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ANKUR

NATURAL FARMING

DEPARTMENT OF BOTANY, BIOINFORMATICS AND CLIMATE CHANGE IMPACTS MANAGEMENT,

SCHOOL OF SCIENCES

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ANKUR

……Sprouting of thoughts

Ankur is symbol of new beginning towards growth. And Ankur is here to introduce budding writers. It would represent interesting articles in Botany, Bioinformatics and Climate Change Impacts Management. Each seed has the innate potential to grow - blossom, and display its magnificence after its dormancy has been broken. Same way this Newsletter would provide a platform to young researchers to share news and views, promote awareness about the subjects and generate interest in related issues. Ankur would be taken care of by a team of dedicated Student Editors who would select and edit articles for online publication.

We wish Team Ankur all the best for this endeavor.

FROM EDITOR'S DESK….

Ankur has reached the milestone of eleven years, marking a significant journey for our newsletter, which will now be published biannually. This publication reflects the growth of Ankur and the students in our department, fostering awareness and interaction among us all. Over the past eleven years, Ankur has flourished, spreading the vital message of the importance of plants.

In this edition, we spotlight **Natural Farming,** emphasizing its benefits and techniques that promote sustainable agricultural practices. Natural farming not only enhances soil health and biodiversity but also reduces reliance on chemical fertilizers and pesticides, leading to healthier ecosystems. As we delve into this topic, we aim to inspire our community to adopt practices that honor nature while ensuring food security. Through articles, we hope to ignite a passion for sustainable agriculture in our readers. Join us on this journey as we explore how natural farming can contribute to a greener future for all.

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Dr. Hitesh Solanki

Dr. Himanshu Pandya

Dr. Bharat Maitreya

Dr. Nainesh Modi

Dr. Saumya Patel

Mr. Parth Desai

PATRON'S MESSAGE

NATURAL FARMING AS A PATH TO A SUSTAINABLE FUTURE

Natural farming represents a transformative approach to agriculture that prioritizes sustainability and affordability, offering a viable alternative to the chemical-intensive practices that often lead to farmer debt and environmental harm. By relying on natural inputs such as cow dung, cow urine, and ecological pest management techniques, farmers can enhance soil health, reduce production costs, and promote biodiversity. This method not only mitigates the health risks associated with synthetic chemicals but also contributes to the resilience of agricultural ecosystems.

Moreover, natural farming fosters a deeper connection between farmers and their land, encouraging practices that respect and restore the environment. It empowers communities by promoting local seed varieties and traditional knowledge, ensuring food security while preserving cultural heritage. As we explore the principles and benefits of natural farming in this journal, let us advocate for its adoption and spread awareness about its potential to create a more sustainable and equitable agricultural future. Together, we can inspire a movement towards healthier farming practices that benefit both people and the planet.

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EMPOWERING FARMERS: GOVERNMENT SCHEMES FOR NATURAL FARMING IN INDIA

Prof. Hitesh A. Solanki

Natural farming schemes in India, aim to combat issues like soil degradation and chemical dependency in agriculture. These initiatives promote sustainable practices by offering training, financial support, and resources to farmers, facilitating a transition to organic methods. ZBNF specifically enhances soil fertility, conserves water, and lowers input costs, ultimately boosting farmer incomes and environmental health. By fostering local value chains and minimizing chemical residues, these programs contribute to a resilient agricultural system aligned with India's sustainability goal.

Here are the two main schemes related to natural farming:

1) BHARTIYA PRAKRITIK KRISHI PADDHATI (BPKP)

The Bhartiya Prakritik Krishi Paddhati (BPKP), formerly known as Zero Budget Natural Farming (ZBNF), has been promoted by the Indian government since 2019 as a sub-scheme under the Paramparagat Krishi Vikas Yojana (PKVY). This initiative aims to revive traditional indigenous farming practices, freeing farmers from reliance on externally purchased inputs. BPKP emphasizes on-farm biomass recycling, focusing on techniques such as biomass mulching and the use of cow dung and urine formulations, while completely excluding synthetic chemical inputs.

Financial Assistance and Support

Under BPKP, farmers receive financial assistance of ₹12,200 per hectare for a duration of three years. This support is designed to facilitate the transition to natural farming methods and improve overall agricultural sustainability.

Key Components of BPKP

Sr.no.	Component/s	Benefit/s
1	Manpower Deployment and Management	A budget of ₹4,500 per hectare is allocated over three years for effective implementation and data management
2	Cluster Formation and Capacity Building	The program supports the formation of farmer clusters and provides training, with funding of ₹3,000 per hectare over three years.
3	PGS Certification and Residue Analysis	Farmers receive assistance for obtaining Participatory Guarantee System (PGS) certification and conducting residue analysis, with an allocation of ₹2,700 per hectare over three years.
4	Direct Benefit Transfer (DBT)	An incentive for farmers has been established through DBT, reduced from ₹31,000 per hectare to ₹2,000 per hectare, encouraging participation in natural farming practices.

This scheme is a forward-thinking initiative aimed at promoting natural and traditional farming practices across India.

2) THE NATIONAL MISSION ON NATURAL FARMING (NMNF)

To further motivate farmers to adopt chemical free farming and enhance the reach of natural farming, the Government has formulated National Mission on Natural Farming (NMNF) as a separate and independent scheme from 2023-24 by up scaling the Bhartiya Prakritik Krishi Paddati (BPKP). The success of NMNF will require behavioral change in farmers to shift from chemical based inputs to cow based locally produced inputs and thus requires continuous creation of awareness, training, handholding and capacity building of farmers in the initial years

OBJECTIVES OF NMNF:

- **Promoting Alternative Farming:** Encouraging farmers to reduce reliance on purchased inputs and increase income.
- **Integrated Agriculture Models:** Advocating for models that incorporate animal husbandry using local resources, particularly desi cows.
- **Documentation and Research:** Collecting and validating natural farming practices while fostering participatory research with farmers.
- **Awareness and Capacity Building:** Conducting training and demonstrations to promote natural farming techniques.
- **Certification and Standards**: Establishing standards and branding for natural farming products in national and international market.

In conclusion, The Bhartiya Prakritik Krishi Paddhati and the National Mission on Natural Farming represent significant strides towards sustainable agriculture in India. By promoting traditional practices that enhance soil health and reduce chemical dependency, these initiatives empower farmers while preserving indigenous knowledge. As they continue to evolve, they hold the potential to transform India's agricultural landscape into one that is more resilient, eco-friendly, and aligned with global sustainability goals.

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THE ROLE OF MICROBES IN NATURAL FARMING

Prof. Himanshu A. Pandya

Natural farming is a relatively new idea that is becoming more and more acknowledged as an economical way to lessen the usage of artificial pesticides and fertilizers in agriculture. Numerous soil processes depend heavily on soil microorganisms. For instance, soil microorganisms aid in the breakdown of xenobiotics, aid in the sequestration of soil carbon, aid in the digestion of nutrients by encouraging the breakdown of organic compounds, and even offer protection against crop diseases. Our knowledge of the intricate connections and precise roles of microorganisms, as well as their taxonomic makeup, has improved thanks to recent advancements in microbial analytic technologies. For instance, amplicon sequencing, a database, and prediction techniques can be used to evaluate the nutrient-cycling capability of microbial communities. It has been observed that the calculated functional profiles match soil-nutrient relationships.

