THE SIGNIFICANCE OF ORGANIC FARMING: IN THE AGRICULTURAL SECTOR, SCIENTIFIC RESEARCH, AND THE ENTIRE ECONOMIC DEVELOPMENT OF INDIA

Abstract

Chemical fertilizers boost agricultural yields.Because they provide vital plant nutrients like nitrogen, phosphorus, and potassium, these fertilizers have evolved into indispensable components of today's agricultural practices. On the other hand, using fertilizers in excess might have unintended consequences for the surrounding ecosystem. Utilizing the PGPB-based inoculation method in conjunction with the ideal amounts of fertilization will allow one to reach the highest possible degree of success in terms of money saved on fertilizers and improved crop yields. In addition, using effective inoculants may be regarded as a significant technique for sustainable management and lowering the number of chemical fertilizers used, which in turn lowers the number of environmental issues that are caused. At least 141 nations now produce organic food on a commercial scale, indicating that organic agriculture is seeing significant development. The production of organic food was estimated to take place on around 32,2 million hectares throughout the world in the year 1999. More than 1.2 million farmers, including smallholders, were responsible for its production. In addition to agricultural land, there is a certified organic aquaculture industry that covers 0.4 million hectares. Approximately 65 percent of the nations that practice organic agriculture are considered to be developing nations.

Keywords: FYM, low input farming, non-chemical, organic agriculture, rained farming,

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I. INTRODUCTION

1. **Organic Farming in Agriculture** Oceania, Europe, and Latin America have the most organically maintained farmland. Australia, Argentina, and Brazil have the most organic land. Poor countries have 11 Mha of organically maintained land. Latin America dominates this landmass, followed by Asia and Africa. Organic land increased by about 1.5 million hectares in 1998 compared to 1999. In Latin America, organic land has grown by 28% or 1.4 Mha. Organically maintained land expanded by a million hectares (27%) in Africa but only 0.33 million hectares (4%) in Europe. Austria boasts 8.40% organic farmland, the highest after Germany, Switzerland, and the UK. (Hass D, *et. al.*,2003) Organic farming is only used on 0.03% of India's land, despite its potential. As interest in organic farming has grown, so has an emphasis on traditional agricultural methods that use lots of chemicals and water. The decline in agricultural productivity in certain nations due to excessive chemical usage, soil fertility decline, and environmental awareness has revived interest in organic agriculture. Exports were considerable, although less than in other nations. (Sharma S. B. *et al.,* 2013)

   The purpose was to safeguard nature and promote ecologically friendly farming. There are now several national and state-level government bodies and businesses in India actively supporting organic farming. Uttarakhand and Sikkim have both decided to become "organic states" inside their respective countries. Since 1998, organic farming has been practiced on around 5% of Maharashtra's total cultivable area, or about 1.8 million acres. (Sharma, A. 2014)

   - **Conventional Farming is a Lot Less Labor-Intensive Than Organic Farming:** Price, market data, and food variety certification depend on external support systems, confined to resource-rich farmers and export markets.Thus, organic farming's social impact and possible benefits are restricted. Ecological farming aims to increase self-sufficiency, productivity, and cost reduction. Farmers with and without resources benefit, the procedure is simple, the regional market is prioritized, and the program's reach and social effect are significant. (Hayat R, *et. al.*,2010) Ecological farming starts with non-chemical pest control, local pesticide-free food sales, community seed banks, and chemical-free nutrition management. Due to a labor shortage, the local ecological technique is fading away. The National Rural Employment Guarantee Act (NREGA) allows the enterprise to profit from labor incentives, which is one of its numerous benefits. According to a study (Hirel B., *et al.,* 2011),

     Andhra Pradesh and SERP are implementing the Sustainable Agriculture Network of Non-Governmental Organizations' Community Managed Sustainable Agriculture. The Centre for Sustainable Agriculture provides technical assistance for the effort. Fifty communities were pesticide-free in 1999, and seven had switched to organic farming. The Timbaktu Collective is another Ananthapur-based organization that advocates for organic farming. (Huang XD, *et. al.*,2005)Andhra Pradesh's state government has been running a variety of organic farming-related activities via its Departments of Agriculture and Horticulture. During the 1999-2000 school year, the Agricultural Department of the state of AP invested 18.29 billion rupees into a variety of programsto increase organic farming in the state. Like California, Andhra Pradesh

(AP) launched its organic agricultural initiative in the 1999–2000 fiscal year as part of the State Horticulture Mission (SHM). Andhra Pradesh has not yet concluded its policy on organic farming, and the drafting that was created in this regard is now the subject of heated discussion on several fronts. Reference: (Dadhich SK, *et al.,* 2011)

Farmers' dissatisfaction with pesticide-heavy conventional agriculture is a major factor in the move to organic farming. Some worry about farmers who use chemical fertilizers and pesticides. Organic farming has benefits other than health, therefore it's worth switching. Punjab, Haryana, and eastern Uttar Pradesh farmers must dramatically boost chemical inputs to preserve crops. Organic farming may lower yields on irrigated farms. Chemical fertilizers increase soil fertility, but agricultural production drops. Conversion will boost agricultural production. Rain-fed agriculture produces substantially less, while conventional and conversion yields are similar. Organic farms are more productive than conventional ones, according to a few yield comparison studies.(Sharma, H., *et. al.,* 2019).

