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NATURAL FARMING AS A SUSTAINABLE AGRICULTURAL PRACTICE: SCOPE AND FUTURE PROSPECTS

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Abstract

Agriculture forms the backbone of many developing economies and plays a vital role in ensuring food security, employment generation, and rural development. Over the past several decades, conventional agricultural practices characterized by intensive use of chemical fertilizers, pesticides, and synthetic inputs have significantly increased crop productivity. However, these practices have also contributed to environmental degradation, soil fertility loss, water pollution, biodiversity decline, and increasing production costs. In response to these challenges, natural farming has emerged as a sustainable agricultural approach that seeks to restore ecological balance while maintaining agricultural productivity. Natural farming emphasizes the utilization of locally available natural resources, biological processes, and ecological principles instead of synthetic chemical inputs. This approach promotes soil health, biodiversity conservation, environmental sustainability, and economic resilience among farmers. The growing concern regarding climate change, food safety, and sustainable development has increased global interest in natural farming. This paper examines the concept, principles, evolution, significance, and scope of natural farming as a sustainable agricultural practice. It further analyzes the opportunities, challenges, and future prospects associated with the adoption of natural farming in India and across the world.

Keywords: *Natural Farming, Sustainable Agriculture, Organic Agriculture, Soil Health, Environmental Sustainability, Food Security, Climate Change.*

Introduction

Agriculture has historically been the foundation of human civilization and continues to play a crucial role in economic development and food security. The growing global population, increasing demand for food, and pressure on natural resources have encouraged the adoption of

intensive agricultural practices aimed at maximizing productivity. The Green Revolution of the twentieth century transformed agricultural production through the extensive use of high-yielding varieties, chemical fertilizers, pesticides, irrigation systems, and mechanization. While these innovations contributed significantly to food production and reduced hunger in many countries,

they also generated serious environmental and ecological concerns.

The continuous use of chemical fertilizers and pesticides has adversely affected soil fertility, water quality, biodiversity, and ecosystem health. Excessive dependence on external agricultural inputs has increased production costs and reduced the sustainability of farming systems. Farmers in many regions face declining soil productivity, increasing pest resistance, groundwater depletion, and environmental degradation. These challenges have raised important questions regarding the long-term viability of conventional agricultural practices and highlighted the need for more sustainable alternatives.

Natural farming has emerged as a promising response to these concerns. Unlike conventional farming systems that rely heavily on synthetic chemicals, natural farming seeks to work in harmony with nature by utilizing biological processes and locally available natural resources. The philosophy of natural farming is based on the belief that nature possesses inherent mechanisms for maintaining soil fertility, controlling pests, and sustaining ecological balance. Rather than attempting to dominate natural processes, natural farming emphasizes cooperation with natural ecosystems.

The increasing awareness regarding environmental sustainability, food safety, climate change, and public health has contributed to the growing popularity of natural farming across the world. Consumers are becoming increasingly concerned about the presence of chemical residues in food products, while governments and international organizations are exploring sustainable agricultural models capable of balancing productivity with environmental protection. In this context, natural farming has gained recognition as a viable strategy for promoting sustainable agricultural development and ensuring long-term food security.

Concept and Meaning of Natural Farming

Natural farming refers to a system of agriculture that minimizes or completely avoids the use of synthetic fertilizers, pesticides, herbicides, and other chemical inputs. It is based upon the

principle that nature is capable of maintaining ecological balance and agricultural productivity when allowed to function without excessive human intervention. Natural farming seeks to create self-sustaining agricultural ecosystems that depend upon biological diversity, natural nutrient cycles, and locally available resources.

The concept of natural farming gained international recognition through the work of Japanese agricultural scientist **Masanobu Fukuoka**, who is widely regarded as the pioneer of modern natural farming. Fukuoka developed a farming philosophy based on minimal intervention and ecological harmony. His famous work, *The One-Straw Revolution*, emphasized that nature possesses an inherent capacity to sustain productivity without reliance upon synthetic chemicals and intensive cultivation practices. According to Fukuoka, excessive human interference often disrupts natural ecological processes and creates problems that subsequently require additional interventions.