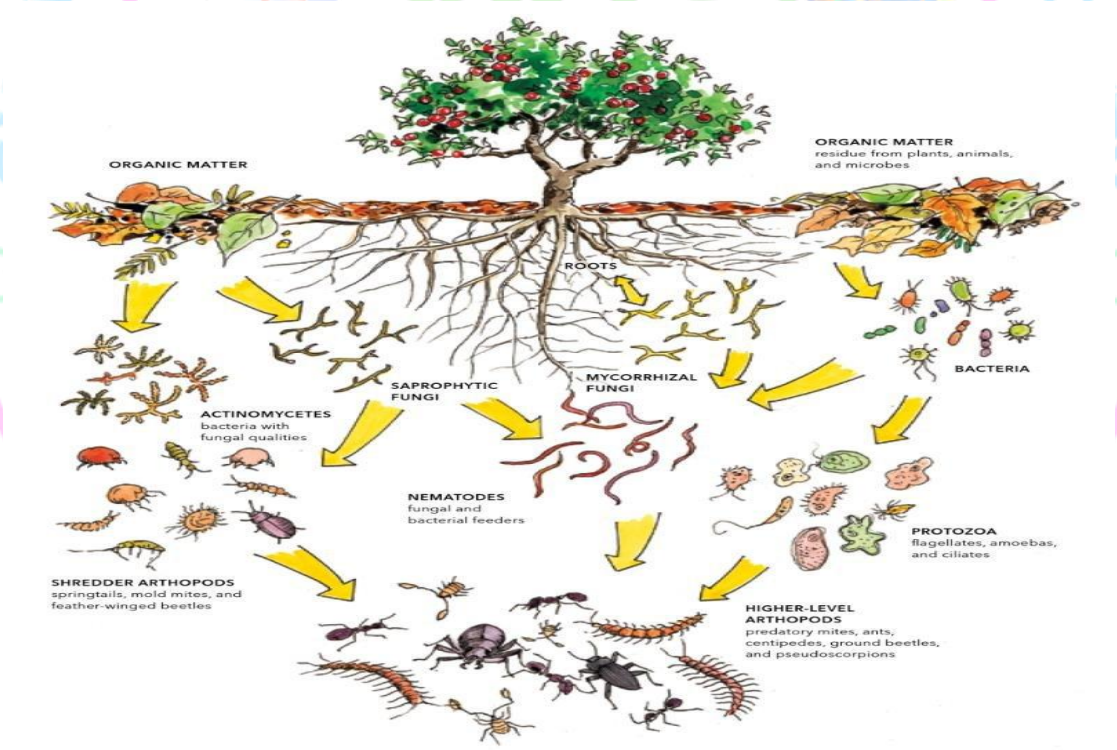

Figure 1 Interdependent and interconnected network of microorganisms with plants [Source: Kumar et al., (2020)]

In comparison to soil that has undergone chemical fertilization, the richness and diversity of root microorganisms are higher in natural farming circumstances. The following list includes some of the advantageous microorganisms that can be found in soil where nature farming is practiced:

1. Bradyrhizobum: It fixes atmospheric nitrogen and is called Plant Growth Promoting Rhizobacteria (PGPR).

2. The bacterial genera Curvibacter and Piscinibacter, which are Betaproteobacteria, are also abundant in the soil when nature farming is practiced. According to reports, the majority of betaproteobacteria are PGPR.

3. Haliangium: It produce haliangicin, an antifungal agent capable of restricting the growth of a broad range of fungi.

4. Fe - reducing bacteria: An increased population of iron-reducing bacteria, such as the genera Sideroxydans, Acidibacter, and Anaeromyxobacter, is present in soil where natural farming practices are upheld.

5. Higher populations of Curvibacter and Anaeromyxobacter are observed in soil that undergoes natural farming methods.

The microbial diversity of the soil is naturally increased by the bio-cultures created from the urine and dung of cow species. This process turns unavailable minerals into available forms, which eventually leads to disease-free, improved crop growth, and increased productivity.

In conclusion, the growing recognition of natural farming highlights its potential as an environmentally sustainable and cost-effective alternative to conventional agriculture. By reducing the reliance on chemical inputs, natural farming promotes the health of soil ecosystems, where beneficial microbes play a key role in nutrient cycling, organic matter breakdown, and disease suppression. The increased diversity and abundance of soil microbes in natural farming systems contribute to improved soil fertility and resilience

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NATURAL FARMING: NUTRITION OF THE SOIL

Prof. Bharat B. Maitreya

Agriculture is a culture of sacrifice. Nature has gifted us with food security through various resources. It is our moral duty as farmers to maintain the balance of nutrients to keep the soil fertile. the basic source of crop production, alive and nutritious. Adding nutrients to the soil that are necessary for crops does not fulfil our responsibility, but it is necessary to maintain the nutritional capacity of the soil for years and that is why we have turned towards organic farming from time to time. At this time, it was very important for the farming community to receive scientific information about the nutrition of the soil under organic farming. Under organic farming or natural farming, considering the need for information about soil nutrition and its nutritional management towards organic farming, it is also necessary to maintain a necessary effort, especially since soil is the basic element in the production of any agricultural product. In addition to soil fertility and its necessary maintenance to make the soil organic, its bulk density, the effect of organic fertilizer on the availability of elements like nitrogen, phosphorus, potash, etc. Plant nutrients, Essential nutrients are its major, secondary and microelements such as nitrogen, phosphorus, potash, sulfur, calcium, magnesium, zinc, iron, copper, manganese, boron, molybdenum, chlorine, nickel, etc.

Diagnosis of nutrient deficiencies in standing crops is also necessary. Apart from this, which are especially agricultural products, which have chemical, physical or biological effects, organic fertilizers are also required for soil fertility and nutrients of agricultural products. Especially the basic principles of making organic fertilizers, which keep in mind the carbon of organic matter and its sources such as compost, green padvas, fruits, organic fertilizer, Panchagavya, vermicomposting and vermis, for this, traditional farmer method or heap method is also necessary. Indore method, Bangalore method, Coimbatore method, Nadep pip Wire method etc. are necessary. The proportion of nitrogen, phosphorus or potash in organic fertilizers made by different methods is usually the traditional method, ideal Ukrada (Compost animal and plants waste) method, Indore method, Bangalore, Coimbatore, Chimney, Nade Pip Wire Cage for Amrut panchgavya, there is a restriction on the percentage of compost made from Earthworm and thus we can maintain the nutritional system in organic farming.

N, P, K (%) IN ORGANIC FERTILIZER MADE by Various METHODS

METHODS	Nitrogen	Phosphorus	Potash
Traditional Methods	0.34	0.09	0.22
Ideal Ukarda Methods	1.90	0.70	0.32
Indore	0.34	0.11	0.35
Bangalore	0.62	0.15	0.39
Coimbatore	0.98	0.57	0.46
Chimney	0.98	0.50	0.27
Nadep	1.26	0.37	0.51
Pip	1.76	0.88	0.19
Wire cage	0.98	0.52	0.24
Amrut Soil	0.42	0.11	0.27
Vermi compost	1.20	0.81	0.34

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NATURAL FARMING OR DO-NOTHING FARMING

Prof. Nainesh R. Modi

Prime Minister of India Mr. Narendra Modi is talking about the need of reduce the use of chemicals in agriculture and to promote natural and organic farming. Recently the Prime Minister urged all states to introduce natural farming. The Prime Minister observed, “We need to unlearn the wrong practices that crept into our agriculture.”