It is quite rare for a departure from normal agricultural practices, which need little outside inputs, to reduce crop yields. Yields may decline significantly in the first few years following conversion from agricultural practices that depend largely on external inputs and may not return to pre-conversion levels until natural tilth and fertility of the soil have been adequately restored. However, based on organic management efficiency and fertilizer quality they may settle at levels that are similarly low or considerably higher. (Sharma, H., *et. al.,* 2023)

2. **Conventional Farming:** Farmers will have their horticultural requirements met by the extensive selection of organic fertilizers, which are formulated using the farmer's expertise and the resources that are available in their area. When the most productive practices are used throughout the transition from conventional to organic farming, organic farming may compete economically with conventional farming. Surveying to evaluate organic farmers' information needs and customizing information delivery techniques may be advantageous. (James EK, *et. al.,*2000)Organic farming seems to be less economically viable for some crops, such as rice, as compared to farming methods used for other types of crops. On the other hand, if organic farming became the standard method of production, there would be a greater opportunity to reduce the economic cost and the damage done to the environment over time. In addition to these things, the natural balance of the ecosystem is preserved so that humans, trees, animals, and other forms of life may coexist more peacefully. Growers may experience direct economic advantages from a reduction in the usage of pesticides. These benefits might take the form of lower costs for inputs, which can lead to higher net returns. Crop diversification in organic farms may have additional potential economic advantages since it can provide some protection against unfavorable price swings in a particular product. (Jetiyanon K, *et. al.,*2002) This is because diversity protects against bad price movements. The majority of people who practice organic farming have said that they were not inspired to start organic farming because of the higher price of organic products; rather, they were driven to start organic farming because they spent less money on inputs and achieved yields comparable to those of their conventionally farmed neighbors. (Sharma A, *et. al.,* 2009).

Their 25-year Swiss research shows that temperate regions can grow crops without agro chemicals. Most agricultural experts believe huge volumes of farm yard manure (FYM) and other biomass material may replace fertilizers. They further say that organic farming increases national food insecurity since certain crops need agrochemicals, such as fertilizers. Since their revenue and expenditures are spread throughout the year, organic farmers borrow less. First, organic growers require less money. However, organic farmers often allege lender prejudice, which might be economically detrimental. (Sharma, H., *et. al.*, 2022)

However, this problem is more perception than actuality. Organic farms earn as much as conventional farms. Organic farming is better for low-income families in the long run because it increases yields, produces security, and independence from external inputs. On 14 Midwest conventional and organic crop/livestock farms, these variables, particularly in marginal regions, have investigated financial viability. Physical parameters and agricultural enterprises paired study farms. Organic crop prices declined 11% per acre. The two systems had similar net revenue per acre due to lower production costs. We compared 15 conventional western Corn Belt farms to 15 equivalent organic farms. The net profits for organic farms are much greater. Organic farming was determined to have lower production costs in both investigations. (Noreen R, *et. al.*, 2015)

Two cash grain farm comparison studies were conducted in Washington. Three organic farms and three conventional farms were compared, and conventional farms generated 38% higher net income per unit area. The author of six organic farm follow-up studies concluded that organic farms had greater net returns than conventional farms by 22%. has looked into the economic benefits of growing wheat on 10 organic farms and ten conventional farms in New York and Pennsylvania. When just cash operating expenses were taken into account, organic farms showed greater earnings. When land and unpaid family labor were included, the average net return for conventional farms was greater than that of organic farms. (Kokalis-Burelle N, *et. al.*,2002)Each of the above investigations has flaws. The limited sample size, which made statistical analysis of group differences difficult, was the biggest issue. The averages did not accurately represent the great level of variability that existed among both kinds of farms in terms of their yields as well as their net returns. The act of pairing farms for the study also produced several complications, particularly with the works. In conclusion, not a single one of the studies took into account the cattle business, despite the possibility that this component is necessary for organic farms to achieve their full potential economically. (Gupta A, *et. al.*, 2013)

3. **Low-Input Farming:** It's possible that the sample wasn't typical of organic farms as a whole, and it's also possible that a lot of the replies were based more on people's impressions than on meticulously maintained data. According to the results of the poll, a high degree of contentment seems to exist about the financial success of low-input farming. Organic farming and food production is the solution for millions of small farmers in our nation who are concerned about their impact on the environment and their ability to provide for their families. Organic farming has significant positive effects on society as a whole since it helps cut down on pollution while also preserving energy, fish and animal populations, and the nutritional content of the soil. Additionally, it guarantees

that future generations will have access to food. However, policymakers have practically little access to accurate data on the extent of these advantages; as a result, when compared to other policy options, organic farming cannot be compared. (Kokalis-Burelle N, *et. al.*,2006) It is important to identify, analyze, and remove any legislative obstacles that stand in the way of organic farming in regions where it is already shown that organic farming is economically possible. Both farmers and politicians are beginning to see the benefits of organic farming as an alternative agricultural method. However, the new biochemical technology that is being used in agriculture is having a significant number of unfavorable effects on the surrounding ecosystem. Since the 1960s, there has been a discernible rise in the use of various chemicals, such as those used in the production of fertilizers and pesticides. There are sufficient reasons to be concerned about the effects that these substances will have on the ecosystem. It wasn't until the 1980s that people started to realize that traditional agricultural methods were no longer sufficient for achieving sustainable development. Consistent pesticide usage has led to the rise of serious ailments like cancer and epilepsy, which people must suffer for years.(Duponnois R, 2008)