Natural farming differs from conventional agriculture in its fundamental approach to soil fertility and pest management. Rather than relying on externally purchased chemical inputs, natural farming utilizes biological resources such as cow dung, cow urine, compost, crop residues, green manure, and beneficial microorganisms. These materials contribute to soil fertility, enhance microbial activity, and improve the overall health of agricultural ecosystems. Pest management relies primarily on biological control mechanisms, ecological balance, and natural formulations prepared from locally available materials.

In India, natural farming has gained considerable attention through the efforts of agricultural practitioners and policymakers promoting environmentally sustainable farming methods. The approach has been popularized through initiatives such as Zero Budget Natural Farming, which emphasizes reducing dependence on external inputs and minimizing production costs. Natural farming seeks to enhance farmers' self-reliance while simultaneously improving environmental sustainability and agricultural resilience.

Principles of Natural Farming

The philosophy of natural farming is guided by several fundamental principles that distinguish it from conventional agricultural systems. One of the most important principles is the maintenance of soil health through natural biological processes. Healthy soil is regarded as a living ecosystem containing microorganisms, earthworms, insects, and organic matter that collectively contribute to nutrient cycling and plant growth. Natural farming seeks to enhance these biological processes rather than replace them with synthetic fertilizers.

Another important principle involves the conservation of biodiversity. Natural farming encourages the cultivation of diverse crops, trees, and beneficial organisms within agricultural landscapes. Biodiversity contributes to ecological stability, reduces vulnerability to pests and diseases, and enhances resilience against environmental stresses. Mixed cropping, crop rotation, agroforestry, and integration of livestock are commonly employed to promote biodiversity and strengthen ecological interactions.

Natural farming also emphasizes the recycling of agricultural resources within the farm ecosystem. Crop residues, animal waste, organic matter, and biological materials are utilized to maintain soil fertility and reduce dependence on external inputs. This approach contributes to resource efficiency and supports the development of self-sustaining agricultural systems.

Water conservation represents another significant principle of natural farming. Sustainable water management practices such as mulching, soil moisture conservation, rainwater harvesting, and organic matter enhancement help improve water-use efficiency and reduce pressure on groundwater resources. These practices are particularly important in regions facing water scarcity and climate-related challenges.

The principle of ecological harmony lies at the core of natural farming. Rather than treating nature as an adversary that must be controlled through chemicals and intensive interventions, natural farming seeks to cooperate with ecological processes. This perspective recognizes that sustainable agricultural productivity depends upon maintaining healthy ecosystems and preserving

the natural resources upon which farming ultimately depends.

Need for Natural Farming in the Contemporary Era

The growing importance of natural farming can be understood in the context of contemporary environmental, economic, and social challenges. Modern agriculture faces increasing pressure from climate change, soil degradation, biodiversity loss, water scarcity, and rising production costs. The intensive use of synthetic chemicals has generated significant environmental concerns, including pollution of water bodies, contamination of food products, and disruption of ecological systems.

Soil degradation has emerged as one of the most serious threats to agricultural sustainability. Continuous application of chemical fertilizers often reduces organic matter content and adversely affects soil microbial activity. As soil health deteriorates, productivity becomes increasingly dependent upon external inputs, creating a cycle of dependency that can be economically burdensome for farmers. Natural farming offers an alternative approach focused on restoring soil fertility through biological processes and organic matter enrichment.

Climate change further underscores the need for sustainable agricultural practices. Rising temperatures, changing precipitation patterns, extreme weather events, and increasing frequency of droughts and floods pose significant risks to agricultural production. Natural farming systems characterized by improved soil health, greater biodiversity, and enhanced ecological resilience may be better equipped to adapt to these challenges. By reducing dependence on synthetic inputs and promoting carbon sequestration, natural farming can also contribute to climate change mitigation efforts.