Natural farming is related to microbiology. It is a chemical-free farming and livestock-based farming which is more or less a poison-free farming method. This system discourages farmers from using any chemical fertilizers, or pesticides, insecticides, or weedicides on plants and in all agricultural practices. This farming method encourages farmers to use local breeds of seeds, and native varieties of vegetables, grains, pulses and other crops. The natural farming method promotes non-chemical and homemade pest control methods. “Natural Farming is a farming practice that imitates the way of nature,” it was created in Japan by Masanobu Fukuoka and Mokichi Okada. It is described as “the natural way of farming” or “do-nothing farming.” (Source: Maunakeatea). In natural farming, neither chemical nor organic fertilizers are added to the soil.

In natural farming, there is no plowing, no tilting of soil, no fertilizers, and no weeding is done just the way it would be in natural ecosystems. There are many working models of natural farming all over the world, and zero-budget natural farming (ZBNF) is the most popular model in India. This comprehensive, natural, and spiritual farming system is developed by Padma Shri Subhash Palekar.

ILL-EFFECTS OF CHEMICALS ON ENVIRONMENT AND HUMAN HEALTH

Harmful effects of Chemical Fertilizers:

- Water pollution
- Soil acidification
- Contribute to the release of greenhouse gases.

Harmful effects of Pesticides:

- Asthma
- Birth defects

- Hormone disruption
- Depression
- Cancer etc.

Advantages of Natural Farming

- Replenishes natural ecosystems for cleaner water and air, all without toxic pesticide residues.
- Small and marginal farmers who spend a lot of money on chemical inputs will benefit the most.
- Protect soil and environmental quality.
- Helps in combating climate change by ensuring higher carbon fixation into soil.
- Reduces Ocean acidification, since it eliminates chemical fertilizers and pesticides.
- Natural farming has a smaller carbon footprint.
- Conserves and builds soil health.

Overall natural farming tends to have better soil quality and reduce soil erosion compared to its conventional counterparts. Natural Farming could play a major role in sustainable Agriculture. It fits perfectly in the people, planet and profit philosophy.

ONE HEALTH CONCEPT AND NATURAL FARMING

Mr. Parth Desai

Human activities are increasingly disrupting ecosystems, creating conditions that foster the emergence and spread of diseases. Factors such as animal trade, intensive agriculture, urbanization, extractive industries, climate change, environmental degradation, habitat fragmentation, and human encroachment into natural habitats are all contributing to this imbalance. In response to these challenges, the One Health approach has emerged as a crucial framework for understanding and addressing the complex interconnections among human health, animal health, and ecosystem health.

The One Health Approach

The One Health approach emphasizes the intrinsic link between the health of humans, animals, plants, and the environment. By recognizing that these elements are

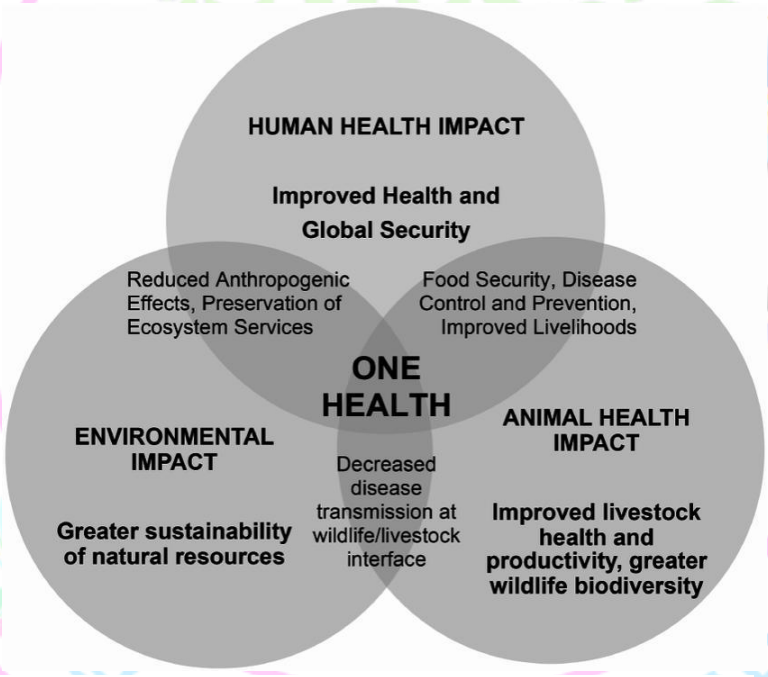

Figure 2 One Health Concept (Source: Okello et al., 2014)

interdependent, One Health promotes a collaborative strategy that integrates knowledge and expertise from various sectors.

This holistic perspective is essential for addressing the root causes of diseases and developing sustainable solutions that benefit all aspects of health. Central to the One Health initiative is the Quadripartite collaboration, which includes four key organizations: The Food and Agriculture Organization (FAO), the United Nations Environment Programme (UNEP), the World Health Organization (WHO), and the World Organization for Animal Health (WOAH).

Agriculture and One Health Concept

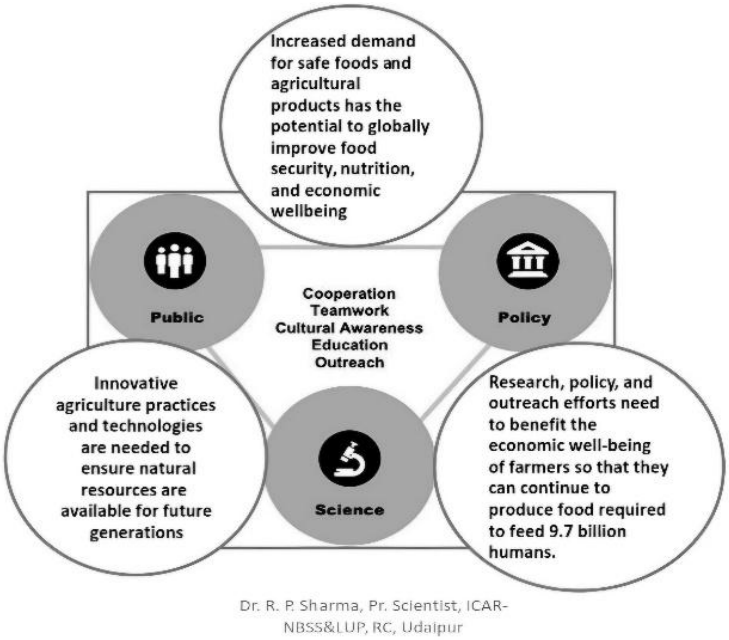

Figure 3 Agricultural Framework and One health concept

The One Health approach in sustainable agricultural practices enhances biodiversity through crop diversity, which strengthens ecosystem resilience and soil health while reducing reliance on synthetic inputs. By minimizing chemical use, it also lowers the risk of zoonotic diseases, promoting reduced disease transmission. The approach supports climate resilience by enhancing soil carbon sequestration and lowering greenhouse gas emissions. Additionally, it employs integrated pest management techniques that utilize natural pest control methods, safeguarding beneficial insects and ecosystems. Community engagement is fostered to enhance collaboration among farmers, health professionals, and environmentalists, ultimately improving food security and public health outcomes.

Integrating One Health into natural farming not only advances ecological sustainability but also reinforces the vital connections between humans, animals, and the environment.

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HISTORY OF FARMING

Mr. Hitesh Kumarkhaniya

Farming has evolved over thousands of years, from the early Neolithic Revolution, where people shifted from hunter-gatherer lifestyles to settled agricultural communities, to the high-tech farming practices of today. It is not only essential for food production but also plays a critical role in shaping economies, cultures, and societies. The future of farming will likely involve innovations that balance productivity with environmental sustainability to meet the needs of a growing global population.

Natural farming, often synonymous with sustainable or organic farming, refers to agricultural practices that aim to work in harmony with nature, avoiding synthetic chemicals and promoting biodiversity. It focuses on soil health, ecological balance, and minimal human intervention. Its history can be traced back to various traditions, cultures, and movements over the centuries.