II. SUSTAINABLE AGRICULTURAL DEVELOPMENT

While the identification of viable alternatives to pesticides is a long-term goal, the promotion of sustainable agricultural development (SAD), which accounts for environmental and health concerns, requires the concerted effort of all stakeholders. We also need to evaluate our agriculture policies' financial and environmental effects on pesticide use and promote ecologically friendly farming techniques. Many informed farmers understand the importance of ecological agriculture, but they may not be able to implement it on their main farm. On their homestead property, farmers are using this technique more frequently since it is less impacted by market pressures and other external considerations. (Lucas GJA,*et. al.*,2004) They may think this strategy is necessary to solve the problem. Even though conventional farming is far from being replaced by organic farming, these data show a huge improvement in farmer understanding. Even in organic farming-friendly Chhattisgarh, farmers struggle. If farmers upstream use pesticides that infiltrate into organic farmers' crops, the chemical analysis would show that the food is poisoned. Medicinal plants, which are employed in life-saving drugs and other health items, have a higher sensitivity index. The organic agriculture movement's success hinges on the agricultural community's knowledge and motivation to switch to organic farming. (Gregory S. Bisacchi, *et al.* 2015)

Awareness of environmental protection and the health threats associated with agrochemicals, as well as the need of consumers for safe and risk-free food, are the key elements that contribute to the worldwide rise in interest in alternative methods of agriculture. Organic farming is only one example of the various sustainable production methods available. Both industrialized and developing countries are seeing annual increases in organic food consumption of about 20–25 percent. The environmental advantages of organic farming, as well as its compatibility with integrated agricultural systems for rural development, give it serious consideration as a development vehicle for nations like India.(Graham PH., 2008)

III. EXAMINING THE COSTS AND BENEFITS OF GROWING CROPS USING BOTH ORGANIC AND CONVENTIONAL METHODS

It showed that organic farming was lowering production costs. Improved soil health and resilience, decreased pollutants, and greenhouse gas emissions are hard to quantify. Alterations to the soil's structure, an increase in ground cover, a reduction in runoff of 10 to 50%, and an increase in infiltration of 10 to 25% all contributed to a two-fifths to four-fifths reduction in soil erosion on organic fields. Water lost as runoff and nutrients in degraded soil cannot be valued. (Kokalis-Burelle N, *et. al.*, 2003) They're rotated throughout the property to keep them available for crop production, but that's about it. It would seem that India is quite a way behind other countries in terms of the adoption of organic agricultural practices, despite the considerable efforts that have been made by several non-governmental organizations (NGOs). At the levels of government policymaking, there are specific concerns that need to be addressed to establish the groundwork for the expansion of organic agriculture in the nation. (Limpens E, *et. al.*,2003)

To raise awareness among farmers and customers, one must aggressively promote the benefits of organic farming over conventional farming. The National Agricultural Policy does not include organic farming. For some farmers, organic farming represents a viable alternative to conventional farming. When it requires a lot of paperwork, regulation, organization, and bureaucracy, organic food certification becomes doubtful. The state of Chhattisgarh supports medicinal, aromatic, and dye plant growth in addition to agricultural and horticultural production. The government may support organic farming in a herbal state. The Chhattisgarh State Minor Forest Produce Federation, Horticulture and Agriculture Departments, and Vanoushadhi Board encourage organic agriculture, horticulture, medicinal, and aromatic crops. (Lambers H, *et. al.*, 2008).

However, some state governments have made substantial headway in organic farming while the federal government has mostly disregarded the movement. Sikkim, Mizoram, and Uttarakhand administrations have taken major measures to make their states organic. Karnataka, Madhya Pradesh, Arunachal Pradesh, and Meghalaya, as well as Punjab, have adopted state government initiatives. In Uttarakhand's multi-pronged organic endeavor, the organic model is promoted not just as a farming technique but also as a key component of rural development. Despite this program's inclusion of exporting, local market development has been prioritized. It's too early to judge this program, However, if it is done properly, it might serve as a template for state-driven organic growth in India. Although it's too early to make any judgments on this program.(Jackson M.L, 2009)

Organic crop growth may benefit from the Indian subcontinent's large range of naturally viable organic nutrients. Nutrients are found nationwide. This will be of significant assistance in the organic production of various plant life. Both the climate and the environment may be somewhat different from place to place. (Kennedy IR, *et. al.*,2001) The ancient farming system in India is robust, and the country's farmers are known for their creativity. The country also has extensive stretches of dry terrain, so it uses very few agricultural chemicals. The rain-fed tribal, northeastern, and hilly parts of the nation have been practicing subsistence agriculture for a significant amount of time; such places are organic by default since small amounts of chemicals are utilized in agricultural production.

(El-Kholy MA, *et. al.*, 2005)

IV. PESTS & DISEASES IN ORGANIC VS. CONVENTIONAL AGRICULTURE

Organic farmers producing the same crops face many of the same pests and diseases that affect conventional farms, resulting in lost harvests or costly chemical treatments. Organic farmers don't use synthetic pesticides, which disrupt the system's natural defenses and raise the risk of subsequent infestations. (Khalid A, *et. al.*,2001)Pesticide-intensive systems are more likely to have secondary pest problems, such as spider mites in orchards treated for codling moth in temperate climates, rice brown plant hopper in tropical paddy rice, Rhizoctonia black scurf in potato after nematicides reduce fungi feeding collembola, and apple scab after benomyl decimates earthworms, which slows leaf decomposition. Due to the maintenance of their natural opponent complex, organic systems control a major portion of conventional systems' most problematic pests. (Djebali N, *et. al.*, 2010)

