, breeding animals are mostly purchased as males from traditional farms, while females are primarily produced on the farm.

Issues with Traditional Breeds

For specialised performance (such as milk, growth rate, meat amount, or eggs), high producing breeds are used. Such one-way high performance could put the organism under stress, as from metabolic stress. Animals that produce high yields are often very sensitive to management changes or errors. There are several health issues that affect performance, such as limb issues, metabolic disorders, mastitis in dairy cows, and illnesses of the reproductive system in laying hens and breeding sows. High achievements can only be achieved with a lot of concentrates, as well. Due to competition with human food, organic farming should strive to limit feeding farm animals with concentrates in order to address the issue of global hunger.

The preservation of breeds that are less susceptible to illnesses or poor management is one goal of organic agriculture. This might lead to a trade-off between production and "hardiness." Another option is to offer a feed ration with a reduced nutritional content in order to not fully use the genetic potential of a breed that produces high yields. For all types of animals, this is not recommended. It could work with dairy cows or pigs being raised for meat. For instance, in organic agriculture Holstein Friesians often get less concentrates. There may be certain health issues, mostly with 158 Modern hybrid poultry lines (including meat and layer strains), when not fed according to their genetic needs, fall within the category of organic agriculture from a global viewpoint. For instance, chickens may have behavioural issues and yet feel hungry (e.g. feather pecking).

Biological Variety

Genetic diversity has significantly decreased as a result of intensive animal production and selection for maximal unidirectional performance. A third of all domestic breeds are thought to be in risk of extinction or at the very least endangered. Over the last 15 years, almost 300 breeds have gone extinct globally. Half of the breeds that existed in Europe at the start of the 20th century are now extinct. Additionally, the methods of global breeding businesses have promoted genetic homogeneity by reducing breed-specific biodiversity. For instance, some Holstein bulls have more over a million offspring. For poultry, pigs, and high-yielding dairy breeds like Holsteins, genetic degradation is particularly severe. Sheep and goats nevertheless exhibit more variety.

The fact that native breeds are often extremely well suited to local circumstances is one benefit of doing so. When the going gets tough, they are often more suitable than current breeds. This may also apply to areas where a specific breed is not indigenous, as in the case of Brahman cattle in Australia. Local breeds may have some undiscovered qualities or features that are significant. They often possess traits that are crucial for sustainable agricultural systems, such as lifespan or disease resistance. Additionally, the cultural heritage of the nation of origin includes unusual breeds. Contrary to popular belief, both conventional and organic agriculture often use the same breeds.

For instance, barely 10% of unusual breeds are employed in German organic dairy farms. In the last ten years, this rate has not altered. Due to their superior performances, the majority of German or Dutch farmers and organic advisors choose contemporary breeds. Better health or lifespan may somewhat offset lower performances. Higher product pricing or subsidies are additional forms of compensation. Governments in numerous European nations provide subsidies for the preservation of endangered breeds. These subsidies, however, are often insufficient to fully make up for diminished output. Therefore, it can be advantageous to exploit the preservation of an ancient breed as a marketing strategy to persuade customers to pay a higher price. The German Swabian-Hall saddleback pig is a good illustration. A marketing firm effectively markets the beef as a luxury commodity, emphasising its exceptional quality and regional provenance. The sows are often mated with Pietrain boars as a compromise to get more muscle. The corporation employs the unique marketing label known as "controlled origin" that was given to it by the EU.

This strategy was quite effective. The population significantly grew within 15 years and is no longer thought to be in grave danger of becoming extinct. For example, see for a list of the various initiatives the FAO has undertaken in the area of cattle genetic diversity conservation. The FAO established the Commission on Genetic Resources for Food and Agriculture (CGRFA), the principal international platform for formulating genetic resource policy. In 1992, the CGRFA launched a worldwide plan for the management of farm animal genetic resources. The technique aims to stop the genetic deterioration of animal resources while still ensuring their usage. The plan offers a structure for helping nations, regions, or other stakeholders implement management plans. FAO created the Domestic Animal Diversity Information System as a communication and informational tool to help carry out the worldwide policy (DAD-IS).

A worldwide databank for farm animal genetic resources was also developed by FAO. Information is gathered for this databank from 189 different nations. There are now 6379 breeds from 140 nations, representing 30 mammalian and avian species in 1995 there were only 3882 breeds. These

The global watch list for domestic animal variety was published using data from 159 organic livestock husbandry and breeding. In 2006, the FAO intends to release a study on the status of the world's animal genetic resources. About 9000 entries for breeds, kinds, and variations of cattle, as well as extinct ones, are included in Porter's (2002) inventory of endangered livestock breeds. More than 180 endangered British and North American breeds were identified by Dohner in 2002. Hall (2005) presented thorough details on cattle biodiversity and made preservation suggestions.

Numerous organisations around the world work to preserve endangered livestock breeds, such as Rare Breeds International (www.rbi.it), Rare Breeds Survival Trust in the UK (www.rare-breeds.com), Stichting Zeldzame Huisdierrassen in the Netherlands Pro Specie Rara in Switzerland Gesellschaft zur Erhaltung alter und gefährdeter Haustierrassen in Germany These organisations often give connections to breed groups as well as information on the status and history of ancient breeds.

Breeding Purposes

The subject of significant debate is the breeding goals traits suitable for organic farming. Some organic dairy producers lack knowledge of contemporary breeding methods and place a lot of faith in the methods used by commercial breeding businesses due to the wide range of situations, breeding goals will not be the same for every situation. For the sake of organic breeding, existing goals may sometimes get a different weighting within the selection index. Other times, new goals will be included. Longevity, vigour, and fertility are the main breeding goals for all farm animal species in organic agriculture.

Breeding for disease resistance has received a lot of scientific interest recently, particularly in cattle and sheep. One excellent example of a health recording system is the Scandinavian dairy cow health tracking system. Within that program, veterinarians compile information about veterinary procedures. In other nations, measurements like somatic cell counts which serve as a mastitis indicator are routinely supplied during milk recording. This method's possible drawback is the need for comprehensive performance recording techniques.

CHAPTER 7

ANIMAL HEALTH AND NUTRITION IN ORGANIC FARMING

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Successful organic farming demands a deep understanding of how natural processes work and what management options are available. For organic farming to be effective, there must be a desire to understand how to support natural processes and preserve and enhance harvests. Those who are getting in touch with local farmers who already practice organic farming if you're interested in adopting their methods and learning from them. Some farmers may excel at composting, cultivating green manures, and brewing tea from plants or manures learning from seasoned farmers enables one to gain first-hand knowledge in local settings and discover the benefits and potential difficulties of using sustainable agricultural practices.

Farmers could start learning from their personal experiences on their farms after gathering information about the needs, opportunities, and key conversion strategies. Farmers are working to reduce the chances of crop failure, animal losses, and frustrating overload. It is advised to introduce organic farming methods gradually, choosing particular ones at a time, and trying them on particular animals or plots individually. But which methods ought one to pick farmers should naturally begin by using techniques that are low risk, low investment, demand minimal specialized knowledge, involve little more work, and have a strong short-term impact. Among the recommended interventions is mulching is the practice of covering soil using dead plant matter.

Mulching is a simple method of weed management and soil protection for annual crops it tasks the soil with dead plant debris. Most current cropping methods may incorporate this strategy where finding suitable plant material, however, may be the primary concern. Intercropping is a frequent strategy in organic farming to vary production and get the most out of the land. It involves growing two crop production together, typically a green manure crop like beans or an organic manure crop in alternate rows of maize or the other cereal crop or vegetable. To avoid crop competition for light, nutrients, and water during intercropping, extra care must be taken. Understanding arrangements that support the development of at least one crop is necessary for this application of Composting.

Composting - The development and yields of crops can be significantly impacted by the compost that is applied to the fields. Farmers would need enough crop resources and animal manure, if any are available, to start compost manufacture. If such resources are in short supply, farmers would first need to start the growing plant. Resources just on the farm by planting quickly growing legumes that produce a lot of energy and, if necessary, introducing livestock to produce manure. Farmers should receive training from an expert individual to become familiar with the composting process. Although it costs nothing to produce compost properly, it does need some knowledge, expertise, and additional effort. Most farmers may be unfamiliar with the idea of planting a type of leguminous plant for biomass production and soil integration, or "green manuring." Despite this, this approach can significantly boost soil fertility. Improved fallows, seasonal green manures in crop rotation, or strips between crops are all possible ways to cultivate green manures first and do proper green manuring.

Organic pest management is the careful pairing and control of plants and animals to stop the spread of pests and diseases. At first, bio-control chemicals may be used, but ecological strategies that create a pest/predator balance are the best ways to accomplish organic pest management balance. While selecting resistant crop varieties is essential, there are other ways to prevent pest outbreaks, such as choosing sowing times that do not coincide with pest outbreaks, enhancing soil health to ward off soil pathogens, rotating crops, trying to encourage natural biological agents to control disease, insects, and weeds, using physical barriers to deter insects, birds, and other animals, modifying habitat to attract pollinators and natural enemies, and trapping pests in pollen attractants. The right seeds and gardening supplies difference can be made by using strong and/or improved cultivars, healthy seeds, and planting supplies.

The use of healthy plants and planting materials, as well as the use of robust and/or upgraded cultivars, can significantly alter crop productivity. Information about the choice of seeds and other planting supplies, including the availability of enhanced seed treatments and varietals. Because of their resistance to local circumstances, locally adapted seeds are typically preferred. Leguminous tree planting - Leguminous trees like inflorescences, induced by an external, and protein can be found can be planted in perennial planting crops for crops like bananas, coffee, or cocoa to improve the growth conditions for the fruit crop by offering shade, mulching material, or nitrogen through nitrogen fixation. Additionally, some leguminous trees make suitable cattle feed. Understanding the needs of tree crops for shade and space is necessary for this technique.

Own farm production of animal feed Farmers may plant grasses and green manure fodder crops nearby, between other crops, or in rotation to increase the quality of the feeds available to cattle. Farm-grown feed is the greatest option when evaluating feed sources since animal feed must come from organic origin. Gardens and soil bunds are important soil conservation techniques that should be built along the arcs of hills. This procedure lays the groundwork for future increases in soil fertility on slopes. Although it is highly relevant, its implementation calls for a lot of work and specialist training.

The organic farm is viewed as 'one organism,' therefore growing certain crops is not the only thing that is being done. Instead, the emphasis is on selecting crops that can be quickly incorporated into the current farming system and will help to enhance it. But the farmer's knowledge also plays a role in the decision based on the crops' proper maintenance, their contributions to a varied family diet, or the market's need for them. Farmers may need to produce leguminous cover crops in addition to food crops so that they can nourish the soil and give animals high-protein feed. In most cases, it is advisable to plant trees for shade, windbreak, firewood, feed, mulch, or other purposes for crop-related criteria.

Selection criteria for crops during transition first and second, organic farmers need to provide enough food for their families. To earn money for other household needs, individuals can also desire to raise crops for the market. Farmers ought to, raise crops that enhance soil fertility legumes and pasture grass are necessities for farmers who raise cattle. In general, farmers should choose crops that have a low chance of failing. Maize, sorghum, millet, beans, and peas are just a few examples of cereals and legumes that are particularly well suited for conversion since they are inexpensive to grow, often have modest nutritional requirements, and are resistant to pests and diseases. Many conventional crops can also be kept and sold in local marketplaces.

Organic farming is a method of agriculture that prioritizes the use of natural resources, such as soil, water, and air, and avoids the use of synthetic fertilizers, pesticides, and growth hormones. The focus on using natural resources for animal health and nutrition has grown in recent years, as more people become aware of the negative impacts of conventional farming methods on the environment, animal welfare, and human health.

Animal health in organic farming is maintained through the use of proper feeding practices, pasture management, and preventative healthcare measures, such as vaccinations and natural parasite control. Organic farmers aim to provide a balanced diet to their animals that is based on their natural feed needs. This is achieved through the use of locally sourced feed, such as grass, hay, and legumes, and the inclusion of supplementary feed, such as grains, when necessary.