In the Yellow River Valley and other regions of China, farming began around the same time. The Chinese domesticated crops like rice in the southern regions and millet in the northern regions. The domestication of animals, including pigs, dogs, and cattle, also supported agricultural development. Over all, natural farming aims to create a sustainable, resilient, and environmentally friendly agricultural system that minimizes the impact on the planet and supports long-term food security.

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NATURAL FARMING: PRINCIPLES AND SCOPE

Mr. Trupesh Revad

"Natural farming is a farming practice that imitates the way of nature," Masanobu Fukuoka and Mokichi Okada defined it is. "The natural way of farming" or "do nothing farming" are terms used to describe it. Natural farming is a climate-resilient, Low-input, indigenous agricultural method that promotes the total abolition of synthetic chemical agro-inputs in india. Gujarat, Adhra Pradesh, and Himachal Pradesh are states that promote natural farming the most. In 2020-21, the central government introduced Bharatiya Prakritik Krishi Paddhati (BPKP), a Paramparagat Krishi Vikas Yojana (PKVY) sub-scheme that promotes natural farming. Our country's diverse agroclimates and plenty of traditional farming knowledge present numerous prospects for establishing natural farming.

Principles of natural farming- According to Okada, must meet five criteria: (1) Produce food that is safe and nourishing and guarantees good health; (2) Benefit producers and consumers economically and spiritually; (3) Be sustainable and simple to implement; (4) Preserve and protect the environment; and (5) Produce enough high-quality food to feed a growing global population.

Scope of natural farming- Environmentally, it improves soil health, encourages biodiversity, saves water, and lessens pollution by avoiding artificial chemicals. Economically speaking, it reduces production costs, increases organic produce's resilience to crop and market volatility, and fetches premium pricing. In terms of health, it yields crop that higher in nutrients and have fewer chemical residues. By utilizing traditional knowledge and encouraging cooperation, it strengthens the bonds between farmers, customers, and the environment while also empowering communities on a social level. Research and innovation keep improving methods and integrating technology to improve crop and pest management. It supports important Un sustainable Development Goals and helps mitigate climate change on a global scale.

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FOUNDATION OF NATURAL FARMING: KEY PILLARS

Isha Pandya

Natural Farming is a unique method of farming which requires absolutely no monetary investment for purchase of key inputs like seeds, fertilizers and plant protection chemicals from the market. The farmer can grow hardy local varieties of crops without application of fertilizers and pesticides. Since it is a zero-budget farming no institutional credit would be required and dependence on hired labor is also reduced to bare minimum. In natural farming, nothing has to be purchased from the outside. All things required for the growth of the plant are available around the root zone of the plants.

Top Four Pillars of Zero Budget Natural Farming

1. Bijamrita

Farmers have been treating their seeds by local cow urine, cow dung and little soil from the bund of the farm or land of the farm since time immemorial (mentioned even in our Vedas as well as other ancient literature). This was the traditional method and also a totally scientific method. Under Natural Farming, the seeds are treated with the formulation made from cow urine, cow dung and other locally available material which is equally effective in checking seed borne diseases.

2. Jivamrita

It is a fermented microbial culture. It provides nutrients, but most importantly, acts as a catalytic agent that promotes the activity of micro-organisms in the soil as well increases the earthworm activities Jivamrita also helps to prevent the fungal and bacterial plant diseases.

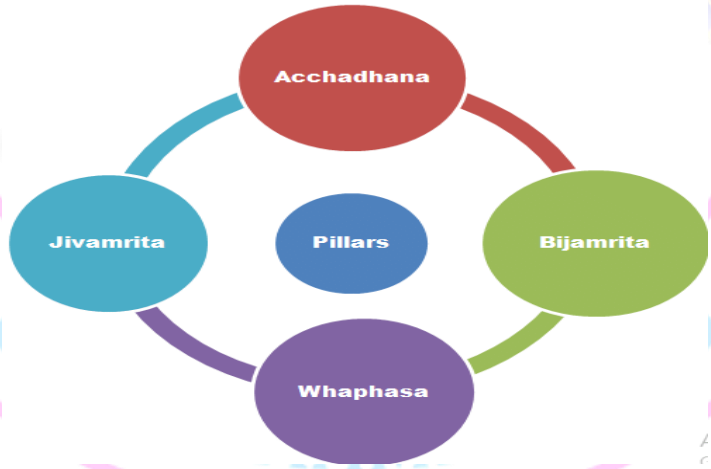

Figure 1 PILLARS OF NATURAL FARMING (Source: Khan et al.,2022)

3. Acchadana (Mulching)

Mulching promotes humus formations, suppresses weeds and maintains the water requirement of crops. For the proper growth, multiplication and activity of beneficial micro – organisms that are applied through Jivamrita, a favorable definite microclimate is required. When we much mulch the soil, this microclimate is created automatically. There are three types of Mulching:

A. Soil Mulching B. Straw Mulching C. Live Mulching

4. Whapasa (Moisture)

According to Palekar, what roots need is water in the form of vapors. Whapasa is that microclimate in the soil, by which the soil organisms and roots ca live freely with availability of sufficient air and essential moisture in the soil.

Nature farming has a bright future in our modern society. Studies have shown that natural farming, with the minimum external inputs and by application of supplements like Jivamrita, improves the soil fertility by increasing the soil micro flora and available nutrients. Therefore, it is concluded that nature farming has a good future although there are many problems yet to be overcome by practitioners and by adopting integrated farming every individual of the country will be able to get chemical free food with improved nutritional security.

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BEEJAMRIT: A NATURAL SEED TREATMENT FOR SUSTAINABLE AGRICULTURE

Aayushi Panchal

A traditional organic seed treatment used in methods of sustainable agriculture, especially in India, is Beejamrit. By promoting the use of natural resources rather than chemical fertilizers and pesticides, this approach is consistent with the ideals of organic farming.

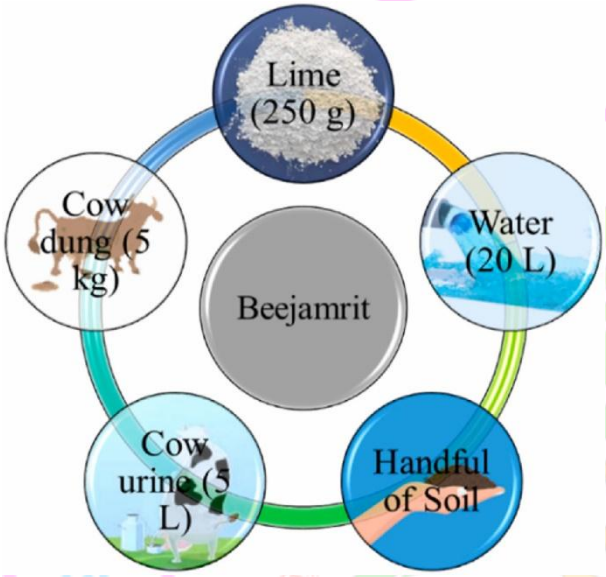

Fig 1: elements that are used for Beejamrit (Shukla, Y. et al., 2023)

Beejamrit is made through a combination of cow urine, cow dung, water, and a tiny bit of soil. The mixture is subsequently applied to the seeds before planting. Studies have shown that Beejamrit not only promotes seed health but also increases soil fertility and minimizes demand for chemical inputs. (Kumar et al., 2019)

Beejamrit treated seed germination at 15-20% greater than untreated seeds. Beejamrit contains beneficial microorganisms that help to reduce hazardous soil pathogens, enhancing plant survival through the early growth stages. (Sharma et al. 2020)

In Conclusion, Beejamrit offers a holistic, sustainable approach to seed treatment that complies with organic farming principles. It not only benefits the seed but also enhances the long-term health of the soil, making it a vital method in sustainable agriculture.