Public concern regarding food safety has likewise contributed to growing interest in natural farming. Consumers increasingly prefer food products produced without excessive chemical inputs and are willing to support sustainable agricultural practices that promote environmental and human health. This shift in consumer preferences creates new opportunities for farmers adopting natural

farming methods and encourages the development of sustainable food systems.

Advantages, Economic Significance, Environmental Benefits, and Scope of Natural Farming

Natural farming has attracted considerable attention because of its potential to address multiple challenges facing contemporary agriculture. Unlike conventional agricultural systems that often require substantial financial investments in fertilizers, pesticides, herbicides, and other external inputs, natural farming seeks to create a self-sustaining agricultural ecosystem. The benefits of this approach extend beyond crop production and encompass environmental conservation, economic sustainability, social well-being, and long-term agricultural resilience. These advantages have encouraged researchers, policymakers, and farming communities to explore natural farming as a viable alternative to chemically intensive agricultural practices.

One of the most significant advantages of natural farming is its positive impact on soil health. Soil constitutes the foundation of agricultural productivity, and its quality directly influences crop growth, nutrient availability, water retention, and ecosystem functioning. Conventional farming practices often result in declining soil fertility due to excessive use of synthetic fertilizers and pesticides. Natural farming, in contrast, emphasizes the restoration of soil as a living ecosystem. The application of organic matter, biological inputs, and natural formulations enhances microbial activity, increases organic carbon content, and improves soil structure. Healthy soils are better able to retain moisture, resist erosion, and support sustainable crop production over extended periods.

The environmental benefits of natural farming are equally significant. Modern agriculture is frequently associated with environmental challenges such as water pollution, soil degradation, biodiversity loss, and greenhouse gas emissions. Chemical fertilizers and pesticides often contaminate rivers, lakes, and groundwater resources, affecting both ecosystems and human health. Natural farming minimizes these risks by reducing or eliminating synthetic chemical inputs. The adoption of environmentally friendly

practices contributes to the preservation of natural resources and supports the long-term sustainability of agricultural landscapes.

Biodiversity conservation represents another important benefit of natural farming. Agricultural intensification has often resulted in the simplification of ecosystems and the decline of beneficial organisms. Natural farming encourages the cultivation of diverse crops and promotes ecological interactions among plants, insects, microorganisms, and animals. Greater biodiversity enhances ecosystem stability, reduces vulnerability to pests and diseases, and strengthens resilience against environmental disturbances. The preservation of biodiversity is particularly important in the context of climate change, where diverse ecosystems are generally better equipped to adapt to changing environmental conditions.

Water conservation is a critical issue in many agricultural regions, particularly in countries experiencing increasing water scarcity. Natural farming contributes to sustainable water management through practices that improve soil moisture retention and reduce water wastage. The incorporation of organic matter into soil enhances its ability to retain water, while mulching reduces evaporation losses and protects soil from extreme temperatures. These practices help farmers utilize water resources more efficiently and reduce dependence on irrigation. In regions facing irregular rainfall patterns and declining groundwater levels, such improvements can significantly enhance agricultural sustainability.

The economic significance of natural farming is particularly relevant for small and marginal farmers. Rising costs of agricultural inputs have become a major concern in many farming communities. Expenditure on chemical fertilizers, pesticides, hybrid seeds, and other inputs often constitutes a substantial portion of production costs. Dependence on external inputs may also expose farmers to market fluctuations and financial uncertainty. Natural farming reduces reliance on purchased inputs by encouraging the use of locally available resources such as farmyard manure, compost, crop residues, and biological formulations. As a result, farmers can lower production costs and improve economic self-reliance.

The reduction of input costs is especially important in developing countries where many farmers operate on small landholdings and possess limited financial resources. High levels of indebtedness among farming households are often linked to increasing production expenses and unstable market returns. By minimizing expenditure on external inputs, natural farming can contribute to greater economic stability and reduce financial vulnerability. Furthermore, improved soil health and ecosystem functioning may enhance long-term productivity, thereby supporting sustainable agricultural livelihoods.