The use of pasture management is crucial for animal health in organic farming. Animals are encouraged to forage for food, which allows them to exercise and engage in natural behaviors, such as grazing and rooting.

This helps to maintain their physical and mental health and reduces the risk of disease. In addition, the use of rotational grazing systems helps to improve soil health, which in turn benefits the health of the animals that feed on it.

Preventative healthcare measures are also essential in maintaining animal health in organic farming. Vaccinations are used to prevent the spread of disease, while natural parasite control measures, such as herbal remedies and essential oils, are used to manage parasites. Animal nutrition in organic farming is based on the principles of providing a balanced and natural diet. This involves the use of locally sourced feed and the avoidance of synthetic additives and growth hormones. Organic farmers aim to provide their animals with a diet that is rich in nutrients, including essential vitamins and minerals, which are necessary for optimal health and growth.

In addition to providing a balanced diet, organic farmers also focus on maintaining the quality of the soil, which provides the foundation for plant growth and is the source of the nutrients that are available to the animals. Soil health is maintained through the use of cover crops, composting, and reduced tillage practices, which help to improve soil fertility and structure, which in turn benefits the health and nutrition of the animals. Organic farming also emphasizes the importance of animal welfare, as well as the health and nutrition of the animals. Organic farmers aim to provide their animals with a comfortable living environment, which includes access to clean water, fresh air, and sufficient space to move around freely. Animals are also allowed to engage in natural behaviors, such as socializing and grazing, which helps to improve their physical and mental health.

In conclusion, organic farming provides a sustainable and environmentally friendly approach to animal health and nutrition. By using natural resources, such as soil, water, and air, and avoiding synthetic fertilizers, pesticides, and growth hormones, organic farmers aim to provide their animals with a balanced and natural diet, while also maintaining the quality of the soil and promoting animal welfare. The focus on animal health and nutrition in organic farming provides a positive impact on the environment, animal welfare, and human health, and is a key aspect of sustainable agriculture.

Organic farming emphasizes the use of natural methods to enhance the health and well-being of animals, as well as to promote sustainable agriculture. It prioritizes the use of natural feed, proper animal husbandry practices, and minimal use of synthetic substances, to maintain animal health and minimize the risk of diseases. The following is an overview of animal health and nutrition in organic farming.

1. **Natural Feed:** In organic farming, animals are typically fed with a diet that consists of organic feed and pasture. The feed is grown without the use of synthetic pesticides, fertilizers, or genetically modified organisms (GMOs). This helps reduce the risk of chemical residue in the animal products, and ensures that the feed is free from harmful substances.

2. **Pasture-based Systems:** Organic farming often involves the use of pasture-based systems, where animals are allowed to graze on grass and other vegetation. This provides animals with a natural source of nutrition and reduces the need for feed supplementation. It also promotes animal well-being, as it allows them to express their natural behaviors and reduces stress levels.

3. **Proper Animal Husbandry Practices:** Organic farming emphasizes the use of proper animal husbandry practices to promote animal health. This includes providing adequate space and shelter, proper ventilation, and access to clean water. Additionally, organic farmers often use natural remedies, such as herbal remedies and homeopathic treatments, to treat illnesses and injuries in animals.

4. **Minimal Use of Synthetic Substances:** In organic farming, the use of synthetic substances is minimized to reduce the risk of chemical residue in animal products. For example, antibiotics are only used in cases of severe illness and are typically avoided in cases of minor illnesses. The use of synthetic hormones is also prohibited in organic farming.

5. **Nutrient-rich Feed**: In organic farming, animals are often fed with a diet that is rich in nutrients, including vitamins, minerals, and antioxidants. This helps to promote overall animal health, as well as to produce high-quality animal products that are free from harmful substances.

6. **Preventive Measures:** Organic farmers often employ preventive measures to reduce the risk of disease and promote animal health. For example, they may implement measures to reduce stress levels, such as providing access to shade, reducing herd density, and promoting social interaction. They may also implement measures to reduce the risk of parasite infestations, such as rotating pasture land and using natural remedies, such as herbal treatments.

In conclusion, organic farming prioritizes the use of natural methods to promote animal health and well-being, while minimizing the risk of diseases. It emphasizes the use of natural feed, proper animal husbandry practices, and minimal use of synthetic substances, to produce high-quality animal products that are free from harmful substances.

By using these methods, organic farmers are able to promote sustainable agriculture and ensure the health and well-being of their animals.

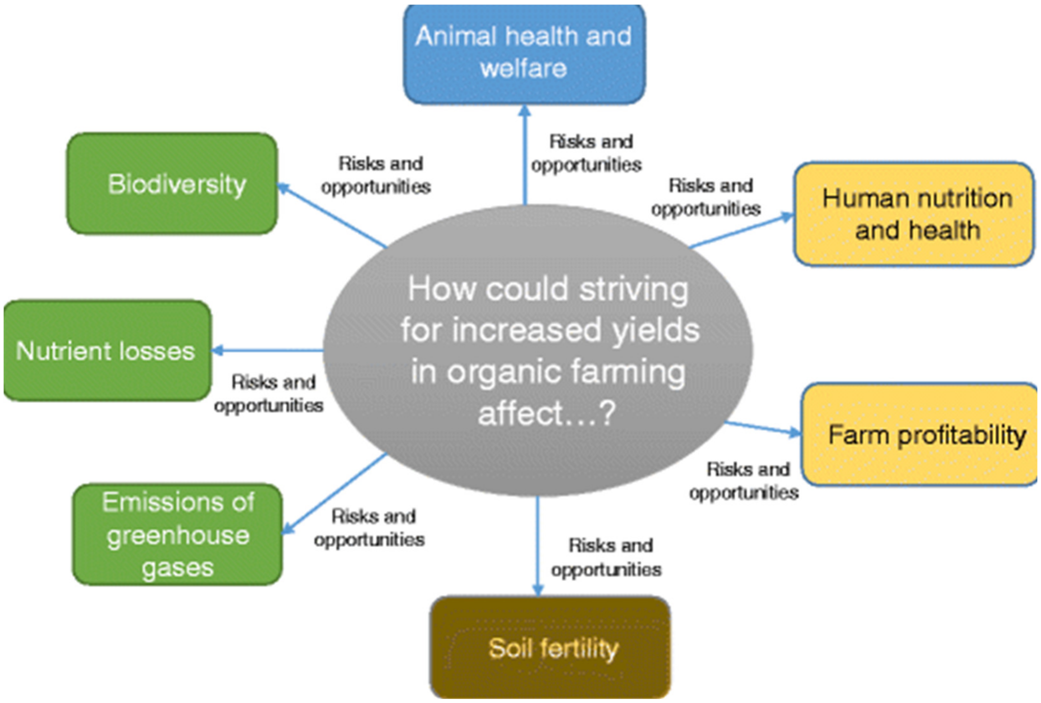

Figure 7.1 shows the Risks and opportunities of increasing yields in organic farming.

Animals play a significant role in organic farming systems, both conceptually and practically, where emphasis is placed on creating an integrated system that balances the needs of humans, animals, and the environment while using local feed and waste recycling. An essential objective of organic husbandry is the health and wellbeing of the animals. Animals, as opposed to crops, are sentient beings as well as components of the agricultural system, and as such, they need unique moral care. They are persons who need care, who are capable of suffering, who can interact with one another as well as with the people and environment around them. Therefore, managing animals is significantly different from managing crops.

Since this is wrong, humans have a moral duty to treat animals humanely and to step in before they suffer or pass away. In terms of preventing pain, organic agricultural practises go considerably further than just increasing animal welfare. Access to "natural" behaviour for animals under organic management is one of the fundamental tenets of organic farming, which significantly broadens the definition of "welfare." These viewpoints are given and explored in Chapter 8, where Lund highlights the significance of incorporating naturalness into the theoretical underpinnings and actual implementation of animal welfare in organic animal husbandry.

Synthetic medications may be used to treat ill animals in accordance with the purpose of preventing suffering for animals. Use of "chemicals" is only permitted and even encouraged in this specific situation in organic farming in Europe. Antimicrobial treatments are totally forbidden in the United States of America (USA). Therefore, some farmers shift their illness management strategies and resort to ostensibly supplementary or alternative therapies, sometimes in conjunction with analgesics (often known as "painkillers"). No matter how diseases are controlled, breeding for increased disease resistance, introducing more species-appropriate housing, and promoting a well-balanced diet are some of the more fundamental changes that should be made to husbandry practises in order to avoid suffering and the need for disease treatment. We shall talk about feeding and illness control after Hörning covers the topics of breeding and housing.

In this book, the importance of organic farming in a worldwide context is emphasised, thus we discuss non-certified organic farming from the viewpoints of how it is practised in many parts of the globe 168 A worldwide view of organic farming.

For certified organic animal products, there are often very few local markets (such as in the majority of African nations), and export restrictions due to disease status apply to all livestock goods. Fruits and grains make up the majority of certified organic goods, which are exported to wealthy customers in places like north-western Europe. Most farmers find the certification processes to be too expensive, particularly when no one wants to pay more for organic goods, there is no support for organic growers, or premium pricing are hard to come by. In their 2005 article on non-certificated organic farming, categorised the "hidden world of ecological farming" into four categories:

One explicitly organic approach (for example, joining a certification organisation); two similar approaches (for example, the permaculture movement in Zimbabwe); three low external input sustainable agriculture (weighting local resources and processes); and four traditional farming (food grown without chemicals, or "organic by default"). In this chapter, we'll bear in mind the fundamental principles of organic animal husbandry and also discuss the possibilities for producing organic livestock using instances from uncertified regions. The term "organic farming" in this context refers to farming that emphasises a harmonious relationship between the use of the land and the care of animals, as well as creating "certified animal products."

Regarding distinct farming methods and environmental requirements, there is a lot of variation across nations and regions; farm settings vary from mountainous to grassland regions, and farming methods range from traditional to intensive systems. This chapter aims to present and debate many elements of nutrition and animal health in organic farming systems. A succinct summary of the most recent research on animal welfare, sickness, and health in organic agriculture is provided. We will concentrate on the links between animal health and welfare and nutrition in particular. The majority of our focus will be on dairy cows and grassland feeding, but we will also provide additional instances.

It is challenging to have a worldwide perspective on the evolution and makeup of organic livestock production. There are no comprehensive government data on organic animal production, not even in Europe, where organic farming is widespread. 3.5% of the land in Europe was devoted to organic farming in 2003, with 155,100 farms spanning 5.8 million hectares across 25 member states of the European Union (EU). The area and quantity of farmers who convert varies per nation. For instance, the amount of land utilised for organics rose in 2003 in Germany, France, Portugal, Greece, Austria, and Spain, but fell in Denmark, the UK, and the Netherlands.

Globally, there are a wide range of organic livestock products on the market. The biggest markets in the EU are found in Germany, France, the United Kingdom, and Italy, as well as in Denmark, Austria, and Switzerland. There is a lot of diversity across product categories. The organic percentage of the overall market for beef was 1.6% in 2003, 1.2% for milk and milk products, 1.3% for eggs, but 0.6% or less for pig and poultry meat (Hamm and Gronefeld 2004). The average market share in the EU for crops was between 1% and 1.8% in 2001. For the organic markets for milk, beef, sheep and goat meat, it is challenging to balance supply and demand. In 2001, the distribution of organic items offered alongside conventional ones varied greatly per nation. However, in the EU, 32% of the average population is Animal nutrition and health in organic agriculture According to Hamm and Gronefeld (2004), 169 milk, 31% of the beef, and 46% of the sheep and goat meat had to be sold to conventional markets at prices that were often lower than those paid for organic commodities.

Organic farming specifically aims to promote the health and wellbeing of animals. The word "health" is often used to mean "no illnesses," but it also refers to a variety of other things. Here, we concentrate on the health issues that organic animal farming encounters. We shall tackle this problem by providing a brief summary of study results concerning illness levels, mostly in Europe. When evaluating the findings of organic research, it's important to keep in mind how organic livestock production has evolved and altered over the last several years (e.g., standards, attitudes, and infrastructure). We concentrate on how humans contribute to the production of organic cattle towards the chapter's conclusion and provide recommendations on how to more systematically include health care principles.