1. **Natural Pest and Pathogen Controls:** Organic farmers aggressively promote natural predators and parasites. Organic farms protect older plants from soil-borne illnesses. Organic soils reduce disease, boost microbial activity and variety, and increase macrofauna diversity due to lower soil and crop N concentrations. Organic crops' foliar tissues or phloem contain less nitrogen, powdery mildew, rust, and sucking insect pests like aphids and whiteflies may all be mitigated. (Assefa G, *et. al.*, 2001)

   Some arthropods thrive in organic farming, such as below-ground pests like the garden symphylan, cutworms, wireworms, and slugs, or bugs like the strawberry weevil and the Lygus bug are tenacious pests that cannot be managed with legal organic inputs because of the lack of effective biological controls. Due to their quick reproduction in freshly introduced organic matter, damping-off diseases like Pythium species may damage organic crops. Potato late blight and onion downy mildew, which are controlled by frequent fungicide treatments on conventional farms, may damage organic crops under humid circumstances. (Kokalis-Burelle N, 2003) Since synthetic pesticides are banned, pests that attack stored foodstuffs should challenge organic growers. Both conventional and organic farms face difficulties from pests that attack stored products. The many shortcomings of synthetic chemical methods used in the previous several decades for long-term pest management in storage, and the introduction of novel remedies to this age-old issue. Natural pest management practices utilized by organic farmers also fall under this category. Vertebrate pests such as deer and other ungulates, birds that eat fruit and seeds, rat colonies, rabbits, and squirrels may reduce crop yields and food quality on both organic and conventional farms. (Khalid A, *et. al.*,2003) Common practices on organic farms, such as cover cropping, farm scalping with non-crop flora, and mixed cropping, draw in beneficial species and deter certain vertebrate pests, but they may also provide more space for gophers, voles, and noxious birds. While both organic and conventional farmers use several forms of pest control-including cleanliness, exclusion, trapping, and the use of various repellents (visual, plant management, and auditory-organic farmers do not use numerous fumigants, anticoagulants, and toxins-the two systems diverge in their use of chemicals. (Zorita MD, *et. al.*, 2009)

   To that end, organic farmers may face the same pests and diseases as their conventional counterparts. But the dynamics of these species rely on how well their resource needs are supplied and how well natural controls in the management system are working. (Joo GJ, *et. al.*,2005) In this way, despite the existence of the same crop host, the chance of establishment and spread in the agricultural field is reduced for many pests and diseases by using organic approaches. Other pests and diseases benefit from organic techniques since they provide ideal circumstances for population expansion, creating unique difficulties for farmers who have few agrochemicals to choose from. (Tawaraya K. 2003)

2. **Conventional vs. Organic Pest & Disease Management:** The three primary methods in which farmers safeguard their crops are via the prevention of pest and pathogen colonization, the reduction of pest and pathogen populations through biological processes, and the use of curatives permitted by organic agriculture standards. Two of these methods focus on preventing pests from ever appearing, while the third entails moving away from the synthetic chemical inputs often used in traditional farming to deal with pests that have already taken hold. (Khalid A, *et. al.*,2004)The crop is the host, the field and surrounding area are the biotic community, and the pest or disease is the invader that sets up shop in the crop habitat and multiplies rapidly, wreaking havoc on crop production. The crop may be segregated from pests and diseases that might cause an outbreak in many ways, and if populations of pests and pathogens are generated, community resistance can be used to combat them. Communities that put up a fight against an invasion use the term "community resistance" to describe the conditions they've created. Examples of such factors include competitive pressures, limited food supplies, and predator abundance. Traditional agricultural methods use a combination of natural pesticides and community-based natural and artificial resistance. Above ground, plant species protect and promote beneficial fauna. (Sharma, H., *et. al.*, 2021).

   Activating the food web in the soil, which may be accomplished by amendment with organic materials that decompose slowly, is one way to increase the community's resilience in the soil. The primary focus of these activities is on the conservation and protection of the world's diverse biological communities. When pathogen or pest populations rise, organically approved biocides or natural behavior-modifying compounds may be used to treat them, as can the release of rivals, predators, or parasites. (Kennedy IR, *et. al.*,2004) In traditional agriculture, restorative remedies might replace synthetic pesticides. Additionally, these measures have the potential to supplement other strategies, such as the promotion of biodiversity. In organic farming systems, effective crop protection depends on prophylactic measures, which stop the colonization, establishment, or buildup of pests and pathogens. These measures are often used in tandem with curative treatments, which are used only when necessary. Pests and illnesses must be prevented in organic agriculture. Sanitation, contamination source isolation, and other preventative measures may protect a crop field, orchard, vineyard, storage facility, or other agricultural environment against pests and diseases. (Idriss EE, *et. al.*, 2002)Sanitation, clean seeds or vegetative propagation materials, crop rotation, planting time modification, weed removal, fence or netting against vertebrates, and sealing or repelling storage pests may be used in organic and conventional agriculture. Pathogens and pests cannot colonize using these approaches. Due to the lack of therapeutic procedures in organic farming, they are more important. To prevent pests and diseases from colonizing crops, organic and conventional farmers use several crop protection strategies. These activities are designed to keep the crop free from contamination. Consider the cases of sanitizing seeds and rotating crops as an illustration of some of the more specific challenges that organic farmers face. Another strategy to protect crops from microbial and animal invaders is to change the planting season or rotate crops with different pest and disease groups (called "temporal isolation"). (Balagurunathan R, *et. al.*, 2010)