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PREPARATION OF SOIL'S AMRUT: JEEVAMRUT

Heli Oza

The word 'Amrut' means immortal, similarly, once we apply this fertilizer for few years our soil will keep naturally working on its pH, microbes, essential nutrients, soil texture, etc. 'Jeevamrut' is a fermented microbial culture. It acts as a catalytic agent and provides nutrients that promote microbial activity in soil and increase earthworm activity. In 48 hours of fermentation process, existing aerobic and anaerobic bacteria in the cow dung and urine multiply by eating ingredients (like pulse flour). A handful of soil is then added to the preparation, as inoculation of native microbes and organisms. According to agriculture expert Subhas Palekar, there is a saying that after continuous use of Jeevamrut for 3 years, the soil will be self-sustaining.

The solid form of Jeevamrut known as 'Ghan-jeevamrut', prepared using similar ingredients with significantly low amount of water can be stored for a period of 8 months.

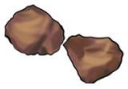
Drum of 100 L

5 L cow urine

5 kg cow dung

500 g pulse flour

250 g soil



500 g jaggery

Preparation for Jeevamrut:

- Put 100 liters of water in a barrel.
- Add mixture of 5 kg fresh local cow dung and 5-10 liters of cow urine.
- Add mixture of 500 g of Jaggery (brown), 500 g of pulse flour and a handful of soil from the land of the farm. Stir the solution, clockwise (12 times) and anticlockwise (12 times), regularly for 7 days.
- Cover it properly after stirring and let it ferment for 48 hours in the shade.

Preparation for Ghan-Jeevamrut:

- Add mixture of 5 Kg fresh local cow dung and 5-10 liters cow urine.
- Add mixture of 500 g of Jaggery (brown), 500 g of pulse flour and a handful of soil from the land of the farm.
- Make balls or cakes, let it dry out completely.

Jeevamrut

Application:

- 200 liters of Jeevamrut is sufficient for one acre of land.
- Apply the Jeevamrut to the crops twice a month in the irrigation water or as a 10% foliar spray.

Ghan- Jeevamrut

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EFFECTIVE WEED MANAGEMENT STRATEGIES IN NATURAL FARMING

Jyoti Chauhan

Weed management is an important part of the natural farming system because uncontrolled weed growth can compete for nutrients, water, sunlight, and space, resulting in lower crop yield. Unlike conventional farming, natural farming prioritizes ecological harmony and avoids the use of synthetic herbicides. Instead, it uses a combination of prevention, mechanical, cultural, and Biological measures to efficient manage weeds while maintaining soil health and diversity.

Preventive Measure- Preventive weed management aims to reduce the spread of weeds through preventive approaches. Crop rotation, for example, affects the life cycle of specific weed species by switching between crops with different growth patterns. Cover crops, especially clover and rye, limit weed germination by shading the soil and competing for nutrients. Proper irrigation management can also help, as overwatering generates a perfect environment for weeds.

Mechanical Method- Mechanical weed management is the physical eradication of weeds with tools and equipment. Hand weeding, hoeing, and shallow tilling are common practices in natural farming system. Mulching, which involves covering the soil with organic materials like straw, wood chips, or leaves, is an effective way to control weed development. Mulches block sunlight, preventing weed seeds from sprouting, while also enriching the soil through decomposition. Organic mulches are more appropriate in natural farming rather than inorganic mulches. While mulching can be extremely effective, it necessitates enormous labor for application and maintenance. Furthermore, some farmers may find it difficult to source huge volume of organic mulch resources. Despite these restrictions, mulching remains a vital component of weed management in natural farming due to its significant environmental advantages.

Organic Mulching

Plastic Mulching

Cultural Practices- Cultural approaches involve practice that promote crop development while reducing weeds. Intercropping, or growing multiple crops alongside one another, reduces the amount of available space for weeds. Similarly, increased plant density can result in a canopy that

shadows the soil and inhibits weed germination. Timing is crucial in cultural practices, planting crops at an appropriate time enables them to grow quickly and outcompete emergent weeds.

Biological Control- Biological weed control involves using weeds natural enemies, such as insects, fungi or bacteria, to lower their population. Certain fungal diseases, for example, eliminate certain weed species while causing no damage to crops. In addition, livestock such sheep and goats can graze on weeds in fallow fields, combining weed control with animal husbandry.

Integrated Weed Management(IWM)- Integrated Weed Management integrates multiple strategies to produce a complete and long-term solution. Farmers can efficiently handle weed concerns by combining preventive, mechanical, cultural, and biological strategies. IWM not only suppresses weeds, but it improves soil fertility, promotes biodiversity, and adheres to natural farming principles.

Conclusion- Effective weed management in natural farming practices necessitates a comprehensive approach that prioritizes ecological balance and sustainability. Farmers can efficiently manage weeds while improving soil health and yields of crops by combining preventive measure, mechanical method, cultural practices, and biological controls. Integrated weed management is a dynamic framework that encourage long-term success in natural farming system.

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INDIAN COW BREEDS AND NATURAL FARMING

Anusha Maitreya

India has a special bond with cattle, especially cows, which have played a crucial role in its farming traditions. The nation's agricultural landscape has been significantly shaped by the interaction between Indian cow breeds and natural farming methods. Indian cow makes a substantial contribution to sustainable farming methods, particularly when used in conjunction with natural farming techniques.

Indian Cow Breeds:

India has a wide variety of native cow breeds that have all adapted to the country's different climates and topography. Indian cows have developed to be more hardy, disease-resistant and environmentally adapted than the invasive breeds that are frequently seen in other regions of the world.

Among the most popular Indian cow breeds are:

1. Gir: Gir cows which are native to Gujarat's Saurashtra area that are renowned for their robust temperature and large milk production. They are frequently regarded as one of India's best native breeds for producing milk.
2. Kankrej: It is known for their strength, endurance and high milk output. Kankrej cows are primarily found in Gujarat and Rajasthan. Draught work also makes extensive use of them.
3. Sahiwal: It is originating in Punjab. Sahiwal cows are well-known for their capacity to endure high temperatures and yield high-quality milk in hotter regions.
4. Rathi: It is mainly found in the states of Rajasthan, Haryana and Punjab. This breed is renowned for its exceptional milking capacity.
5. The Red Sindhi: It is a popular breed in India, particularly in states of Rajasthan and Haryana. It is primarily found in Sindh, which is now in Pakistan. Red Sindhi cows are renowned for their productivity and strong disease resistance.
6. Tharparkar: It is native to the desert. Tharparkar cows can withstand drought and adapt to dry environments while still yielding high-quality milk.

Unlike foreign varieties, which frequently need specialized care and circumstances, these native cows are distinguished by their resilience, capacity to flourish in challenging environmental conditions and effective conversion of locally available grain into milk.

Indian cow breeds' function in Natural farming, sometimes referred to as zero-budget natural farming (ZBNF), is an agricultural practice that eschews the use of synthetic inputs, chemical fertilizers and pesticides. Rather, it emphasizes improving soil health, supporting biodiversity and growing crops using organic inputs.

Indian cow breeds are essential to success of chemical free farming practices.