Changes in living circumstances, feeding practises, outdoor production, treatment standards, or shifts in farmers' attitudes and views are the main causes of changes in disease patterns linked to the conversion to organic farming. All of these adjustments may affect disease patterns in both good and negative ways, and as the conversion period may be marked by adjustments and novel herd management techniques, the conversion itself may have a detrimental impact on the herd's disease status. Based on a review of peer-reviewed journal articles on various aspects of animal welfare and health in organic farming, cautiously came to the conclusion that, aside from parasite-related diseases, health and welfare in organic herds are generally the same or better than in conventional herds. The conclusion that organic farming techniques have strong possibilities for effective parasite management with regard to parasitic illnesses.

Mastitis, lameness, and metabolic illness in adult cattle, as well as internal parasite infections in young animals, are significant disease concerns that are identical for conventional and organic dairy herds. The severity of these issues seems to differ more across farms than between conventional and organic farming. In organic dairy cows, mastitis has been identified as the primary animal health issue. In contrast to conventional farms, which had essentially no dry period mastitis, showed that 50% of examined organic herds in England and Wales had quite high levels of the condition. The frequent use of antibiotics in dry cow treatment in conventional herds in the UK may be responsible for the discrepancies in these results. Data comparing claw lesions with lameness are inconclusive. According to, traditional farms had a higher incidence of lameness. While found no significant differences between the systems, a more recent Danish study revealed a greater prevalence of documented claw and leg diseases on freshly converted organic farms. Furthermore, rumen acidosis owing to greater grain proportions in the feed diet and more grazing have likely produced a much higher frequency of liver abscesses in Danish organic dairy cows compared to conventional dairy cows.

Lungworm illness may be a concern in dairy cows, especially in recently converted herds when the animals have not previously been on pasture. Gastrointestinal parasites and coccidia can also pose issues, especially in early calves. Most of these illnesses are manageable with the right treatment practises, 170 Though 45% of Danish organic dairy farms were forced to revert to anthelmintic treatments during the 2002 grazing season, organic agriculture: a global viewpoint (Weinreich *et al.* 2005).

On Swedish smallholder farms, nutrition, endoparasites, haemonchosis, diarrhoea, high lamb mortality (3–36%), and lean ewes seem to be the most significant health issues in organic sheep production. These issues were identified as the most prevalent health issues in 37 flocks of organic sheep, albeit they are not notably different from those in flocks of conventional sheep (Lindqvist 2001). The most common health issues among organic producers in the UK were lameness, mastitis, fly strike, fasciolosis, and various helminths. Chemotherapy and chemoprophylaxis are restricted or prohibited, which necessitates the use of management techniques like closed flocks and reduced stocking numbers. Internal parasites, especially digestive nematodes, pose a significant danger to the organic sheep and goat industries. According to, the majority of organic sheep farmers must depend on grazing management techniques including frequent shifts to clean pastures and supplemental feeding. In certain nations, regular (even preemptive) use of anthelmintics is still a component of the control approach. To combat Haemonchus contortus, for instance, in Sweden estimated that 20% of organic farmers spray ewes around lambing. For organic farmers, vaccination is still a possibility. On many conventional sheep farms in the UK, sheep are routinely vaccinated against clostridium, and 44% of questioned organic farmers reported doing the same (Roderick *et al.* 1996), with 10% of flocks additionally receiving pasteurellosis vaccinations.

Production of organic pigs varies greatly throughout Europe. According to Hermansen *et al.* (2004), switching ruminant production methods to organic systems is far easier for farmers to do than it is for pigs and poultry. Depending on the system, farrowing, suckling, and even fattening occur outside, whereas in other systems, housing with modest outside exercise spaces are given in colder temperature nations like Germany, Denmark, and the Netherlands. These techniques allow for more area per pig than traditional farming. Although there is a paucity of information on pig illness patterns, health and welfare issues seem to be different between organic and conventional agriculture.

In a UK survey conducted in the late 1990s, respiratory illnesses and diarrhoea were seen as minor issues whereas external parasites and infertility were recognised as the main concerns (Hovi and Roderick 1999). A case study (four herds) showed that among outdoor sows, traumatic lameness, injuries, and sunburn were the most common clinical findings. Small Nordic case studies have shown a low incidence of diarrhoea and respiratory disorders but an increased incidence of joint diseases compared with indoor herds. Endoparasites and ectoparasites have been reported to be quite common in various studies, perhaps as a result of outdoor access, a high intake of insoluble fibre (roughage), poor cleanliness, and the usage of permanent pastures. Following a recent Ascaris infection, several organic herds have had severe issues with milk stains in the liver, leading to rejections at slaughter. The organic cattle used relatively little antibiotics. Numerous Danish studies have shown that piglet mortality is high in organic systems, while it is similar to that in traditional outdoor systems.

Intensive organic egg layer flocks generally tend to have the same illness issues as conventional flocks, but sometimes to a greater degree. The discovered that organic flocks had a greater laying period mortality rate than any other flocks that produced eggs. Without a doubt, free-range farming is linked to certain particular illness issues. Free-range flocks are more susceptible to coccidiosis, helminth parasites, histomoniasis, and ectoparasites, as well as illnesses brought by wild birds such pasteurellosis, salmonellosis, and avian influenza.

Free-ranging birds run the danger of contracting TB, which is a problem in organic farming. In July 2005, concern was raised over the free-range status of organic poultry flocks in Europe after avian flu outbreaks in Asia, Russia, and Kazakhstan as a recent example of disease epidemics involving migratory birds. When compared to caged and restricted chickens, organic and other free-range systems have both good and negative welfare effects. According to unpublished data from the Danish Poultry Council from 1997, Kristensen (1998) showed that the mortality of organic laying hens in Denmark is 15% to 20% (4-5% in conventional battery cages; 9–10% in free-range production), despite subsequent (unpublished) studies showing noticeably lower mortality on organic farms. Coccidiosis, external parasites, feather plucking, and cannibalism were all mentioned as important potential issues in organic and other free-range systems, where beak cutting is not permitted and is not seen to be an acceptable solution to the issue. Recent European research have corroborated these issues. A certain amount of feather plucking may be a normal preening procedure, but in less ideal circumstances, it causes serious health and welfare issues. Regarding these issues, breed and strain of chicken also matter.

Roughage feeding and providing the chickens with suitable outdoor living spaces (shelter, shade, opportunities for dust baths, and places with plants) will greatly lessen issues with excessive feather plucking and cannibalism. Overcrowding, poor living conditions, and nutritional inadequacies (such as a lack of key amino acids) may exacerbate the issue. Bestman (2000) demonstrated the need of farmers comprehending the needs of the birds in order to properly adapt the system to the natural behaviour of the poultry. Poultry must be raised organically in order to be produced, and they should also be raised organically as adults. As cage-adapted birds may not adjust to the floor under organic circumstances and may develop feather picking, this implies that hens are raised on the floor. Coccidiosis and breast blisters appear to be the main disease issues in broiler (table hen) production.

The Difficulties of Organic Farming In Terms Of Animal Nutrition and Feeding

For the health and wellbeing of animal herds, a healthy, well-balanced feed diet is essential. There are many obstacles to building a well-balanced animal production system when adhering to the principles for organic livestock production about naturalness, supporting the species-specific characteristics of animals, and at the same time emphasising local production, minimal transport, and outdoor life. According to Hörning's discussion in Chapter 6, certified organic herds primarily depend on the breeds and breeding objectives of conventional herds, which could lead to a conflict because:

1. The conventional breeding objectives frequently aim for high production levels, which could conflict with natural behaviour or other breeding objectives or characteristics (e.g. strong legs).
2. Attempting to sustain a production level that is physiologically viable while still enabling natural behaviour, development, reproduction, and longevity in the herd by feeding animals in line with their natural needs (e.g., encouraging rumination through eating in ruminants).

However, feeding animals with high genetic potential for production in accordance with organic farming norms may not fulfil the animals' nutritional needs, which may damage their wellbeing. In conclusion, the difficulty of organic animal feeding is to find a quantity and quality of organic feedstuffs that support the physiology and production of the animals. Simultaneously, the methods of feeding (such as accessibility that causes the animals the least amount of stress) are modified to the shifting conditions of the animals such as from the dry period to lactation, and allowing them the greatest amount of freedom of choice is also essential for their well-being and performance.

A worldwide view of organic farming

The animals' fundamental dietary needs must be addressed, with respect to the amounts of minerals \sand vitamins, to maintain their health and wellbeing. Supplementing with vitamins, trace elements, and minerals is not a common practise in several nations, whether or not they are certified organic. Feeding with bioactive forages is another component of the connection between animal health and nutrition related worm control, as described, for instance, and based on an EU-funded project WORMCOPS.

Feeding using locally produced feed

A fundamental tenet of organic farming is that the animal herd is an integral element of the overall agricultural system. As a result, organic herds should rely largely on homegrown feed and minimise the use of imported feed. On many organic farms, a high level of productivity, comparable to that of conventional herds, is maintained by utilising the genetic potential for production. This places extremely high demands on both the quality of the feed and the quantity of food consumed. The goal of feeding organic livestock exclusively home-grown feeds must be achieved in a way that satisfies their nutritional needs while maintaining ecological and financial sustainability. The best strategy to achieve this goal will depend on the local and regional environment and how well the balance between the animal herd and the land can be maintained. Grassland feeding will predominate in organic dairy farming (such as in Switzerland), and wintertime hay feeding may satisfy more than 90% of the nutritional needs of dairy cows (Früh 2004). Based only on grassland feeding, an example using beef cattle from Australia is provided.

Using roughage

Roughage feeding, which may have a significant influence on health and disease patterns, is given a lot of attention in organic farming. According to the Danish Cattle Advisory Board from 1998, a high percentage of roughage in cattle would often be beneficial to the rumen environment and lead to fewer metabolic diseases. Ruminal acidosis may provide issues that need additional research, according to recent discoveries. The use of roughage, such as pH-lowering silage, in organic pig production may minimise the frequency of nematodes while reducing the occurrence of gastrointestinal bacterial diseases such salmonella, dysentery, and lawsonia. Roughage has a lower energy density than most concentrates, so using it frequently can be problematic because it could lower the energy density of the ration to a level that is insufficient for high levels of production, resulting in the potential conflict between breeding for high production and using roughage extensively. Unbalanced diets, particularly those with insufficient calories and an overabundance of crude protein, may increase the risk. Due to the lack of commercial organic concentrates and the need for home-grown pasture, this resulted in poorer reproductive efficiency in cattle in Norway in the mid-1990s.

Due to reduced energy levels in the diets, organic milk output in the majority of European nations ranged between 80% and 95% of that of conventional herds. In spite of the bigger negative energy balance between production and feed consumption in organic herds, a Danish research indicated that the level of subclinical ketosis in organic dairy herds was at the same level as conventional herds, although appearing at a later stage of lactation. This was explained by the availability of food twenty-four hours a day, regular activity, and the feeding of roughage to the young.

Changing from an "organic by default" to a "organic as a goal" diet presents challenges in tropical climates. Most organic livestock production now in existence occurs in highly intensive production systems in Europe and North America, but we need also take into account the possible development of organic production systems in other nations, such as in tropical nations. With the exception of the very significant use of pharmaceuticals to manage vectorborne illnesses (see Animal disease treatment in organic animal husbandry), many systems may nearly be considered "organic by default." Since grazing is a common system foundation, the potential benefits of switching from "organic by default" to "organic by principle" will be briefly examined below in connection to grazing. In regard to a future conversion to organic systems, it is also important to debate and investigate different systems. In Box 7.1, we provide an illustration of how a small-scale dairy system that is totally zero-grazed may possibly transition to a partially pasture-based production system by employing homegrown feed.