Organic field crop farming often utilizes longer intervals of time between crop rotations than conventional field crop production, ranging from 5-8 years to 23 years. Rotation lengths are shorter in organic greenhouse production since only high-value crops like tomato, sweet pepper, and cucumber may employ comparable cultural approaches. (Galal YGM, *et. al.*,2000)Root-knot nematodes may provide significant challenges for organic farmers that use short-crop rotations in greenhouses. This is especially true for the production of high-value products that are grown in soil. (Sharma, N., *et. al.*, 2023)

3. **The Resilience of the Host Plant Protecting Crops without Sacrificing Host Plant Quality Happens When:** Having toxic or repelling properties is sufficient to prevent the use and survival of a pest or disease. The nutritional state of plants is kept optimal for growth and resistance to disease without the overabundance of nutrients or the imbalances that attract herbivores in large numbers. The flexibility of the first approach allows farmers to adjust their practices in response to the dynamic nature of a virus or insect. (Bloemberg GV,*et. al.*,2001) A resistant cultivar has been selected and will be used throughout the season. The cultivar's marketability, the risk of an invasion, the severity of the pest or disease, any yield loss, its effectiveness against the target and other potential exploiters, and its complementarily with other crop protection strategies all affect its use. If nitrogen sources create ammonia, high nitrogen levels may attract insects but repel plant-parasitic worms. Such sweeping assertions don't apply here. Mustard oil is toxic to certain insects, therefore its high concentration drives them away, while it attracts those who feed only on mustards.(Turkmen O, *et. al.*, 2008).

4. **Researching Organic Systems:** As a result of the breadth and depth of the repercussions that are placed on agricultural research in the modern day, there is an urgent need to reevaluate the methodologies, procedures, and institutional frameworks that are currently in place within the field. The research community is expected to stay relevant and adapt to society's and agriculture's changing goals, intentions, and values. Agriculture research is not exempt from these criteria. They reflect society's shift from seeing science as an independent source of objective information to a unique learning process.(Sharma, H., *et. al.*, 2022)

   Agricultural research is crucial to the rapid technological advancement and development of alternative production techniques in agriculture. Agricultural science is a systemic science since it affects the field it investigates. Research into socioecological systems must understand both complex agro ecosystem linkages and human behavior in social systems. Thus, research on agricultural systems must address society's diverse interests, values, and meanings. (Erman M, *et. al.*, 2009)

Agricultural research must openly consider values like aims and social interests. When and how values enter research and how agricultural research's systemic structure affects scientific quality requirements are covered. Research is also influenced by values. Agriculture research must meet this requirement. In organic farming, values are very important. (Chandra S, *et. al.*,2007) Organic farmers' ideals and goals are clear and determined, and they differ from conventional farming practices. A concise overview of the unique benefits of organic farming is presented, followed by a consideration of what this evident and demonstrable value base implies for organic research, including how that research ought to be carried out and how it ought to be assessed. The link between organic research and conventional research is examined, and sound research techniques and acceptable research procedures for organic research are explained.(Barea J-M, *et. al.,* 2005).

5. Ethics, Fundamental Values, and Guiding Principles

Organic farming has differentiated itself from conventional farming via the adoption of alternative agricultural practices, ways of view on the world, and fundamental principles. The organic movement is most renowned for clearly formulating core principles and criteria for organic production and processing. (Dakora FD, 2003) This is one of the movement's most significant achievements. These ideas are predicated on the recognition that human civilization and the natural world are closely interwoven, as well as on the adoption of a more holistic approach to health care. The key to improved organic systems is an understanding of the ecological processes that drive productivity and environmental impact through soil biology, vegetation dynamics, pest population dynamics, disease epidemiology, and so on. These processes include things like disease epidemiology and the dynamics of pest populations. These processes include topics like the epidemiology of diseases and the dynamics of population control of pests. This in no way means that they do not play an important role in the agricultural practices of the past. (Guo JH, *et. al.,*2004)Organic farming relies more on natural ecological systems than conventional farming because it lacks the technological tools to overcome natural and ecological issues, such as artificial pesticides, fertilizers, and preventive medicine. Conventional farming uses chemical pesticides, fertilizers, and preventative medicine. Organic farming prioritizes animal welfare, ecological preservation, and economic viability. One of the basic principles of organic agriculture is that the health of the land, plants, animals, and humans are interconnected. This organic agriculture principle states that land, plant, animal, and human health are interconnected.(Guntoro D, *et. al.,* 2007).

The present IFOAM fundamental Standards (IFOAM 2002) include 15 key aims and fundamental principles for each area covered by the standards, making the general concepts difficult to understand. IFOAM is revising organic agricultural principles. The 2005 General Assembly in Adelaide will discuss and approve a set of core ethical principles. (Hayat R, 2005) The May 2005 draught includes health, ecological, justice, and caring principles. Researchers need essential ethical principles of organic agriculture to conduct proactive, far-reaching research to improve organic and sustainable agriculture. IFOAM's approach should make it easier and more uniform for researchers to organize and conduct organic agricultural research. (Karahne V, *et. al.,* 2009)

6. **Quality Standards for Organic Research:** Conventional researchers, like conventional farmers, have resisted organic research. This criticism may prompt the organic research community to reevaluate past and future studies. Depending on quality requirements, these questions may be answered. (Herman MAB, *et. al.*,2008) It's called ethical reductionism, and it holds that science should be value-free. Organic research is criticized because science should be unbiased. It has been stated that scientific research that starts with organic farming philosophy and beliefs is not scientific.(Sharma, H., *et. al.*, 2022).