Natural farming also creates opportunities for value addition and market differentiation. Consumer demand for environmentally friendly and chemical-free food products has increased significantly in recent years. Many consumers are willing to pay premium prices for products perceived as healthier and more sustainable. Farmers practicing natural farming may therefore benefit from access to specialized markets and improved profitability. The development of certification systems, direct marketing channels, and sustainable supply chains can further strengthen economic opportunities associated with natural farming.

Another important advantage of natural farming is its contribution to food quality and nutritional security. Concerns regarding pesticide residues and chemical contamination have generated increasing public interest in naturally produced food. Natural farming seeks to produce crops without excessive chemical intervention, thereby reducing potential health risks associated with synthetic inputs. Although debates continue regarding comparative productivity and nutritional outcomes, many consumers perceive naturally produced foods as safer and more environmentally responsible. This perception has contributed to the growing popularity of natural farming in both domestic and international markets.

The social dimensions of natural farming are equally noteworthy. Sustainable agricultural practices contribute to rural development by strengthening local resource utilization and reducing dependence on external suppliers. Natural farming encourages the preservation of traditional agricultural knowledge and promotes community-based approaches to resource management. The emphasis on local resources and

ecological sustainability aligns closely with broader objectives of rural empowerment and community resilience. In many regions, natural farming has also facilitated knowledge-sharing networks and collaborative learning among farmers.

The relevance of natural farming has become particularly evident in the context of climate change. Agriculture is both a contributor to and a victim of climate change. Conventional farming practices often involve significant greenhouse gas emissions associated with fertilizer production, transportation, and intensive cultivation. Natural farming reduces dependence on synthetic inputs and promotes carbon sequestration through improved soil management. Increased organic matter content enhances the capacity of soils to store carbon, thereby contributing to climate change mitigation efforts.

In addition to mitigation, natural farming supports climate adaptation. Agricultural systems characterized by healthy soils, biodiversity, and ecological resilience are generally better able to withstand climatic shocks such as droughts, floods, and temperature fluctuations. Enhanced soil moisture retention, diversified production systems, and reduced dependence on external inputs improve the adaptive capacity of farming communities. These characteristics make natural farming particularly relevant in regions vulnerable to climate-related risks.

The scope of natural farming in India is substantial due to the country's diverse agro-climatic conditions, extensive agricultural base, and large population of smallholder farmers. Indian agriculture faces numerous challenges, including declining soil fertility, groundwater depletion, increasing production costs, and environmental degradation. Natural farming offers potential solutions to many of these problems by promoting resource conservation and sustainable agricultural practices. Furthermore, the availability of livestock resources and traditional agricultural knowledge provides a strong foundation for the adoption of natural farming methods.

Government initiatives have played an important role in promoting natural farming in India. The Government of India has increasingly recognized the importance of sustainable agricultural practices and has introduced various programs to

support natural farming. One notable initiative is the , which seeks to encourage the adoption of natural farming practices and reduce dependence on chemical inputs. Several state governments have also launched programs aimed at promoting sustainable agriculture, farmer training, and ecological farming methods.

States such as Andhra Pradesh, Himachal Pradesh, Gujarat, and Uttarakhand have undertaken significant efforts to expand natural farming initiatives. Andhra Pradesh, in particular, has attracted international attention for its large-scale efforts to promote community-based natural farming. Such initiatives demonstrate the growing recognition of natural farming as an important component of sustainable agricultural development. Training programs, demonstration projects, farmer field schools, and extension services have contributed to increasing awareness and adoption of natural farming practices.

The scope of natural farming extends beyond agriculture and encompasses broader objectives of environmental sustainability and rural development. As concerns regarding climate change, biodiversity conservation, and sustainable resource management continue to grow, natural farming is likely to assume increasing importance within agricultural policy frameworks. Educational institutions, research organizations, and development agencies are also becoming more actively involved in studying and promoting sustainable farming systems. This growing interest creates opportunities for innovation, capacity building, and policy support.