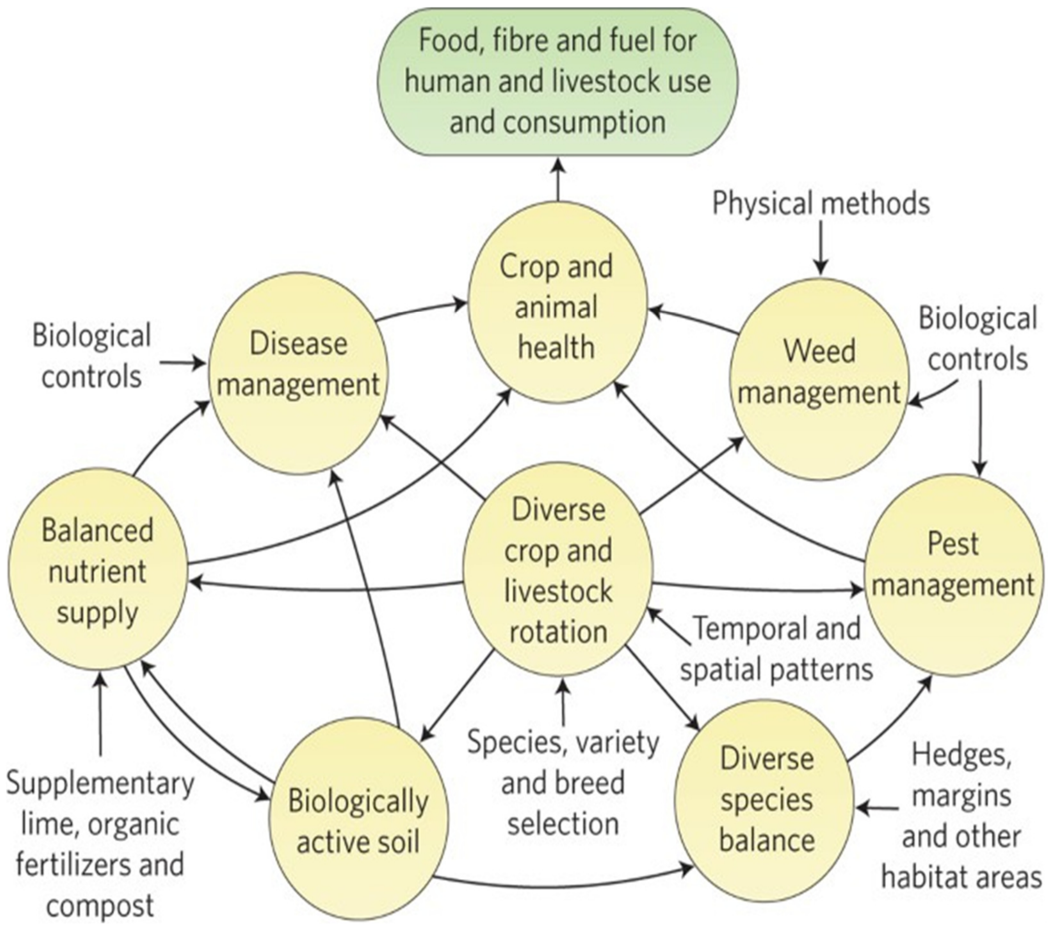

Figure 7.2 shows the Organic agriculture in the twenty-first century.

The difficulty in many current systems is to start producing better pasture and legumes for high output cows instead of relying on bringing feed concentrates onto the farm. In addition, it is important to talk about the compatibility of Holstein-Friesian cattle in tropical agricultural systems in terms of "naturalness," disease resistance, supporting the local ecology, and recirculation. The biological conundrum of monogastric animals: the sources of protein. The feeding of protein to monogastric organic animals is one specific area of concern. Current manufacture depends on adding more synthetic amino acids, much as traditional synthesis. Pigs and poultry both have significant needs for sulfur-containing amino acids.

CHAPTER 8

ANIMAL WELFARE AND ETHICS IN ORGANIC AGRICULTURE

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Organic agriculture is a farming system that aims to produce food in a way that is sustainable, environmentally friendly, and equitable. The principles of animal welfare and ethics are an important part of organic agriculture, and are integrated into the practices and regulations of the sector. Animal welfare in organic agriculture involves providing animals with proper living conditions, nutrition, and healthcare. This includes providing adequate space for movement, access to pasture or forage, and protection from harsh weather conditions. Organic farmers also prioritize the use of non-toxic products and avoid using antibiotics and growth hormones, which can harm the health of animals.

The ethical principles of organic agriculture include a respect for the autonomy and dignity of animals, and a commitment to minimize harm and suffering. This involves avoiding practices that cause unnecessary pain and stress, such as confining animals in small spaces, mutilating them, or subjecting them to intensive management practices. Organic farmers also recognize that animals are sentient beings, capable of experiencing emotions and sensations, and therefore must be treated with respect and care.

In addition to these basic principles, organic agriculture also recognizes the importance of preserving biodiversity and maintaining healthy ecosystems. This is accomplished by avoiding the use of synthetic fertilizers and pesticides, and by promoting crop rotations and other agroecological practices that maintain soil health and support local ecosystems. Organic farmers also work to protect the natural habitat of wildlife, and to maintain the integrity of ecosystems by avoiding the use of genetically modified organisms.

Organic agriculture also aims to promote social and economic justice, by supporting the livelihoods of small-scale farmers, and by providing consumers with safe, healthy, and affordable food. This involves establishing fair prices for farmers and promoting equitable distribution of resources and benefits.

The organic certification process is an important tool for ensuring that organic farmers adhere to these principles of animal welfare, ethics, and sustainability. This process involves regular inspections of farm operations, and requires farmers to meet strict standards for production and management practices. Organic certification also includes a traceability system, which helps to ensure that products are accurately labeled and that consumers can trust that they are purchasing food that has been produced in accordance with organic standards.

Despite these efforts, some challenges remain in ensuring the welfare and ethical treatment of animals in organic agriculture. These include the need for better regulations and enforcement, the need for more research on the impacts of organic practices on animal welfare, and the need for continued education and outreach to farmers and consumers.

Animal welfare and ethics are fundamental principles of organic agriculture, and are integrated into the practices and regulations of the sector. Organic agriculture seeks to produce food in a way that is sustainable, environmentally friendly, and equitable, and is committed to minimizing harm and suffering to animals, preserving biodiversity, and promoting social and economic justice. Despite some challenges, the organic certification process provides a valuable tool for ensuring that these principles are upheld, and for promoting the continued growth and development of the organic sector.

Organic farming emphasizes the use of natural methods to enhance the health and well-being of animals, as well as to promote sustainable agriculture. It prioritizes the use of natural feed, proper animal husbandry practices, and minimal use of synthetic substances, to maintain animal health and minimize the risk of diseases. The following is an overview of animal health and nutrition in organic farming.

1. **Natural Feed:** In organic farming, animals are typically fed with a diet that consists of organic feed and pasture. The feed is grown without the use of synthetic pesticides, fertilizers, or genetically modified organisms (GMOs). This helps reduce the risk of chemical residue in the animal products, and ensures that the feed is free from harmful substances.

2. **Pasture-based Systems:** Organic farming often involves the use of pasture-based systems, where animals are allowed to graze on grass and other vegetation. This provides animals with a natural source of nutrition and reduces the need for feed supplementation. It also promotes animal well-being, as it allows them to express their natural behaviors and reduces stress levels.

3. **Proper Animal Husbandry Practices:** Organic farming emphasizes the use of proper animal husbandry practices to promote animal health. This includes providing adequate space and shelter, proper ventilation, and access to clean water. Additionally, organic farmers often use natural remedies, such as herbal remedies and homeopathic treatments, to treat illnesses and injuries in animals.

4. **Minimal Use of Synthetic Substances:** In organic farming, the use of synthetic substances is minimized to reduce the risk of chemical residue in animal products. For example, antibiotics are only used in cases of severe illness and are typically avoided in cases of minor illnesses. The use of synthetic hormones is also prohibited in organic farming.

5. **Nutrient-rich Feed:** In organic farming, animals are often fed with a diet that is rich in nutrients, including vitamins, minerals, and antioxidants. This helps to promote overall animal health, as well as to produce high-quality animal products that are free from harmful substances.

6. **Preventive Measures:** Organic farmers often employ preventive measures to reduce the risk of disease and promote animal health. For example, they may implement measures to reduce stress levels, such as providing access to shade, reducing herd density, and promoting social interaction. They may also implement measures to reduce the risk of parasite infestations, such as rotating pasture land and using natural remedies, such as herbal treatments.

Organic farming not only benefits the environment but also the health and well-being of the animals. Organic farmers take a holistic approach to animal health, incorporating various practices and techniques to promote overall health and well-being, while minimizing the use of synthetic substances and avoiding harmful practices.

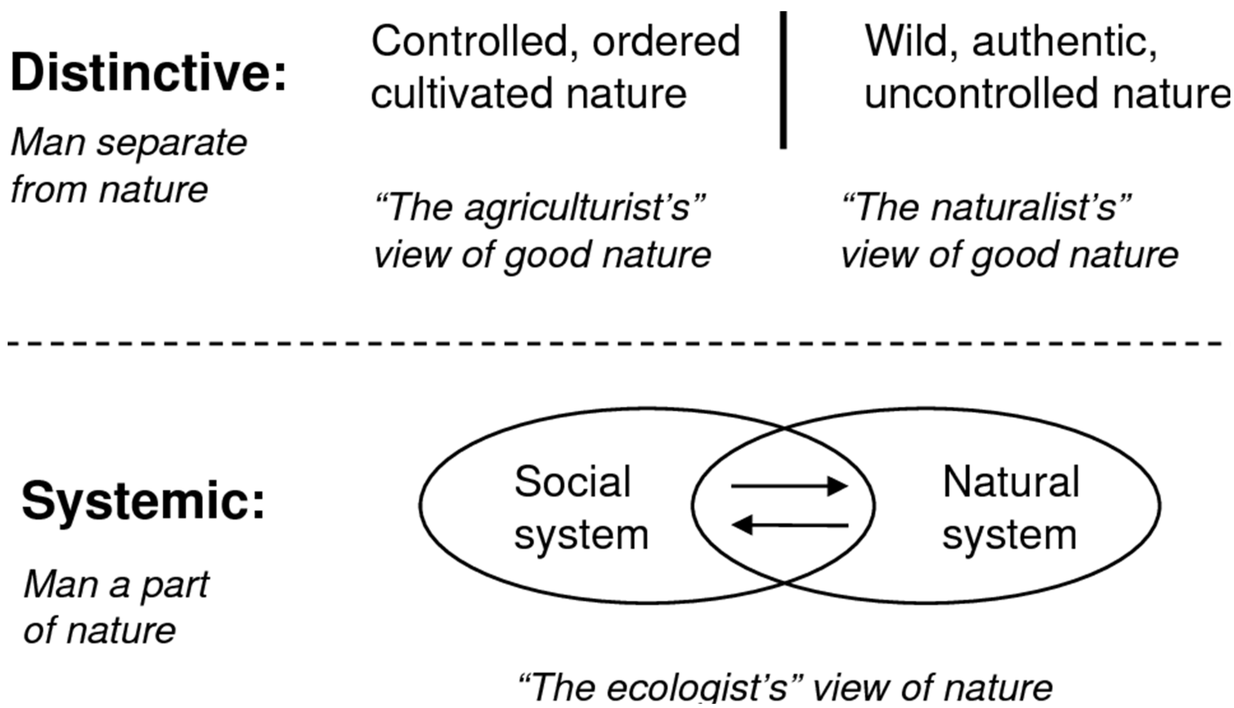

Figure 8.1 shows the ethics in organic agriculture.

Breeding Practices: Organic farmers use responsible breeding practices to maintain genetic diversity and improve the health of their animals. This involves selecting breeding stock based on traits such as hardiness, disease resistance, and fertility, rather than on size or production capabilities. Organic farmers also aim to avoid inbreeding and over-selection, which can lead to genetic problems and reduced immunity to diseases.

Pasture Management: Organic farmers manage their pastures to provide adequate nutrition and reduce the risk of disease. They aim to provide diverse and nutritious forage, which allows animals to select a balanced diet and reduces the risk of overeating any one food source. Additionally, organic farmers rotate pastures to reduce parasite buildup and to prevent overgrazing.