1. Organic Fertilizers: Indian cows provide excellent resources for natural farming, especially their urine and manure. Cow during is a great source of organic manure, which improves the soil's structure and adds vital nutrients. Cow urine is utilized as a natural insecticide and growth enhancer since it is high in nutrients and good microbes.
2. Bio-Cultures and Manure: The foundation of soil fertility in natural farming is compost and bio-manures made from the excrement of Indian cows. The excrement can be utilized to make a number of native preparations such as 'Jeevamrit', a fermented concoction of cow dung, urine and other organic matter that increases water retention, microbial activity and soil health.
3. Cow-Based Biodynamic Farming: Biodynamic farming is a sustainable and all-encompassing farming method that also incorporates natural farming ideas. With cow-based preparations being used to revitalize the soil and increase agricultural output, Indian cow breeds are crucial to biodynamic methods. The farm environment is balanced by the cows' organic presence and the utilization of their by-products.
4. Climate Resilience and Sustainability: Indian cow breeds are renowned for their capacity for environmental adaptation. By supplying necessary services like draft power for transportation and ploughing, they lessen the demand for mechanized equipment and help to ensure the sustainability of the farming system. In an age of climate change, their ability to adapt to harsh weather conditions like intense heat or drought makes them attractive, particularly when paired with the resilience that natural farming fosters.
5. Promotion of Livelihoods: Natural farming enables small-scale farmers to drastically cut expenses by focusing on local resources and requiring few external inputs. Farmers can create self-sustaining ecosystems that need minimal outside assistance while sustaining their livelihoods by rearing native cows and using their outputs such as milk, manure and urine.

There are various advantages of using Indian cow in natural farming that are consistent with sustainable farming methods:

1. Soil Health : Adding organic during from Indian cows to the soil improves its fertility. Cow-based manure distributes nutrients gradually, unlike synthetic fertilizers, increasing the soil's long-term production
2. Decrease in Chemical use: the use of cows as natural inputs reduces the need for chemical herbicides and fertilizer. This guarantees healthier crops and cattle in addition to protecting the environment.
3. Conservation of Biodiversity: Indigenous cow and natural farming methods promote biodiversity. Prioritizing local ecosystems aids in the preservation of wildlife, soil organisms, and native plant species.
4. Increased Food Security: A more resilient and varied agriculture system is promoted by natural farming. Farmers are better equipped to guarantee food security and are less reliant on outside markets when they use resources that are available locally, particularly in light of climatic uncertainty.
5. Healthier Product: because toxic chemicals are not used in natural farming, the product has a higher nutritional value. Furthermore, the milk and other animal product produced by

cows maintained on organic farms are usually hormone and antibiotic-free, making them safer and healthier to eat.

Conclusion:

In conclusion Indian cow varieties are essential to the country's efforts to promote natural farming. In addition to providing milk, these cows are essential for preserving soil fertility, fostering biodiversity and lessening the negative effects of farming on the environment. The wisdom of ancient agriculture methods such as using native cow breeds provides a way ahead for Indian farming in the face of growing interest in sustainable agriculture. Incorporating Indian cows and natural farming can contribute to the development of resilient agriculture systems that benefit the land and its inhabitants as the globe struggles with issues of food security and climate change.

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INSECT PEST MANAGEMENT APPROACHES IN NATURAL FARMING

Aanal Maitreya

Natural farming prioritizes preserving biodiversity and ecological equilibrium with little interference in the environment. The management of insect pests in this system is based on ecologically sound preventive and reactive measures.

Pest pressures can be decreased by increasing biodiversity through intercropping, crop rotation, and the establishment of habitat of natural predators. Higher plant diversity has been linked to a more stable environment with fewer pest outbreaks, according to studies (Gurr et al., 2016). The use of flower strips and hedgerows, among other habitat diversification techniques, draws beneficial insects that control pest populations, according to research by Tscharntke et al. (2007).

Pest populations are naturally regulated by diseases, parasitoids, and predators. One important tactic in natural farming is the encouragement of natural enemies. Research indicates that preserving a robust natural predator population can lessen the requirement for chemical pest control (Losey & Vaughan, 2006). Targeting pest species through the discharge of certain biological control agents, such as entomopathogenic fungus or parasitoids wasps, has proven effective in organic and natural farming systems (Desneux et al., 2007).

Practices that improve soil health, such composting and reduced tillage, indirectly lessen pest problems because healthy, well maintained crops are less vulnerable to pest damage (Altieri, 1999).

Phenols, tannins, and flavonoids have been shown to improve plant defenses against insects. It has been reported that, in various ridge gourd genotypes, fruit length and fruit diameter had significant positive correlations with the percentage of fruit infestation and the larval density per fruit, while the length of ovary pubescence, rind hardness, fiber content, and rind thickness had significant negative correlations. (Haldhar et al., 2015)

Instead of depending on calendar-based treatments, farmers can act based on real-time insect levels with the aid of Integrated Pest Management (IPM) strategies, such as threshold-based decision making. Reducing or doing away with synthetic pesticides is the fundamental tenet of natural farming. This is accomplished by integrating several non-chemical pest control techniques.

Adoption of these methods results in more resilient farming systems, according to research (Pretty, 2008).

In natural farming, managing insect pests requires an integrated strategy that puts biodiversity and ecological balance first. Diverse tactics, including biological control, cultural practices, and the use of resistant cultivars, have shown success while reducing the need for synthetic pesticides.

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BEST PRACTICES IN PEST MANAGEMENT FOR NATURAL FARMING

Bhavya Radadiya

Pesticidal capabilities are found in more than 2400 plant species. Several diverse plant allelochemicals hinder or discourage insect feeding. These products are safer, more environmentally friendly, and better for both human and plant health.

In order to control significant pests on various crops, researchers have recently concentrated on employing plant derivative extracts or diverse bio rational products rather than conventional insecticides.

The plant derivative extract (Brahmastra) was described in the current studies. The active compounds' individual component compositions were determined, and their modes of action were compared to current publications. Additionally, field research was conducted to control L. erysimi in rapeseed-mustard under organic farming settings using Brahamastra.

It has been documented that a mix of various bio rational products can serve as an economical and environmentally beneficial substitute for L. erysimi in rapeseed mustard.

The **Braham Astra** at 12.5 liters per hectare proved successful in achieving low aphid counts, a greater percentage of mustard aphid reduction, increased seed yield, and higher financial returns. Furthermore, brahamastra demonstrated both non-phytotoxic and non-toxic effects on the natural enemies. Brahamastra, an organic extract, may therefore be useful in controlling mustard aphids on Gobi, Sarso in organic farming settings as well as in other situations where pest prevalence is minimal in traditional farming systems.

Agni Astra reduced pests as much as possible while causing the least amount of pod damage. Additionally, Agni Astra at 20 liters per hectare produced the maximum grain production.

Neemastra is a component of Indigenous Technical Knowledge (ITK), which is typically used to sustainable farming methods. One such organic insecticide is called Neemastra, which is mostly made from cow urine, dung, and neem leaves. The improved form of the neem oil blend is also known as Neemastra. Neem leaves, which are the primary ingredient in neemastra, have a remarkable pesticidal ability that aids in the management of a variety of pests. Neemastra primarily manages caterpillars, rice weevils, and sucking pests. This organic pesticide exhibits little to no toxicity to people, animals, and beneficial insects, providing a sustainable and safe method of managing pests. For the control of insect pests, all three organic inputs—Neemastra, Agni Astra, and Brahmastra—are recommended. These organic inputs to control root-knot nematodes on tomatoes in nematode-infested fields because of their environmentally friendly, economical, sustainable, and organic management capabilities against insect pests.