Nevertheless, the expansion of natural farming requires continued research, institutional support, market development, and farmer education. The successful integration of natural farming into mainstream agricultural systems depends upon the availability of scientific evidence, effective extension services, and supportive policy environments. Addressing these requirements will be essential for realizing the full potential of natural farming as a sustainable agricultural practice.

Challenges, Future Prospects, Critical Analysis, and Conclusion

Despite its numerous environmental, economic, and social advantages, natural farming faces several challenges that affect its widespread adoption and long-term sustainability. While proponents of natural farming emphasize its potential to restore ecological balance and reduce dependence on synthetic inputs, critics often question its scalability, productivity, and ability to meet the food demands of a rapidly growing population. A balanced assessment of natural farming therefore requires an examination of both its strengths and limitations.

One of the most frequently discussed challenges relates to crop productivity during the transition period from conventional to natural farming. Agricultural lands that have been subjected to intensive chemical use for extended periods often require time to restore soil health and biological activity. During this transition phase, farmers may experience temporary reductions in crop yields as ecological processes gradually re-establish themselves. Such yield fluctuations can create uncertainty for farmers who depend upon agriculture as their primary source of income. Consequently, many farmers remain hesitant to adopt natural farming practices despite recognizing their long-term benefits.

Another challenge concerns the availability of scientific evidence and large-scale empirical data. Although numerous case studies and field experiences have demonstrated positive outcomes associated with natural farming, researchers continue to debate the extent to which these results can be generalized across diverse agro-climatic conditions. Agricultural systems vary significantly in terms of soil characteristics, rainfall patterns, cropping systems, and socio-economic contexts. Therefore, comprehensive scientific research is necessary to evaluate the long-term productivity, economic viability, and ecological impacts of natural farming under different conditions. Strengthening the scientific foundation of natural farming will be essential for increasing its credibility among policymakers, researchers, and farming communities.

Knowledge and training constitute additional challenges. Natural farming requires a thorough

understanding of ecological processes, soil biology, crop interactions, and natural resource management. Unlike conventional agriculture, where crop management often depends upon standardized chemical inputs, natural farming involves greater reliance upon local knowledge and site-specific practices. Farmers may require specialized training and continuous technical support to successfully adopt and maintain natural farming systems. The absence of adequate extension services and educational programs can limit the effectiveness of natural farming initiatives, particularly in regions where awareness remains low.

Market-related issues also influence the adoption of natural farming. Although consumer demand for chemical-free and environmentally sustainable food products is increasing, market infrastructure for naturally produced goods remains underdeveloped in many areas. Farmers frequently encounter difficulties in obtaining premium prices for their products because of limited certification mechanisms, inadequate market access, and lack of consumer awareness. The development of efficient supply chains, certification systems, and marketing networks is therefore essential for improving the economic viability of natural farming.

Labour requirements may present another challenge in certain contexts. Some natural farming practices involve greater labour inputs compared to mechanized conventional farming systems. Activities such as compost preparation, biological input production, mulching, and diversified crop management may require additional time and effort. In regions experiencing labour shortages or rising labour costs, these requirements can affect the attractiveness of natural farming. However, the impact of labour requirements varies considerably depending upon local conditions and farming practices.

The policy environment also plays a crucial role in determining the future of natural farming. For many decades, agricultural policies in numerous countries have emphasized productivity enhancement through chemical fertilizers, pesticides, and high-yielding varieties. Transitioning towards sustainable agricultural systems requires policy reforms that recognize the ecological and social benefits of natural farming. Financial incentives, research investments,

extension services, market support, and capacity-building programs are necessary to facilitate this transition. Without appropriate policy support, the adoption of natural farming may remain limited despite its potential benefits.