Stress Management: Organic farmers work to minimize stress in their animals, as stress can weaken the immune system and increase the risk of disease. They provide adequate space and shelter, promote social interaction among animals, and limit the use of physical restraints, such as tie-stalls and crates. Organic farmers also strive to minimize stress during transportation and handling, by providing proper ventilation and ensuring that animals are transported humanely.

Biosecurity Measures: Organic farmers implement biosecurity measures to prevent the spread of diseases and to reduce the risk of contamination. This may involve measures such as quarantining new animals, reducing herd density, and preventing contact between different herds. Organic farmers may also use natural remedies, such as herbal treatments, to control the spread of diseases and to prevent contamination.

Natural Remedies: Organic farmers often use natural remedies, such as herbal treatments and homeopathic remedies, to treat illnesses and injuries in their animals. These remedies are often gentler and less toxic than synthetic drugs, and they can be used safely in conjunction with other natural methods, such as proper animal husbandry practices and proper nutrition.

Proper Nutrition: Organic farmers aim to provide their animals with a balanced diet that is rich in nutrients, vitamins, and minerals. They strive to provide animals with access to diverse and nutritious feed sources, including pasture, hay, and silage, to help reduce the risk of deficiencies. Additionally, organic farmers aim to minimize the use of synthetic supplements, as these can contain harmful substances that may be harmful to animals and the environment.

Organic farming is a holistic approach to animal health and well-being that incorporates various practices and techniques to promote overall health, while minimizing the use of synthetic substances and avoiding harmful practices. By taking a proactive approach to animal health and using natural methods to prevent and treat diseases, organic farmers are able to produce high-quality animal products that are free from harmful substances and are produced in a sustainable and responsible manner.

Organic agriculture is a growing sector that is increasingly seen as an alternative to conventional farming methods. The principles of animal welfare and ethics are central to organic agriculture, and are integrated into its practices and regulations. In this way, organic agriculture seeks to promote a holistic approach to food production, taking into account the well-being of animals, the environment, and communities.

One of the key ways in which animal welfare is promoted in organic agriculture is through the provision of adequate living conditions for animals. This includes providing sufficient space for movement, access to pasture or forage, and protection from harsh weather conditions. Organic farmers also prioritize the use of natural, non-toxic products, and avoid the use of antibiotics and growth hormones, which can harm the health of animals.

In addition to these basic principles, organic agriculture also recognizes the importance of preserving biodiversity and maintaining healthy ecosystems. This is accomplished through the avoidance of synthetic fertilizers and pesticides, and the promotion of crop rotations and other agroecological practices that maintain soil health and support local ecosystems. By doing so, organic agriculture helps to protect the natural habitat of wildlife, and to maintain the integrity of ecosystems by avoiding the use of genetically modified organisms.

Another key principle of organic agriculture is fairness and equity. Organic agriculture supports the livelihoods of small-scale farmers, and promotes equitable distribution of resources and benefits. This is accomplished through the establishment of fair prices for farmers, and the promotion of environmentally and socially sustainable practices.

The organic certification process is an important tool for ensuring that organic farmers adhere to these principles of animal welfare, ethics, and sustainability. The process involves regular inspections of farm operations, and requires farmers to meet strict standards for production and management practices. This helps to ensure that organic products are of the highest quality, and that consumers can trust that they are purchasing food that has been produced in accordance with the principles of organic agriculture.

Despite these efforts, some challenges remain in ensuring the welfare and ethical treatment of animals in organic agriculture. One such challenge is the need for better regulation and enforcement of organic standards. This includes the need for stronger legislation, and more effective enforcement mechanisms to ensure that farmers are adhering to the principles of organic agriculture.

Another challenge is the need for more research on the impacts of organic practices on animal welfare. This includes a better understanding of the effects of organic practices on the health and behavior of animals, and the development of new methods and technologies to promote animal welfare in organic agriculture.

Finally, there is a need for continued education and outreach to farmers and consumers about the principles of organic agriculture, and the importance of animal welfare and ethics. This includes the development of educational materials and programs, as well as increased awareness-raising efforts aimed at promoting the benefits of organic agriculture and encouraging more people to choose organic products.

French-intensive system development is described as a kind of gardening that uses meticulously tended, deeply excavated beds that have been supplemented with manure and other organic inputs spacing to achieve maximum productivity and reduce weed pressure; based on a system of focused gardening that dates back to the 1500s and was made popular by Parisian market gardeners in the 1800s and early 1900s, which included centuries-old procedures (see Complement, Roots of the French-Intensive Method) made popular in the United States by English horticulturist Alan Chadwick at University Of California at Santa Cruz, Covelo, Green Gulch, as well as other gardens that he started.

View French Intense Gardening: A Resource History Key characteristics of the approach that enhances French Deep planting with hand tools (option a) Up to 24 inches can be used for cultivation; the technique gradually deepens the topsoil by distributing organic material and mineral additions throughout the soil layers. Deep cultivation enables crop root systems to develop more vertically, allowing for larger planting densities and better yields per unit of land surface area Integrating concentrated organic matter or mineral fertilizer into long-term growth beds: Organic and mineral matter additions applied at high rates quickly enhance the physical and chemical characteristics of the soil. For maintenance, application rates for compost can be as high as 2 pounds per square foot and as low as 1 ton per acre per year.

Utilizing completely formed particle compost enables a quicker transition from planting cover crops to growing cash crops in the spring and provides immediate nitrogen availability to crops Permanent farming zones and pathways: These restrict crop growth pathway activity and soil compaction speed up the development of soil fertility in the beds. Garden-scale tillage and planting implement French-intensive Soil Cultivation Implements. Basic cultivation gear U-bar, fork, and spade applications and outcomes Spade: In use in single and double excavation to extract and shift soil. Fork: Use in a double dig to fracture the surface and subsoil layer; to provide organic and mineral additions to the surface soil after deep digging to add additives.

Top-dress improved soils with amendments when heavy cultivation is no longer required U-bar: When deep cultivating is no longer required or desired, it is used for quick and coarse tillage to a depth of 16 inches. A bow rake is a secondary cultivation equipment. Applications and results Rake: Used to shape garden beds following initial cultivation and, if required, decrease the size of the soil particles on the surface in advance of sowing seeds and seedlings.

The typical tillage patterns employed in European soil cultivation under the "French Intensive/Double-Digging Sequence." First cultivation, is often known as "double digging" for unimproved soil. Apply compost to the bed's surface at a frequency of around one pound per square foot if the soil is very compacted or on underdeveloped clay soils, break up the top layer of the garden bed's soil with a garden fork until the tines are fully exposed. The dirt from the last trench will be removed, loaded onto a wheelbarrow, and moved to the end of the bed. Shift soil ahead while filling the trench using a spade and a digging board. Spread an additional pound of organic matter per square foot and use a garden fork to rip up the subsoil layers.

Use a garden fork to break up the subsoil layers and spread an extra pound of organic matter per square foot Carry on till the end of the bed. Subsequent cultivation after initial cultivation (deep or double digging) of unimproved soil, this stage is carried out. Use a garden fork to incorporate more organic and mineral matter soil supplements into the top 4-6 inches of surface soil. When required, use a garden fork to coarsen the soil particles on the surface (thing). After initial cultivation, shape garden beds using a bow rake to prepare for transplanting or straight sowing of crops. Primary cultivation, often known as "side forking," is a type of tilting once the soil has been enhanced by deep.

Raised beds may frequently be maintained in following crop cycles by single digging or "side forking" before planting once the soil has been enhanced via deep or double digging. Over time, compacted beds can need a second round of deep. With should be avoided but neither should double digging. Side forking is evenly distributed soil additions made of organic matter and minerals over the top of the garden bed. Articulate the bed's edge and walkways using a garden fork and spade using a garden fork and the "side forking" technique, and incorporate soil amendments into the top 4-6 inches of the surface soil. The French-intensive system's potential advantages are Rapid soil improvement.

Rapid increases in soil health: Enhances the physical, chemical, and biological characteristics of the soil. French-intensive cultivation techniques might significantly speed up topsoil formation Yields per surface land area used are produced by the soil's improved capacity to sustain farmed plant life at high-density spacing Tightly spaced farmed plants produce a live mulch microclimate that lowers rates of organic matter oxidation and surface evaporation. By shading rival plant species, dense plantings lessen weed competition. The requirement for energy-intensive heavy machinery is reduced or eliminated when hand tools alone are used. Potential drawbacks of the system that emphasizes French. Demands a significant amount of input from organic matter on average, which traditional intensive garden systems use up.

Lister bars and bed markers: After primary tillage, these tools are employed in secondary tillage to roughly form beds. Bidders/bed shapers, seeders, and rolling markers are tools used to prepare beds for planting and may be fixed to the back. Furrow chisels reversed disc Hillers, and knives and sweeps: Post-planting row crop equipment for close cultivation. Utilized for soil aeration, mild weed cultivation, and spreading cover crop seed, the spring-toothed harrow brings perennial weeds to the surface. Minimal tilling a.k.a. reduced, conservation, or strip tillage Specified: integrated secondary and primary tillage procedures that prepare a seedbed for a specific crop or area with fewer operations than traditional tillage. Used mostly in large-scale traditional processes in the West such as cereal crops and tomato processing.

Minimum tillage varieties conservation tillage, also known as mulch tillage, is the tillage or soil preparation technique that conserves soil by leaving plant leftovers or other mulch material on it or around the soil surface. Maintain soil moisture and stop soil erosion. Some organic producers use it effectively, however, because of pest and soil fertility problems, conventional tillage is typically used in rotation. Systems to use no and strip-till: into a seed bed that has been only marginally prepared to avoid tillage when planting during the growing season.

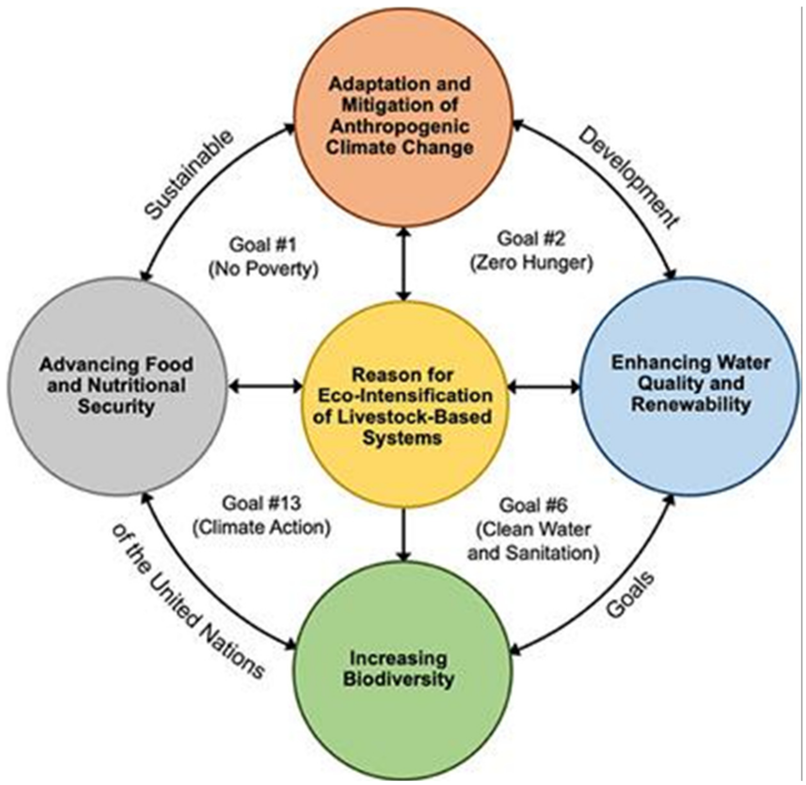

Figure 8.2 shows the Integrating Animal Husbandry with Crops and Trees

Animal welfare is a concern in Western civilization that relates to the quality of the animal's existence. Animals were recognised as sentient creatures in the European Union (EU) in 1997 under the Treaty of Amsterdam (EUR-Lex 2003), with

As instances of nations enacting new and stronger animal welfare laws, include England, Austria, and Norway. The major fast-food businesses and supermarkets in the United States of America (USA) have collaborated to create certain animal welfare standards for their suppliers (Brown 2004).