7. **Organic Farming Approaches Involve:** "Organic farming" uses biologically derived herbicides, fertilizers, and nitrogen-fixing cover crops.Modern organic farming has had many good ecological effects since its start due to traditional agriculture's pervasive use of toxic chemical pesticides and man-made fertilizers. Organic farming, in contrast to conventional agriculture, makes use of a lower total amount of pesticides, lessens the amount of soil erosion that occurs, lessens the amount of nitrate that is leached into groundwater and surface water, and recycles the waste products that are produced by animals. (Hilali A, *et. al.*,2000) These gains are offset, however, by increased prices for food for consumers and, generally speaking, poorer yields. It has been discovered that the yields of organic crops are, on average, roughly 25 percent lower than the yields of crops produced using conventional farming methods, although this may vary quite a little depending on the kind of crop being cultivated. Organic agriculture's objective in the future will be to maintain its environmental benefits, increase yields, and reduce prices while addressing climate change and a growing global population.(Zhu Y-G, *et. al.*, 2003).

   Sir Albert Howard, F.H. King, Rudolf Steiner, and others developed the concepts of organic agriculture in the early 1900s. They believed that the use of animal manures (which were frequently turned into compost), cover crops, crop rotation, and biologically based pest controls resulted in a better farming system. As an agricultural researcher, Howard had the opportunity to study in India, where he was exposed to a variety of traditional and environmentally conscious farming techniques. (Igual JM, *et. al.*,2001) These approaches provided him with a wealth of motivation, and he became an advocate for their widespread implementation in Western countries. They were instrumental in the dissemination of information about organic agriculture. The book "Silent Spring" by Rachel Carson, which was published in the 1960s and detailed the degree to which pesticides caused harm to the environment, was primarily responsible for the rise in demand for organic food at the time. Since the latter half of the 20th century, there has been consistent growth in the market share of organic foods. Due to concerns about pesticide residues and GMOs in food, the organic sector has grown. (Tawaraya K, *et. al.*, 2006)

8. **Fertilizers in Organic Agriculture:** Organic farmers employ organic materials to build and maintain healthy soil as they don't use synthetic fertilizers. Manure, compost, and other animal by-products like feather meal and blood meal are all examples of organic materials that may be used in agricultural applications. The USDA National Organic Standards stipulate that raw manure cannot be spread later than ninety or one hundred twenty days before harvest, depending on whether the harvested portion of the crop is in touch with the ground or not. (Glick BR, *et. al.*,2003) This is because raw manure has the

potential to carry human pathogens, which may be harmful to humans. There are no time constraints imposed on the application of composted manure if it has been churned five times within 15 days, has attained temperatures ranging from 55-77.2 degrees Celsius (131-171 degrees Fahrenheit), and has reached these temperatures. Compost boosts soil health and plant growth by boosting organic matter and helpful bacteria. Soil microorganisms break down organic materials and convert nutrients into a mineralized form that plants can absorb because most of these nutrients are unmineralized. (Goldstein AH, 2007) Synthetic fertilizers, on the other hand, are mineralized and easy for plants to take. Planting cover crops and then tilling them in provides a natural erosion barrier during the off-season while also adding valuable organic material. The soil may be protected if you do this. Soil nitrogen may also be increased by planting cover crops that fix nitrogen, such as clover or alfalfa. Tree fruits benefit from cover crops sown between their rows. Cover crops are commonly seeded before, during, or after cash crop harvests. No-till and reduced-tillage organic farming methods are being developed by scientists and farmers to decrease soil erosion. (Singh BP, 2000)

9. **Pest Control:** Pesticides that are considered organic are made from ingredients that exist in nature. These include biological organisms like Bacillus thuringiensis, which controls caterpillar pests, or plant derivatives like pyrethrins from Chrysanthemum cinerariifolium's dried flower heads or neem oil from Azadirachta indict's seeds. Mineral-based inorganic pesticides like sulfur and copper are allowed. (Nichols KA., 2008)

   Organic pest control uses biological, cultural, and genetic methods as well as pesticides. In insect pest management, "biological control" means utilizing predatory insects like ladybirds and parasitoids like wasps to kill unwanted insects. (Gupta CP, *et. al.,*2002) Crop rotation is the cultural management that is used the most often to interrupt the life cycles of various pests. In conclusion, conventional plant breeding has resulted in the development of a great number of crop types that are resistant to certain kinds of insects or diseases. The utilization of these types, in addition to the cultivation of crops with a broad genetic makeup, provides genetic control against a wide range of plant diseases and pests. (Dobbelaere S, *et. al.*, 2003)

V. A GMO IS A GENETICALLY MODIFIED ORGANISM

An organism whose genome has been manipulated in the laboratory to promote the expression of desirable physiological qualities or the synthesis of desired biological products is referred to as a genetically modified organism, abbreviated as GMO. Breeding selects individuals of a species to produce offspring with desirable traits and has been normal practice in livestock production, crop farming, and pet breeding for a long time. (Hoflich G 2000) Recombinant genetic methods are utilized to create creatures with molecularly changed genomes in genetic modification. Genes from unrelated species that code for traits that would be difficult to gain via selective breeding are usually used to achieve this. GMOs are developed using recombinant DNA technologies and reproductive cloning.(Sharma, H., *et. al.,* 2021)

Reproductive cloning involves inserting a human cell nucleus into a host egg's cytoplasm. Donor kids are born. Dolly, a sheep cloned from an adult donor cell in 1996, was the first. Cloned animals include pigs, horses, and dogs. Using recombinant DNA technology, genes from one species are transferred to another. The transplantation of one bacterial genome into another microbe's cell body or cytoplasm is used only in basic research. Agriculture, health, research, and environmental management have introduced GMOs to society. (Sharma, H., *et. al.,* 2021).