A critical analysis of natural farming reveals that it should not be viewed merely as a rejection of modern agricultural science but rather as an attempt to integrate ecological principles into agricultural production systems. The debate between conventional and natural farming is often presented as a conflict between productivity and sustainability. In reality, the challenge lies in identifying agricultural approaches capable of simultaneously ensuring food security, environmental protection, and economic viability. Natural farming contributes valuable insights into sustainable resource management, biodiversity conservation, and ecological resilience. However, its successful implementation requires careful adaptation to local conditions and continued scientific evaluation.

The future prospects of natural farming appear promising in light of growing global concerns regarding climate change, environmental degradation, food safety, and sustainable development. International organizations, governments, research institutions, and civil society groups increasingly recognize the importance of sustainable agricultural practices. Global initiatives aimed at achieving the Sustainable Development Goals emphasize the need for environmentally responsible food production systems capable of supporting both human well-being and ecological integrity.

Climate change is likely to further increase the relevance of natural farming in the coming decades. Agricultural systems based on ecological principles often demonstrate greater resilience to climatic stresses such as droughts, floods, and temperature fluctuations. Improved soil health, enhanced biodiversity, and reduced dependence on external inputs contribute to the adaptive capacity of farming communities. As climate-related risks intensify, sustainable farming practices are expected to play an increasingly important role in ensuring agricultural resilience and food security.

Technological advancements may also support the future development of natural farming. Modern

scientific tools can be utilized to improve understanding of soil microbiology, ecosystem functioning, and sustainable resource management. Digital agriculture, remote sensing, climate forecasting, and precision monitoring technologies can complement natural farming practices and enhance their effectiveness. The integration of traditional ecological knowledge with contemporary scientific innovations offers significant opportunities for developing sustainable agricultural systems capable of addressing future challenges.

Educational institutions and research organizations are expected to play a crucial role in shaping the future of natural farming. Increased investment in research, farmer training, and extension services can contribute to evidence-based decision-making and wider adoption of sustainable practices. Universities and agricultural research centres have the opportunity to conduct interdisciplinary studies examining the agronomic, ecological, economic, and social dimensions of natural farming. Such research will be essential for generating reliable knowledge and informing policy development.

The growing demand for healthy and environmentally sustainable food products also supports the future prospects of natural farming. Consumers around the world are becoming increasingly conscious of food quality, environmental sustainability, and ethical production practices. This shift in consumer preferences creates economic opportunities for farmers adopting sustainable agricultural methods. As awareness continues to expand, market demand for naturally produced food is likely to increase, encouraging further investment in natural farming systems.

Conclusion

Natural farming has emerged as a significant approach to sustainable agricultural development in response to the environmental, economic, and social challenges associated with conventional agriculture. By emphasizing ecological balance, soil health, biodiversity conservation, and reduced dependence on synthetic inputs, natural farming offers a holistic framework for achieving agricultural sustainability. Its potential benefits extend beyond crop production and include

environmental protection, climate resilience, economic self-reliance, food safety, and rural development. The increasing degradation of natural resources, rising production costs, and growing concerns regarding climate change have highlighted the need for alternative agricultural models capable of balancing productivity with sustainability. Natural farming addresses many of these concerns by promoting resource-efficient and environmentally responsible farming practices. The experiences of farmers and communities adopting natural farming demonstrate its potential to enhance ecological resilience and improve long-term agricultural sustainability.

At the same time, the successful expansion of natural farming requires addressing important challenges relating to productivity, scientific validation, training, market development, and policy support. Sustainable agricultural transformation cannot be achieved solely through technological innovations or policy interventions; it requires active participation by farmers, researchers, governments, and consumers. Collaborative efforts among these stakeholders will be essential for creating supportive environments in which natural farming can flourish. The future of agriculture will depend upon the ability of societies to develop food production systems that respect ecological limits while meeting human needs. Natural farming offers a valuable pathway toward this objective by demonstrating that agricultural productivity and environmental sustainability need not be mutually exclusive. As awareness regarding sustainable development continues to grow, natural farming is likely to play an increasingly important role in shaping the future of global agriculture. Its emphasis on harmony with nature, resource conservation, and long-term resilience makes it a promising strategy for ensuring food security and environmental sustainability for future generations.

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