Animal welfare problems have a long history in organic farming. Animal welfare is commonly mentioned as an aim of the organic movement, however there has also been some harsh criticism of organic animal farming in this area. Representatives from conventional agriculture have often criticised the wellbeing of organic animals, despite the fact that some have stated that organic animal husbandry offers the finest potential welfare in modern farming.

Although it is not always represented in the sales statistics of organic goods, consumers have valued the organic method of rearing animals, and animal welfare is often cited as a benefit when selling organic animal products. What are the causes of these conflicting views on animal welfare in organic production systems, one must wonder? This chapter will evaluate the core principles of organic farming and determine if there is a concern with animal welfare.

Animal Ethics and Welfare

There is no consensus on what it really means for animals to have a high quality of life, despite the fact that this is generally agreed upon. The two dog owners who both assert that they provide their dogs the highest quality of life are an excellent illustration. The first constantly keeps the dog leashed to prevent it from being driven over by a vehicle, ingesting anything poisonous, or escaping. It also ensures that the dog is fed healthy food, additional vitamins, and has regular coat clipping. A healthy food and a well-groomed coat don't bother the other dog owner as much. The dog may run free, play in the mud, and sometimes discover and eat rotting meat leftovers on lengthy treks. The dog's owner wants it released because of 188 Organic farming a global viewpoint will enable it to act in a natural way and is willing to take some chances in order to offer the dog the delight of freedom. Which dog has a higher quality of life is the challenging question.

It won't be feasible to provide a conclusive response to the issue, even if we seek guidance from science. Of course, it's important to learn all you can about how certain illnesses influence an animal's quality of life. Animal welfare is not only a question of statistics, however. What is significant in life is another consideration. For many years, academics and philosophers tried to come up with a single definition of animal wellbeing, but now it is widely acknowledged that animal welfare is not only about facts but also about values. A single definition is thus unachievable due to the interaction between facts and values, or between science and ethics.

The application of ethics, or normative ethics, examines our fundamental principles of right and wrong in life. The interaction between people and animals and the standards that constitute a healthy and ethical relationship are the focus of animal ethics in particular. Fundamental issues like the proper level of care (do animals even have a right to welfare claims, or may they just be utilised for human amusement?) must be resolved. The second point to be addressed is when wellbeing is "good enough" in our world of finite resources if we determine that animals should be given welfare. Welfare standards are a part of ethics; what constitutes a high standard of living for animals? Therefore, when assessing animal welfare concerns in organic farming systems, it's important to know if certain organic "values" may be used to assist inform choices about the right level and kind of animal welfare.

Organic Standards

Organic farmers are a diverse group with a range of objectives and viewpoints. However, the organic movement has worked to advance organic farming, including organic production standards, based on certain common principles. In this chapter, the ideals of organic farming are examined in terms of the organic movement as a whole, not specific farmers. Organic farming has strong ties to the environmental movements of the 1970s and 1980s as well as to ecological and biological farming methods advocated in the early 20th century. The exception is biodynamic farming, which is based on Rudolf Steiner's philosophy and agricultural theories. Nevertheless, although having a separate conceptual foundation, actual biodynamic animal husbandry is quite similar to other aspects of the organic movement. We won't think about biodynamic farming any further in this case.

Ethical theories may be connected to fundamental principles of organic farming. According to the emphasis of moral concern, such ideas addressing the interaction between people and animals or between humans and environment are sometimes classified approximately into four groups moral concern implies that humans in their actions must consider the interests or rights of those beings or entities encompassed by it. According to, these groups include anthropocentric, sentientistic, biocentric, and ecocentric philosophies.

All sentient beings, according to two sentientistic theories; all living things, regardless of sentience, according to three biocentric theories; and all species, ecosystems, and other relevant features of nature, according to four ecocentric theories. According to one anthropocentric theory, only humans have direct moral status. Animal ethics and welfare in organic farming 189. Since it is theoretically possible to give something intrinsic value while excluding it from direct moral concern, these definitions as they are used here do not address the issue of intrinsic value; on the other hand, an animal may be the subject of moral concern while being independent of, or lacking, an intrinsic value.

A thing tends to be proper when it helps to maintain the integrity, stability, and beauty of the biotic community, according to renowned ecocentric thinker and biologist Aldo Leopold. When it veers off course, it is incorrect. This claim emphasises the systemic thinking and holistic perspective connected with ecocentric ethics. According to, organic farming is largely founded on ecocentric principles. The same kinds of problems that organic farming prioritises are also addressed by ecocentric ethics, including environmental concerns and the pursuit of a holistic perspective. This perspective has implications for how "quality of life" for farm animals is interpreted.

Is animal welfare a concern in light of organic principles?

The primary goal of ecocentric ethics, which aligns with the ideals upheld by the organic farming movement, is to preserve or develop healthy, sustainable ecosystems. Ecocentric ethics place a strong emphasis on nature as a whole. It is evident from the organic farming principles (IFOAM 2000) and IFOAM's published policy papers that the main objectives of the organic movement, in general, are ecological sustainability rather than animal welfare. Only one of the 17 fundamental principles included in the IFOAM Basic Standards expressly addresses animal welfare, while the other 13 all deal with sustainability.

The ecocentric approach fundamentally prioritises the health of the system above the welfare of the individual creatures living within it. For instance, the organic perspective holds that treating animals with chemicals, antibiotics, or other things that may adversely influence the environment should be avoided, regardless of the effects on particular animals. The usage of such materials is also seen as being unsustainable since the microorganisms Sentientistic

Anthropocentric, sentientistic, biocentric, and ecocentric are the four basic categories for ethical philosophies that address issues pertaining to connections between humans and animals and humans and environment. However, many philosophers before Leopold and Singer, including Albert Schweizer, Thomas Huxley, Peter Kropotkin, and Charles Darwin, have addressed the concept of an evolution of ethics.

Organic farming: a global viewpoint,

In order for items to be labelled as organic, American national organic standards exclude the use of any antibiotics (AMS-USDA 2000), although the EU permits a maximum of "three courses of treatments with chemically-synthesised allopathic veterinary medical products or antibiotics" within a year (Council Regulation 1999). Organic farming faces this contradiction between system health and individual wellbeing, which may be part of the reason why organic systems have come under fire for their treatment of animals.

Ecocentric ethics do not, it is clear, provide a clear point of departure for the creation of a framework for animal ethics in organic farming. There are other, less extreme forms of ecocentric ethics, on the other hand, where people are also given moral weight. This "ecocentric pluralism" gives equal significance to individual individuals and ecological entities like ecosystems and species. It can also be argued that ecocentric ethics is based on a fundamental respect for nature and acknowledges the interconnectedness of all living things and their relationship to their environment, which means that both humans and animals should be treated with kindness and respect because they are integral and significant parts of nature.

As a result, it is possible to regard animals to be moral beings who need respect and attention as significant members of the ecological community and are more than simply a means of production. For instance, some ecocentric philosophers, like the Norwegian Arne Naess, contend that because all living things are connected metaphysically, injury to one would equally hurt all. Others contend that domesticated farm and companion animals are an integral component of human civilization and as such, they need to be treated well, just like human children. According to, farm animals should be treated well since they are coworkers in the agroecosystem and should thus be recognised as such.

Animal welfare problems in organic production systems cannot be adequately anchored by well-established moral frameworks like animal rights and utilitarian animal ethics. The dominant paradigm among Anglo-Saxon animal ethicists to date, utilitarianism, takes into account the suffering, needs, and interests of particular animals, but its one-sided emphasis on utilitarianism, interests, or pleasure makes it less ideal for farming.

In Singer's utilitarian theory, killing is not entirely forbidden, but whether it is morally acceptable depends on how highly one values the interests of the parties involved. For instance, it is necessary to balance the interests of the animal that will be killed with those of the gourmet meat consumer. This might be acceptable if, for instance, the animal has a broken leg and must undergo a protracted recovery process that could affect its interest in living, or if it is argued that since an animal has no concept of death, it does not have its interests violated if it is mercilessly and without provocation killed. Even still, it is quite challenging to defend industrial farming from a sentientistic utilitarian perspective.

The individual animal in the moral and ecological order, as well as joy, pain, and suffering, are also understood differently in organic farming. Organic farming, which includes other items as morally significant, does not operate effectively from an ethical standpoint that limits moral concern to sentient beings.

Since they see the intrinsic worth of sentient animals as being equivalent to that of humans, animal rights theories fail to function as a complementing philosophy for organic animal husbandry. Because of this, it is difficult to practise animal agriculture, and advocates believe that all types of animal agriculture should be prohibited. Therefore, it is difficult for organic farming to establish an animal ethics that can provide direction on how organic animals should be managed using these two models of well-known and commonly used animal ethics theories.

Animal ethics and welfare in organic farming

In order to get to a conclusion, it is necessary to say that organic farming should be concerned with animal welfare. Animal welfare issues have been central to organic farming from its inception, and they are justifiable in the context of ecocentric ethics.

The natural comprehension of animal welfare

Three (partially overlapping) kinds of definitions have emerged from the scientific-philosophical discussion of what animal wellbeing really entails:

1. The subjective experience method contends that an animal's wellbeing relies on how it perceives its environment; in other words, what counts are the animal's subjective emotions, such as pleasure, pain, or fear.
2. The biological functioning method emphasises that attributes like health, productivity, and reproduction may be used to gauge an animal's wellbeing since these are biological functions that can be quantified. If these tasks are completed well, the welfare of the animal is likely to be high. One of the most popular definitions of wellbeing includes biological functioning as well as "coping effectively with the environment".
3. According to the natural living method, an animal's wellbeing is based on its ability to exhibit natural behaviour and live a "natural" existence that is consistent with its genetically encoded nature, or "telos," as indicated by Rollin (1993). "Not only will welfare imply controlling pain and suffering, but will also include fostering and fulfilling the animals' natures," argues Bernhard Rollin on page 48.

The third type may be the most in line with organic principles. Along with natural behaviour, other factors like food that is tailored to an animal's physiology and a habitat that resembles the species' native biotope are also thought to be significant. According to studies of organic farmers, they largely see animal welfare in terms of "natural living". According to the organic perspective, the fulfilment of an animal's nature is valued more highly than the absence of pain and suffering. Natural life is valued for its intrinsic worth in addition to its use as an instrument. Only inasmuch as it improves the animal's health or well-being would it be favoured as an instrumental value. In order to attain the good, certain unpleasant experiences for the person may be accepted since allowing animals to live in the wild is seen as beneficial in and of itself. Negative experiences are seen in part as a normal aspect of existence that can never entirely be eliminated from the range of experiences that an individual animal may have. This does not suggest that these experiences are not harmful to the individual while they occur, but rather that they constitute a crucial component of the functional feedback system that links a person's actions to their environment. They also explore this strategy and contend that although "a natural existence" does not ensure the absence of suffering, frustration, and discomfort, interaction with nature may add certain beneficial aspects to an animal's life, the effects of which are not necessarily quantifiable. Animal wellbeing is preferred above "useful experience" and "a pleasant life":

A worthwhile experience may but need not contain components that seem to have a short-term negative influence on the person, but it nevertheless causes the person to learn something that will be useful in the long run. Different types of bad experiences could be regarded differently if this strategy is refined further. For instance, many of the issues with welfare in modern farming are either 192 because the animal lacks adaptations to current raising techniques or because the animal has adaptations that cannot work in such systems, organic agriculture takes a global approach.