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NAVIGATING THE CERTIFICATION PROCESS FOR A NATURAL FARMING: GUIDELINES AND STANDARDS

Dhruva R. Jani

Natural faming is a traditional agricultural practice that emphasize biodiversity and maintains ecological balance. Certification plays a vital role in upholding their principle and offers benefits to farmer like access to premium markets and government subsidies Thus certification validates agricultural practices and give transparency and trust to consumer.

In India two primary certification systems for natural farming is there namely **Participatory Guarantee System (PGS-India)** and **National Program for Organic Production (NPOP).** PGS India is a cost-effective, community-driven strategy that is good for small and marginal farmers aiming to reach domestic markets while the **NPOP** is managed by the Agricultural and Processed Food Products Export Development Authority (APEDA) and is for farmers looking for access to international markets. Both systems emphasize the use of natural inputs, prohibit synthetic chemicals, and require continuous monitoring to ensure compliance. In India natural farming standards encourage ecological practices by using natural products Jeevamrutha, avoiding synthetic chemicals and genetically modified organisms. For better vigor of plants mixed cropping and soil conservation is also taken into consideration. Farmers that want to be certified must keep thorough records of their operations and select the right system: NPOP for farming focused on exports or PGS-India for domestic markets.1APEDA-accredited organizations conduct professional audits for NPOP, but PGS-India depends on peer-reviewed group certification. To reduce certification costs and promote sustainable agricultural methods, government programs such as the Paramparagat Krishi Vikas Yojana (PKVY) and Mission Organic Value Chain Development for the North East Region (MOVCDNER) offer funding and training. Thus natural farming certification not only boosts farmer's market access and profitability but also contributes to a sustainable and environmentally friendly agricultural system.

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BUSINESS STRATEGIES IN NATURAL FARMING: A SUSTAINABLE ECONOMIC APPROACH

Minal Patel

Eco-Friendly not only means environment friendly but here I use it as Economically friendly too, as the technique has great significance in overall Agricultural market. This type of farming technique is most efficient as it uses its all the production mass and leaving zero waste behind has proven sustainable. The Portion of production left after fulfilling the food demand can be used to turn it back into food for crops and cycle continues. Market development by focusing on speciality crops, Organic produce and value added products and identifying niche markets. Developing a brand by creating unique brand identity that differentiates and signifies our products. Establishing direct relationships with buyers like restaurants, retailers and consumers. Diversifying crop production by growing multiple crops to reduce dependency on single type. Implementing advanced and smart ways for tools and techniques for irrigation, harvesting and storage to reduce the loss and increase the yield. Another after food demand perspective comes is waste management. By developing composting systems that provides facilities to fulfils soil nutrient requirements and also reduces need for chemical amendments. Along with these all mandatory strategies we can also establish seed banks to conserve the best quality varieties. Finance management can be done by developing a budget and tracking expenses, and planning the pricing based on production costs, market demand and competition. Developing an e-commerce platform by creating websites to turn business on online modes through social media. Hosting farm events like workshops, internships, trainings and awareness programs to attract and engage community. Collaborating and partnering with local business. Hiring manpower with well trained and skilled mentorship can also foster a positive environment. The ultimate things cannot be ignored are risk management by many insurance policies protecting against crop failure and loss. Diversifying income streams and emergency fund planning is also crucial for sustainable approach.

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IMPACTS OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING IN NATURAL FARMING: AN AGRO-INFORMATICS APPROACH

Amarshi Prajapati, Prof. Rakesh Rawal, Prof. Hitesh A Solanki, Dr. Saumya Patel

Introduction:

Natural farming is becoming more and more popular as a sustainable agriculture method that uses fewer outside inputs. Information and communication technology (ICT) integration in agriculture, or Agri-informatics, provides a potent toolkit for maximizing natural farming systems. Present Agri-informatics developments in natural farming are examined in this review paper, along with the possible advantages and difficulties of this approach. The application of artificial intelligence and machine learning algorithms in precision agriculture are among the main areas of attention. Current trends in field of agro-informatics are soil health and crop monitoring. In precision agriculture soil monitoring and crop monitoring plays a crucial role. During soil monitoring various types of sensors and drones are employed to monitor soil moisture, temperature, pH, nutrient levels, and organic matter content. This data enables farmer to optimize irrigation schedules, apply compost and other organic inputs effectively, and identify areas with nutrient deficiencies. Whereas crops growth monitoring requires Remote sensing techniques, including satellite imagery and drone-based imaging, provide valuable insights into crop growth, Vigor, and stress levels. Improvements in agricultural productivity have been demonstrated by the effects of remote sensing combined with deep learning on crop growth and disease detection.

This information can be used to identify nutrient deficiencies, detect pest and disease outbreaks early, and optimize planting dates and irrigation schedules. These methods are employed to examine the leaves of both healthy and sick plants. These techniques are used to analyses the healthy and diseased plants leaves. Some of the challenges in these techniques viz. effect of background data in the resulting image, optimization of the technique for some specific plant leaf diseases, and automation of the technique for continuous automated monitoring of plant leaf diseases under real world field conditions. The classification accuracy of Res-Net, VGG19, InceptionV3, Nas Net-Mobile, Mobile-Net DenseNet121, and DenseNet169 for 28 different types of illnesses in 15 distinct crop species was up to 99.74 %. The development of a general platform for all types of crops and animals, QoS (Quality of Service), the use of explainable artificial intelligence to monitor crop growth and disease prevention. For these purpose various types of algorithms are used like fuzzy logic, Genetic algorithm k-NN, CNN, SVM, and decision trees.

The impact of background information on the final picture, technical optimization for a particular plant leaf disease, and automation of the approach for ongoing automated

monitoring of plant leaf diseases in real-world field circumstances are some of the difficulties with these methods.

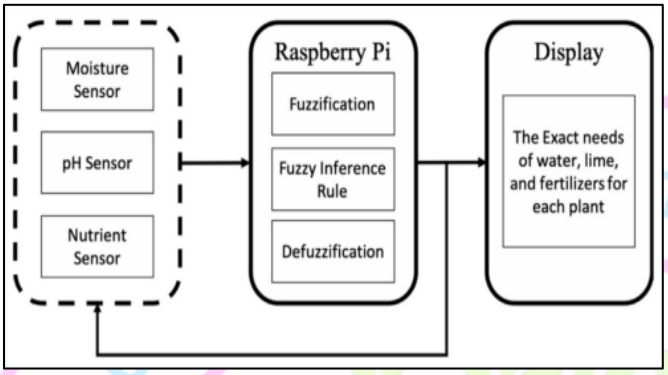

Figure1: fuzzy logic-based recommendations for crop production. [10]

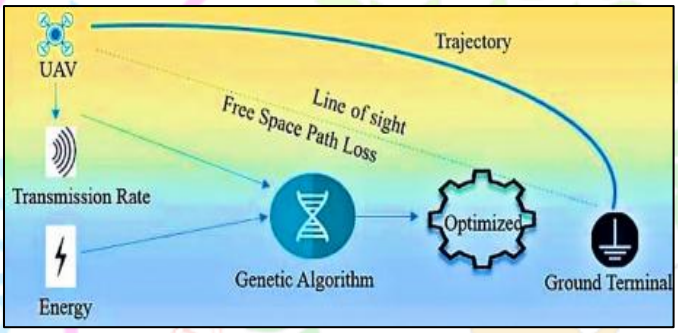

Figure 2: UAV trajectory planning based on Genetic algorithm. [5]