VI. GMO IN AGRICULTURE

In the United States, genetically modified foods (GM foods) were given their initial approval for consumption by humans in 1994. By 2014-2015, around ninety percent of the maize, cotton, and soybeans that were grown in the United States were genetically modified. The Americas were responsible for the production of the vast bulk of genetically modified crops. The agricultural yields that may be obtained from an area of land that is planted with genetically modified organisms can be significantly increased, and in certain situations, the use of pesticides made from chemicals can be reduced. (Kempster VN, *et. al.,*2002) For instance, the use of broad-spectrum insecticides decreased in many regions that grew plants like potatoes, cotton, and maize that were gifted with a gene from the bacterium Bacillus thuringiensis that generates a natural pesticide called BT toxin. This resulted in a reduction in the amount of harmful chemicals that were released into the environment. Field experiments carried out in India that compared BT cotton to non-Bt cotton indicated a 30–80 percent increase in yield from the GM crop. (Hynes RK, *et. al.,*2008) This rise was linked to a considerable improvement in the capacity of the GM plant to withstand bollworm infection, which was previously prevalent. Studies conducted on the cultivation of BT cotton in Arizona, United States, indicated very minor improvements in yield, around 5 percent, with an estimated cost savings of $25–$65 (USD) per acre due to fewer pesticide treatments. This was possible because of BT cotton's resistance to insect pests. The genetically modified cotton crop was initially successful in China, when farmers were given access to BT cotton for the first time in 1997. (Piccinin GG, *et. al.,* 2013)

Farmers that grew BT cotton saw a reduction in the number of pesticides they used that ranged from 50 to 80 percent, while also seeing a gain in their revenues of up to 36 percent. By the year 2004, however, farmers who had been producing BT cotton for many years discovered that the advantages of the crop had diminished as populations of secondary insect pests such as mirids rose. (Khan AG 2005) This was the case because the crop had been exposed to more of these secondary insect pests. During the growth season, farmers had to use broad-spectrum pesticides again. Thus, BT farmers earned 8% less than conventional cotton growers. BT resistance has also emerged in field populations of important cotton pests including the cotton bollworm (Helicoverpa armigera) and the pink bollworm (Pectinophora gossypiella). Cotton bolls are their food.(Zahedi H., 2016)

VII. ORGANIC FARMING IN DRYLANDS

Organic farming's significance has not been lost on the dryland areas. Drylands in India are perfect for organic farming due to the temperature and soil composition found there. These outlying regions, with their similarly poor-quality soils, are not ideal for intensive farming. (Lee S, *et. al.,*2002) These work best in low-input farming systems that heavily rely on natural diversity. Organic farming, on the other hand, may have a positive impact on the economic and ecological well-being of the drylands and the people who live there because of its central focus on conserving and improving soil health, its avoidance of pollutants, and its reliance on local inputs and labor. Semiarid and arid environments often have soils that are low in organic matter and water retention capacity.(Turan M, *et. al.*, 2006).

The depth of certain soils may also prevent agricultural growth. Organic matter, a crucial component of organic farming, increases dryland soils' physical condition and capacity to provide plants with a balanced nutritional composition. There is an excessive amount of exploitation of natural resources occurring in drylands, mainly as a result of the incorrect use of production-enhancing technology. (Lupwayi NZ, *et. al.*,2000) For instance, the usage of tractors may lead to an increase in wind erosion and can interfere with the process by which trees and grasses naturally regenerate. Both water logging and salinity may be caused by incorrect or excessive use of canal irrigation systems. (Rajendra Prasad, 2005)

The groundwater table has plummeted in tube well-watered areas due to excessive pumping. In intensive-input agricultural regions, severe pests are acquiring resistance to synthetic pesticides and soil fertility is diminishing. These are symptoms of improper land usage, which may lead to desertification. Dryland organic farming can help. Due to the region's changeable environment, drylands agriculture frequently includes a diversity of plant, animal, and grass species. (Rao DLN 2001) Diverse methods have been proven to recycle nutrients and restore soil fertility, which is organic farming's main aim. Pests also decrease. Traditional Indian farmers have a lot of information about soil fertility and pest control through years of observation and experience, which may be leveraged to improve organic systems. These two factors will speed up organic farming system development in affected areas. Industrial aid and organic farming are common in the drylands. (Negi S, *et. al.*, 2006)