Since animals in the wild are prepared to deal with unpredictable conditions, of which predators are an important part, stress caused by situations for which they lack adaptive strategies such as a noisy fan in the pig house may be deemed to be worse than stress experienced by outdoor pigs when a fox sneaks around their paddock. This shouldn't deter farmers from defending their piglets from foxes in any way albeit they should employ methods other than culling the fox population since such methods must adhere to the ecocentric paradigm. But with the loud fan, the pigs shouldn't have to worry about the prospect of being subjected to this type of stress. Of course, it may be questioned whether the pigs would benefit from the experience in the sense stated by but it would expose the animals to a broader variety of experiences and introduce "excitements" that would still be within their genetic adaption. As a result, the fan would stand for a "type 2 challenge" and the fox for a "type 3 challenge."

Holmes Rolston, an ecocentric philosopher, proposed a homologous principle for animal husbandry as a solution to the problem of animal suffering in 1988: "Do not cause inordinate suffering, beyond those orders of nature from which the animals were taken. [...] Culturally imposed suffering must be comparable to ecologically functional suffering." The organic agricultural movement shares this viewpoint (Lund 1996). Animal welfare is seen differently in organic farming than it is in conventional farming, where the biological functioning method is often accepted as the standard. The latter strategy is preferred by researchers as well since it makes measuring welfare states very simple.

As a result, a disparity in definitions of welfare may in part explain the criticism of animal welfare in organic farming. While conventional farmers and scientists may focus on the risk of parasite infections, predator attacks, cannibalism, and the homegrown feed's low content of some essential amino acids, organic farmers may believe their chickens have good welfare because they live in an environment where they can engage in most of their natural behaviours. They believe that the wellbeing of these creatures is being jeopardised.

Do organic production systems have an issue with overall welfare?

When attempting to determine if organic production methods have a general concern with animal welfare, a number of factors must be taken into account. The first one is the problem of

1. Adaptations that don't longer serve a crucial purpose
2. Difficulties that the animal has adapted to deal with
3. Difficulties for which the animal lacks the necessary adaptations

Circle A: The animal's modifications.

Circle B: Difficulties the animal is now experiencing.

Many of the problems with animal welfare in modern farming are either caused by the animal's adaptability, which no longer serves a purpose in current raising methods, or by the animal's lack of adaptation to such systems. What a "decent quality of life" for animals should include of Animal Welfare and Ethics in Organic Agriculture. Since there is no one description that applies to all situations, it is important to be specific when defining the notion.

Another problem is that any manufacturing method has both its advantages and disadvantages, as seen in the preceding example with the two dog owners and their canines in the introduction. Many of the issues brought on by intense production and crowded settings are absent from or at least less common in organic farming. Less common are issues with atypical animal behaviour (like as tail-biting in pigs), high production aims, or feeding regimens that are not compatible with the biology of the animals, as well as "production" illnesses such respiratory conditions linked to overcrowding and housing. Instead, issues are linked to a lack of disease management (such as parasite infections in outdoor production) and the increased dangers brought on by giving the animals a more free-range and unrestricted lifestyle. Different management and feeding philosophies and practises among organic farmers may lead to additional welfare issues in organic systems as opposed to conventional ones.

Third, since organic animal husbandry is relatively new, it is still being developed. As a result, study is required to pinpoint and enhance procedures that could address certain animals' welfare requirements. In order to build the management skills required to oversee a production system like organic farming, which depends on biological and ecological services to fulfil production goals, it also needs time to "convert" the thinking of (previously conventional) farmers. As a result, it is important to take into account both the existing state and the welfare potential of biological systems. The welfare potential of the organic standards is significant. For instance, they often go beyond and include more criteria than animal welfare laws in many nations, such as access to pasture and enriched environments. One may make the case that animals confined in barren habitats are less likely to have good wellbeing than those that live in stimulating environments (which often refers to free-range situations). Many certifying organisations (including the EU rules) also demand humane treatment during transit and slaughter, while organic standards sometimes limit or outright prohibit mutilations including tail docking, castration, and beak clipping.

Dilemmas

Organic farming has to handle some welfare conundrums. The tension between the welfare of the system and that of the individual has previously been covered. The clash between the ideals of natural living and individual welfare as understood in terms of "avoidance of suffering" or "promotion of health" is another conundrum brought on by the ecocentric approach, and it is another reason why animal welfare in organic farming has come under fire. The high emphasis organic producers put on natural living suggests that a more natural habitat is favoured to a well-controlled setting where the animal is protected from hazards but has less opportunities for a "natural" existence. Therefore, organic systems mandate free-range systems for chickens even if cannibalism or epidemics of feather plucking may cause significant harm in such systems (Bilcik and Keeling 1999). The Danish Ethical Council Concerning Animals criticised organic chicken rearing in the middle of the 1990s, citing death rates that were double that of conventional poultry herds (Danish Ethical Council Concerning Animals 1995). On the other hand, the likelihood of cannibal outbreaks may be decreased by using management strategies including offering foraging opportunities in free-range settings (e.g. Wechsler and Huber-Eicher 1998). The preference for natural mating, despite the fact that artificial insemination programmes are superior in terms of disease resistance and the elimination of deformities, and the idea of outdoor grazing, which is preferred despite higher risks for parasitic diseases like trichinosis and erysipelas infections in pigs and cattle, as well as Coccidiosis and Ascarid infections in poultry, are other examples of this conundrum. 194 A worldwide view of organic farming Organic animal welfare and food safety also provide a challenge since outdoor raising raises the risk of zoonotic parasite infections like Salmonella and Campylobacter. These are not welfare concerns for the animals, but may pose health problems \sfor people who consume animal products.

Many of the issues associated with natural living can be resolved through better management, breeding, and system development. Despite the fact that these issues are a reflection of divergent underlying value systems, it is crucial for the organic movement to acknowledge that natural living and organic feed alone are insufficient to ensure the welfare of each individual animal.

Effects of organic feed on welfare

Roughage fed to all species must be organic, which is typically advantageous to the animals. This is especially true for ruminants, including pigs and poultry, where it serves as "behavioural therapy" and adds extra fibre to the diet, promoting digestion. While roughage in pig diets might reduce the incidence of infection with harmful bacteria like dysentery, it can also lead to an increase in the presence of certain parasites (nematodes).

There have been worries that dairy cows may get illnesses such milk fever as a consequence of the decreased intensity feeding brought on by the restricted concentrate diet. These concerns have not materialised, however. Contrarily, it seems that organic dairy cows have less issues with metabolic illnesses than traditional cows.

In poultry, a challenge is how to supply enough methionine and, to a lesser extent, lysine to growing animals, especially in areas where the climate makes it difficult to grow soybeans. The issue has emerged as a result of IFOAM and EU guidelines banning synthetic amino acids in feed and restricting the use of animal products which are naturally present in chicken diets. These standards are also leaning toward demanding only 100% organic feed.

It is debatable and complicated, and it cannot be completely explained here, whether feed enrichment with synthetic amino acids equivalent to adding vitamins to the diet is the best answer to the problem. Given that the alternative is often either protein insufficiency or excessive protein feeding, it seems like a workable approach from the standpoint of animal welfare. Particularly, the first choice creates a great deal of stress on the animal and raises the possibility of feather plucking. There aren't many options for organic feed in certain nations, especially those where there aren't many organic farms. Since it becomes difficult and expensive for farmers to supplement poor harvests with purchased feed, this may lead to welfare issues. Purchasing conventional feed is an option, but it is also more expensive because the animals must go through a new conversion process before the goods can be labelled as organic.

Findings from research on organic systems' wellbeing

Scientific understanding of animal welfare in organic herds is poor. The few studies that have been published focus only on health, not wellbeing in general. Where the disparities between organic and conventional systems are most apparent, dairy production rather than the more intensive production systems of pigs and poultry is the subject of the majority of published research. Apart from parasite-related disorders, which are more common in organic farming, these studies generally show that animal health in organic herds is the same as or better than in conventional herds. This implies that there may be some merit to the criticism of organic farming and the issues with parasite infestations. It seems that organic farming has yet to succeed in creating effective alternatives to conventional therapies for the management of both internal and external parasites. The impact of these parasitic infections on animal wellbeing are difficult to assess, at least for pigs and poultry, but parasite infestation must be taken into consideration as a risk factor for animal welfare, even when no symptoms are immediately visible.

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Despite the fact that veterinarians often identify missing antibiotic treatment as an issue, it does not seem to be associated with increased somatic cell counts or mastitis rates. Antibiotic therapy is still needed for the most severe cases, although other approaches seem to be utilised in their place. Although there are differences in behaviours across nations, this issue may be overstated. Overall, it seems that organic farming does not have an issue with general welfare but rather offers the chance to enhance welfare provided the proper management techniques are used. However, there are certain issues or problems that must be resolved. Traditional animal protection campaigns and organic farming

Movements for organic farming and animal conservation have quite distinct histories. While the latter often concentrate on the welfare of individual animals and animal experiments, the early "alternative" agricultural groups tended to be more concerned with the detrimental impacts of industrialised animal farming. Animal Machines had comparable impacts on cattle output as the book Silent Spring, which became a call to action for environmental protection. Due to a growing concern for environmental concerns and a desire to find alternate sources of income, these publications helped fuel the interest in alternative agricultural practises that emerged in the late 1960s. The organic movement has taken into account animal wellbeing in connection to the agroecosystem of which the animals are a part, unlike other animal protection groups, which developed out of concern for the welfare of the individual animal.

According to an interview research, early proponents of organic farming regarded wellbeing as a result of a healthy system. This attitude was supported by a questionnaire research, which revealed that organic farmers placed a considerably higher importance on natural living than those championed by groups for animal protection, such as "rights," "dignity," and "intrinsic worth". However, collaboration between conventional animal welfare organisations and organic organisations has developed as awareness and understanding of farm animal care have expanded. The Humane Society of the United States has a division for Farm Animals and Sustainable Agriculture, and there are collaborative certification processes today, for instance in Canada and the German-speaking nations of Europe.

Future demands for research

It is crucial to be able to ensure the wellbeing of animals used in organic production since it is vital to organic farmers, consumers of organic goods, and not least, organic animals. However, further study on such production methods is required. In order to establish measures of wellbeing suited for organic production systems, the differences in understanding of the animal welfare concept compared to conventional systems need to be better clarified. These metrics will enable the certification organisations to gauge and share with customers the welfare status of organic farms. It will help the farmers determine if they are accomplishing the objectives of organic farming.

To address the welfare issues that organic farming is experiencing, further research is also required. In order to achieve this, welfare issues relating to natural living's lack of control and freedom must be addressed. These investigations will include topics including how to prevent parasite infections, cannibalism and feather plucking in poultry, as well as piglet mortality in outdoor settings. How to manage the danger of zoonotic disease transmission via organic agriculture systems is a key field of study. Additionally, the conflict between systemic and individual welfare must be resolved 196 An illustration of organic farming from a global viewpoint is provided by research looking at alternatives to drugs like antibiotics and anthelmintics (i.e. preventive health and welfare). Although organic farming depends more on biological answers and less on management, it is not the only kind of farming that requires this type of study to be developed. Preventive action is thus essential. Alternatives to such treatment might have significant economic repercussions since they may indicate that items cannot be marketed as organic. The Network for Animal Health and Welfare in Organic Agriculture's final report addresses the need for more research on animal health and welfare in organic farming.

As a reaction to the problems that conventional agriculture encountered, organic farming emerged, finding answers that went beyond the context and forming fresh viewpoints. This creative thinking and imaginative approach are still needed to design "win-win" scenarios that are advantageous to both the system and the individual animal. Developing husbandry systems where animal welfare is an integral and beneficial component of the system and not perceived as a problem to be addressed, that is, systems where animals contribute with goods or services through their natural life, is the challenge for organic farming.

It is crucial to define the term "animal welfare" clearly when making claims about animal wellbeing and to support such claims on scientific evidence. The debate of criticism and general topics will become more productive as a result. Animal welfare is seen from a wider, "systemic" viewpoint in organic farming, and a natural existence is often recognised as a prerequisite for excellent welfare. The conundrum that natural living does not always indicate animal welfare for each individual animal must be acknowledged, just as providing organic feed does not always result in an increase in quality of life. The few evidence to date does not suggest that animals raised in organic systems have lower health or wellbeing than those raised in conventional systems. Rather, organic agricultural techniques have a significant potential to promote wellbeing. Each agricultural system, however, presents unique difficulties, and organic farming must be aware of and address these difficulties. One such area includes problems and hazards associated with a decreased level of control over the animal's surroundings, such as "parasite-related disorders."