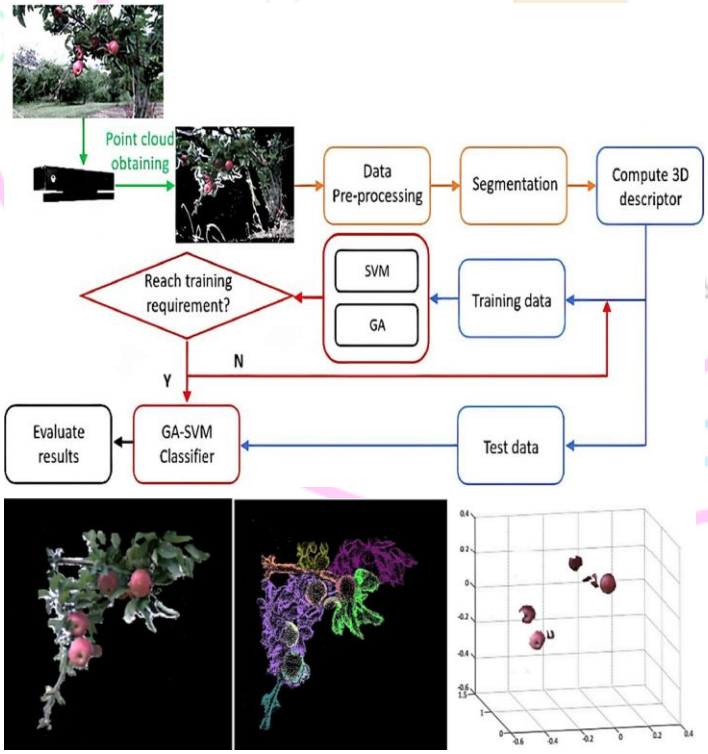

Figure 3: flow chart plant identification based on genetic algorithm with integration of SVM algorithm. [7]

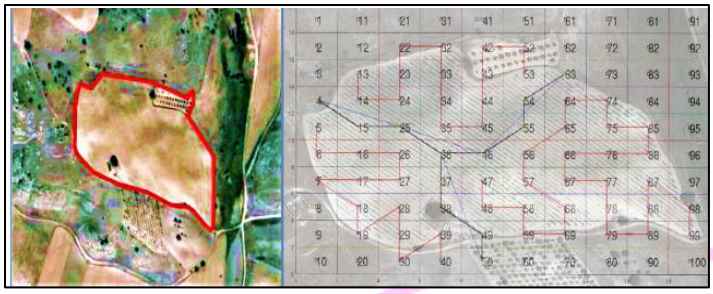

Figure 4: land monitoring and vegetation analysis based on remote-sensing data. [9]

Conclusion: As per conclusion on use of various algorithm for image classification for crop monitoring and disease predictions the most significant algorithm for current scenario is Genetic algorithm and fuzzy logic and CNN. However, it is crucial to address the challenges associated with Agri-informatics adoption, including high initial investment, data accessibility, digital divide, and cybersecurity risks. By investing in research and development, promoting capacity building, and addressing the ethical and social implications of Agri-informatics, we can unlock its full potential to support the growth of sustainable and resilient natural farming systems.

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GLIMPSES OF ACTIVITIES OF GUJARAT UNIVERSITY BOTANICAL SOCIETY

GUJARAT UNIVERSITY BOTANICAL SOCIETY 24-25 INAUGURATION

GUJARAT UNIVERSITY BOTANICAL SOCIETY 24-25 INAUGURATION

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GUJARAT UNIVERSITY BOTANICAL SOCIETY 24-25 INAUGURATION

A Journey from Education to Entrepreneurship

Full-Day Fire Safety Session

Full-Day Fire Safety Session

VISIT: BONSAI EXHIBITION

GUJARAT UNIVERSITY BOTANICAL SOCIETY GARBA

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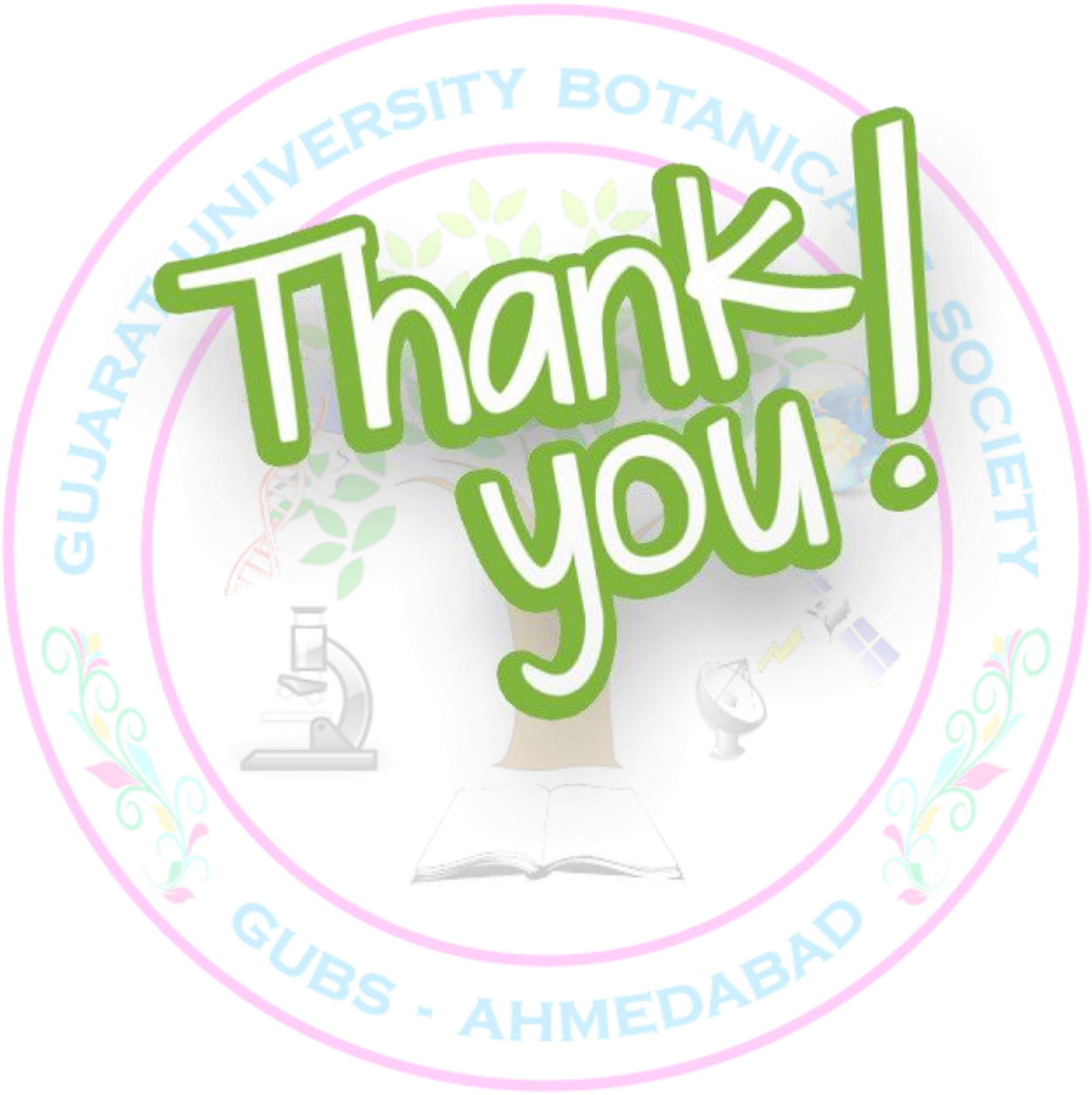
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Thank you!
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