VIII. SOIL FERTILITY IN ORGANIC FARMING

Over the previous two decades, India's rich agricultural soils have depleted rapidly due to agricultural production methods. Despite their goal of increasing agricultural productivity, this has been the case. Chemically marketable agricultural goods were prioritized over the nutrients cycle. The green revolution changed this paradigm. As Punjab has shown, factory-made NPK cannot restore soil fertility, and improving agricultural productivity requires returning some of the land's organic products to the soil. (Raj SN, *et. al.*,2003)Markets can't measure output and yields, and technology and operating outside of nature's ecological processes can't be done without hurting productivity. The green revolution's innovations led to the belief that chemical manufacturers can create rich soil and that agricultural output can only be measured by sales. Nitrogen-fixing pulses declined. Millets, which are marginal crops but restore organic matter to the soil, were ignored. The green revolution miracle cost-benefit analysis ignored biological inputs that were not for sale but were needed to maintain soil fertility. They were not purchased or sold; thus, they weren't inputs or outputs. (Miransiri M., 2010)

IX. FARM YARD MANURE

One of the main ways to make up for lost soil is the FYM. It adds organic matter

(SOM) to the soil, which indicates life, health, and production potential. Plant biomass is the only input needed to enhance soil organic matter. Organic manures cover crops and improve soil texture in dry places. They protect crops from temperature extremes and promote seed germination, soil water retention, and soil bacterium growth. (Persello-Cartieaux F, *et. al.*,2003) Organically cultivated soils are more drought- and nutrient-resistant than conventionally farmed soils. Organic farming may help combat desertification and prevent soil deterioration. Modern agriculture neglects soil nutrition for plant nutrition. When we fertilize the soil, we merely need to restore the nutrients taken out by the seed. This requirement may be met by soybeans and other nitrogen-fixing plants. With minimal fertilizer, you can grow organically. (Kokalis-Burelle N, *et. al.*, 2006)

The green revolution's economic framework values waste as the only way to sustain agriculture. Those that prioritized profit above soil health cannot fix it. If agriculture is organized by the market, soil health cannot recover. Reviving ancient rejuvenation methods and recognizing the soil's freedom to freely disperse its output would restore soil health. (Noling JW, *et. al.*,2001) To accommodate your requirements, you must respect our rights. Farming relies on animal husbandry. Livestock generates excess cash and local jobs in rural areas. Livestock contributes directly to agriculture via manure production, and they may also affect organic carbon availability in the soil through their grazing habits. (Sharma, H., *et. al.*, 2022)

Using animal dung to fertilize crops helps farmers. With the high cost of mineral fertilizers, farmers may use manure more to maintain soil fertility. Every healthy agricultural system needs cattle for soil fertility, draught power, and family food. While historical ties between trees and cattle have weakened, nutrient management systems have become more centralized. Increasing a family's livestock income allows them to spend more on non-farm inputs, which boosts their productivity. Most marginal, small, and medium-sized farmers cannot earn enough from their land to provide for their families year-round, therefore animal husbandry is a viable alternative. (Mantelin S, *et. al.*,2004) Andhra Pradesh's livestock business is undergoing significant change. There has been a slowdown in the expansion of the draught animal stock whereas the expansion of the milk animal stock has been comparatively fast. Also on the rise rapidly is the usage of crossbred animals in the dairy industry. Reasons for this include a general trend toward less available labor as well as smaller farm sizes, more reliance on machines, shrinking CPR areas, and fewer CPRs overall. Because of this, there will be a dramatic reduction in the available manure. (Kloepper JW, *et. al.*,2004)Integrated farming and indigenous land-use systems, in which livestock maintains nutrient cycles and soil fertility, must be strengthened to conserve native animal species. Native animal breeds are vital for food security and economic stability. A panel of farmers from Prajateerpu ruled that corporate agriculture's "Vision 2023" policy harms livestock biodiversity. (Li J, *et. al.*,2000)They called for significant government aid and educational and scientific endeavors to bring cattle back into agriculture. Cow genetic variability, draught power, natural fertilizers, livelihoods, and family assets are declining due to declining feed and water availability and blanket animal breeding. It'll drop more. (Gray EJ, *et. al.*,2005) Farmers that prioritize crop and animal husbandry and post-harvest technology think that better integrating crop and livestock systems, recycling crop leftovers, and employing alternative nutrients will increase agricultural production. This model would analyze crop, animal, and post-harvest technologies to maximize the small farm's income and employment.

Understanding the various farming practices in use is crucial before beginning any large-scale agricultural research endeavor.(Sharma, H., *et. al.,* 2021)

Rainfed habitats lack animal labor. We need to recognize necessary and timely draught power demands in production systems as well as extended consumption of existing power during less critical moments. Cattle production, which generates its own money, reduces agricultural enterprises' income volatility (Anonymous, undated). The nutrient management system has collapsed due to weaker forest-livestock linkages. (Barassi CA, *et. al.,*2000) Small farmers earn more than other enterprises because of this. Dairy and poultry farms earn more. A reduction in common property resource regions reduces soil nutrients. Decline causes this. To sum up, animals boost agricultural output by sustaining soil fertility, supplying draught power, and feeding the farm family.(Minorsky PV., 2008)

This means that modern land-use patterns significantly affect the factors that define soil health. This is because, although these strategies increase the availability of material goods in the here and now, they also threaten a wide range of ecosystem services on a local, national, and international scale. (Çakmakçi R, *et. al.,*2006) For instance, these disturbances might reduce the biomass of dominant species and cause changes to the physical structure of the substrate. Agriculture lowers soil carbon and alters aggregate distribution and stability. This causes the soil to lose its macro aggregates, which are rich in carbon, and accumulate micro aggregates, which are low in carbon. Increased land use and soil disturbances have direct effects on soil aggregation, whereas influences on biotic and abiotic components that drive soil aggregation have indirect impacts. (Selva kumar G, *et. al.,* 2009)

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