Animal welfare must be both theoretically and practically guaranteed in organic farming. Given the welfare of the animals as well as the expectations and demands of animal welfare in contemporary society, this is required. Even if system sustainability is a general aim, it is vital to create systems where the health and wellbeing of each individual animal are protected, and where natural living is in line with the welfare that each animal experiences.

Protecting organic crops from being treated with synthetic pesticides is the responsibility of organic farmers. A farmer that follows organic farming can grow natural produce and fiber even if his neighbor does not. Organic farmers help prevent chemical drift into crops from nearby farms. Farmers should protect their organic crops by taking any of the below precautions: Planting natural hedges along the boundaries of nearby fields can reduce the chance of chemical spray drift through the wind or runoff water. The boundary region surrounding the fields should be as wide as possible organic producers should channel water away from upstream fields to prevent runoff or consult with farmers upstream to discuss ways to cooperate to reduce the danger of contamination through water organic growers.

To encourage their neighbors to embrace organic farming methods or reduce the chance of polluting nature, organic producers should share their expertise and experiences with their neighbors. To create seeds and other planting materials that have been genetically engineered, and extracted DNA from by utilizing techniques other than pollination and overcoming natural barriers, plants, animals, or microbes can enter the crop genome. Therefore, using genetically engineered goods shouldn't be done in organic cultivation, and local farmers should guard against any GMO contamination of their output. The danger of GMO contamination is anticipated to rise with the expanding usage of GM crops in conventional farming methods. Cross-pollinating species, like safflower or maize, or crops pollinated by insects.

The danger of GMO contamination is anticipated to rise with the expanding usage of GM crops in conventional farming methods. Cross-pollinating species, like canola or maize, or insect-pollinated crops, like beans or cotton, are more likely to get polluted by genetically modified crops close by. The danger of GMO contamination is reduced for species that are mostly vegetative propagation pollinated, including potatoes, cassava, and bananas. If Transgenic and organic goods are not properly segregated during storage and transit, there is a danger of contamination in addition to genetic contamination along the production and distribution chain.

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Look at the breeding practices of the particular crops you are considering the majority of hybrid species, like maize, may travel up to three kilometers (km) by the wind or bees. Some agricultural seeds can remain viable in the soil for five to twenty years. Consequently, safety measures must be a position has been made that no new plants have indeed been grown on land intended for organic farming. If GM crops are grown in this area, establish safety (buffer) zones surrounding your fields to lessen the danger of GMO pollen spreading distances separating GM crops.

Using the soil moisture charts, calculate the present soil moisture content (in% field capability) of soil types samples (wet, dry, and ideal). Moisture as Perceived and Seen requests that the student selects the soil sample that has the right amount of moisture for cultivation. Describe the ideal range for soil moisture and give an illustration. List the issues with plowing outside of this ideal range. Show how to modify soil moisture whether it is too wet or too dry. A soil growth stage examines how soil formation affects tillage practices.

Examine how soil formation affects tillage techniques talk to pupils about how degraded, well-developed, and unmodified soils may require various tillage techniques. Give illustrations of each and visual cues that students might employ to decide on tillage techniques. Explain how a certain farming technique may enhance or deteriorate the current soil structure in the examples presented. Talk about/ask how tillage methods could alter as soil fertility increases over time. Soil structure Ask pupils to determine the soil's feel. Explain to the learners why and why tillage techniques may vary for soils with sand, silt, and clay. Provide illustrations of each. Discuss how a certain farming technique may enhance or deteriorate the current soil structure.

The kind of crops to be raised discuss how crop rooting depth, transplant size, and vitality may affect the kind of secondary tillage and the level of crop protection supplementary tilling. Give instances of crops that need a fine seedbed for the best germination or early development of transplants, as well as those that require deep tillage, coarse secondary tillage, and all three. Go through factors to take into account when choosing how much, what kind, when, and when to apply amendments to the soil during cultivation. What fertility additions should be used Talk about or evaluate how to apply the findings of experimental soil analysis and the materials.

Using the soil moisture charts, calculate the present soil moisture content (in% field capability) of soil types samples. Moisture as Perceived and Seen Request that the student selects the soil sample that has the right amount of moisture for cultivation. Describe the ideal range for soil moisture and give an illustration list of the issues with plowing outside of this ideal range. Examine the outcomes of digging in too-wet or too-dry soil or try it yourself. Show how to modify soil moisture whether it is too wet or too dry. A soil growth stage examines how soil formation affects tillage practices.

Examine how soil formation affects tillage techniques talk to your pupils about how degraded, well-developed, and unmodified soils may require various tillage techniques. Give illustrations of each and visual cues that students might employ to decide on tillage techniques. Explain how a certain farming technique may enhance or deteriorate the current soil structure in the examples presented. Talk about/ask how tillage methods could alter as soil fertility increases over time. Soil structure Ask pupils to determine the soil's feel and explain to the learners why and why tillage techniques may vary for soils with sand, silt, and clay. Provide illustrations of each. Discuss how a certain farming technique may enhance or deteriorate the current soil structure.

The kind of crops to be raised discuss how crop rooting depth, transplant size, and vitality may affect the kind of secondary tillage and the level of crop protection supplementary tilling. Give instances of crops that need a fine seedbed for the best germination or early development of transplants, as well as those that require deep tillage, coarse secondary tillage, and all three. Go through factors to take into account when choosing how much, what kind, when, and when to apply amendments to the soil during cultivation. What fertility additions should be used Talk about or evaluate how to apply the findings of experimental soil analysis and the materials.

To determine the requirement for, kind of, and utilization of Providing granular natural manure, discuss or revisit the utilization of lab soil analysis data and the sources in this handbook fertilizer, organic stuff, or both how much compost should be applied to Examine the compost's quality. Explain to students how different application rates could apply to unaltered, fully grown or degraded soils.

Argentina also fits this description. Livestock products were among the top five organic goods in 14 of the 16 European nations. The Network on Animal Welfare and Health in Organic Agriculture, supported by the European Union (EU), between five workshops on issues including varied livestock systems, interactions between humans and animals, nutrition and breeding, and health management, agriculture released its final findings and suggestions. The network also published a scholarly book titled Animal Safety and Welfare in Organic Agriculture. Sustaining Animal Nutrition and Food Security in Organic Farming, with an emphasis on food quality, is another EU-funded Concerted Action Project. Similar to the network, the scientific exchange is the primary activity.

The Food Standards of the Ministry of Agriculture of the United Nations is another form of more generic standard. All producers are required to abide by the EU's organic livestock production laws. EU nations that wish to market the "organically produced" label on their animal products. All nations wishing to export organic goods to the EU must adhere to these standards. The organic movement has not given as much thought to organic animal husbandry standards as it has to organic plant production standards. The organic movement's origins in plant and soil production ('produce healthy plants on healthy soils') may help to explain.

The majority of the data, however, relates to the number of farms, their sizes, and the proportion of their land that is managed organically. There is a shortage of data on the volume of animal production. Foster and Lampkin's (2000) publication included information on certified increasing livestock (dairy cows, dairy cattle, pigs, poultry, sheep, and goats) between 1993 and 1998, but not in connection to farm sizes. At least in nations with significant animal production, the percentages of animals raised organically are likely different for different animal species. For instance, less than 2% of pigs or other poultry were raised organically in Germany in 2002, compared to 17% of all beef cows, 8% of sheep, and 7% of geese.

Similar trends were discovered in other European nations in 1998. More pigs and chickens are raised in close quarters in conventional farming. These a result, farmers have more difficulty transitioning to organic farming. Farms that raise beef or sheep are frequently maintained rather intensively to make conversion easier. The criteria of the International Union of National Organic Movements apply to all of its members and the farmers who are members of those organizations. These requirements cover basic guidelines, minimal specifications, suggestions, and derogations (such as the formal replacement of an organically input with a standard input in cases when an organic input is not available). Because of the foundation for regulation provided by the standards, member organizations can adopt stricter regulations.

The term "livestock housing" refers to "how animals are housed on a farm." Both grazing systems and stables can be included in this. In a general context, housing refers to all aspects that could have an impact on the animal, such as human treatment, transportation, and killing. Additionally, the effects of animal habitation on the ecosystem are taken into account, particularly pollution has provided an overview of animal protection in organic farming elsewhere. High concentrations and a lack of stimulants, such as straw, diminish animal welfare in typical intensive housing systems, which may result in behavioral issues, accidents, or certain illnesses. On organic farms, livestock housing should take into account the cognitive needs of various farm animal species, ease effective management, and employ ecologically friendly materials.

Sections about housing may be found in both the EU rules and the Provides superior standards. The organic requirements generally demand that housing should satisfy the livestock's typical biological and ethological demands. The creatures must be housed together. Since they are sociable living beings, dwelling. For enjoyment and other uses, they must have biological substances. Therefore, it is prohibited to use housing systems like crates for sows, completely slatted pens for growing pigs or cattle, or battery cages for egg production that are frequently employed in conventional agriculture. Additionally, the creatures must have exposure to outside spaces, such as a pasture or an outdoor run. This provides more room and exposure to environmental stimuli.

This provides more room and exposure to environmental cues the majority of solutions for intensive housing prevent farm animals from ever having access to the outside. The EU legislation specifies the stable's and the outside area's minimum sizes. Animals may undergo mutilation (such as beak trimming, tail docking, teeth cutting, and dehorning) as part of intensive animal production to lessen the impacts of cramped living circumstances. Although the reasons for dense housing are still present, the symptoms are gone. Body mutilation should be minimized or kept to a bare minimum (and only permitted as an exception) in organic agriculture. However, others contend that under alternate housing arrangements, some mutilations are required. Pigs rooting in pastures, for instance, might obliterate the vegetation ringing the nose lessens pasture damage.

However, nasal ringing seriously interferes with the species-specific behavioral need and may even cause harm. In large flocks of laying hens, which are typical in alternative housing arrangements, feather picking may be a more serious issue. Trimming the beak is a serious interference with the animal's physical integrity. Therefore, it's crucial to take the right management precautions to prevent such mutilations in alternate housing systems. The aforementioned organic livestock housing standards set up advantages for animal welfare. They might be seen as strong principles, comparable to the prohibition of herbicides in plant cultivation, and this ought to be communicated to consumers. There is a dearth of literature on the dispersion of housing systems within organic agriculture throughout various, mainly English-speaking nations. However, it appears that housing arrangements vary widely amongst nations. For instance, in Germany, many farmers did not adhere to all the requirements of the country's laying hen legislation.

As a result, it would appear helpful to educate employees of organic certification bodies on the rules and be careful you adhere to them. Numerous optional options or derogations are included in the aforementioned rules. In certain circumstances, it appears that the exceptions are taken to be the norm. For instance, in Germany, organic advisors typically advise against adopting loose housing systems for cattle in the winter if the creatures have access to a pasture in the summer. There may be further challenges with interpretation. After 2010, an exception from the EU law permits tethering stalls for livestock in smaller herds, therefore, implementing this derogation.

Questions for Revision

1. What is organic agriculture?
2. How do organic farms manage fertility?
3. Do organic farmers take any precautions when they apply manure on organic farms?
4. How are insect pests managed on organic farms?
5. How are weeds managed on organic farms?
6. How are crop diseases managed on organic farms?
7. What are the requirements for converting to organic dairy production?
8. How do organic animals meet their nutritional requirements?
9. How do producers maintain the health of organic animals?
10. What methods are available to manage parasites in organic livestock?

Reference of Book for Further Reading

1. Nadia SCIALABBA "ORGANIC AGRICULTURE"

2. "Organic Agriculture" by Paul Kristiansen

3. "Organic Agriculture" by Dr. B.D. Singh

4. "Organic Farming" by N. Ravisankar

5. "Organic Farming" by Jaivik Khetihttps
