Ministry of Agriculture & Farmers Welfare
Government of India

Awareness Training Program on Natural Farming for Gram Pradhans

Study Material for Awareness Programme for Gram Pradhans on Natural Farming

Translated into _____language

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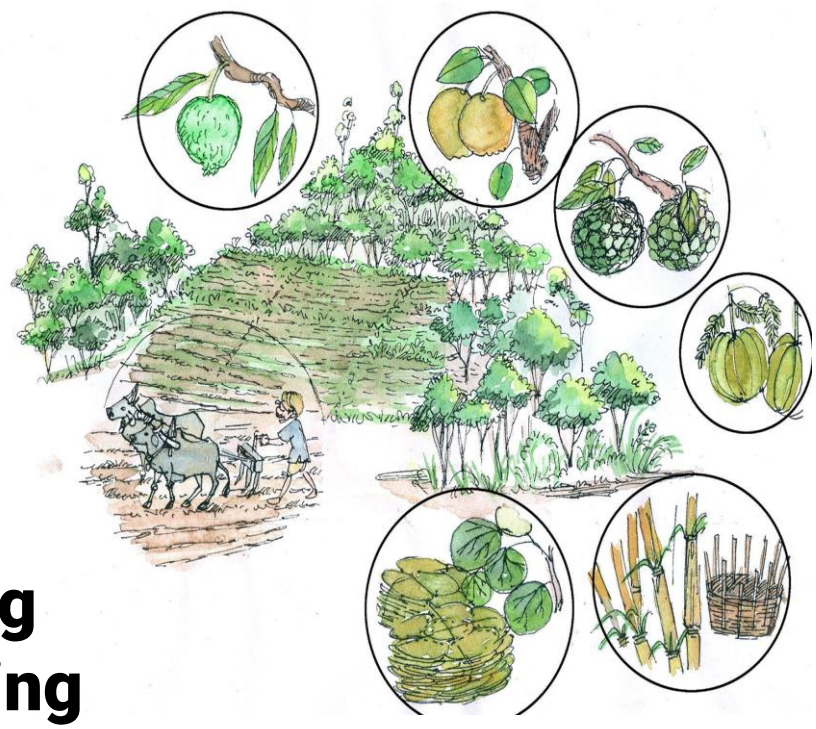


Understanding Natural Farming Principles

Natural Farming Training program for Gram Pradhans

Benefits of Natural farming

- Reduction in cultivation costs
- Increase in cropping intensity thro multi-cropping
- Fodder for livestock
- Protection from Climate Risks
- Rejuvenation of farm lands
- Needs less water for crops

Benefit of Natural Farming :

Across the Indian states, lakhs of farmers are now switching over to adopt agro-ecological practices to sustain their livelihoods. While some are driven by revived interest in moving back to traditional practices, majority are driven by the need to move away from high input use and reduce costs of cultivation.

Natural farming practices are evolved to work with the local ecology. From crop selection to inputs used as fertilisers and for pest & disease management are all designed considering the local ecology. For example the inputs used are produced from raw materials either found in one's own farm or near-by local region. This hugely reduced the farmers' dependency on inputs to be bought from the market. Thus reducing the cost of cultivation.

With the scientific objective of maintaining nutrient balance in the soil, practicing multi-cropping is a key principle in natural farming. This practice not just increases the crop intensity from the small patch of farmland but also incorporates fodder plants which supports livestock. Manures produced from livestock, be it cows, goats, or poultry, is hugely beneficial for the plant growth. It is understood that the remains of

livestock increase the microbial activities in the soil. Thereby, natural farming not only increases the cropping intensity but also provides fodder for the livestock.

Since the crop selection in a natural farm is conducted in alignment with the local ecology, the crops selected have over the years evolved to the climatic and environmental aspects of the region. Additionally, the practices such as multi-cropping and mulching ensures less run-off and greater moisture holding capacity in the soil. This way the usage of water is limited and no additional external source of water is required.

For a barren land, the soil is dry and the land is not usable for cultivation purposes. In such a scenario growing plants that are locally found, using manures from livestock and local inputs helps in rejuvenating the microbial activity in soil. The practices of mulching further helps in harvesting water and thereby the natural farming practices support in rejuvenating natural farming.

Benefits to livelihood & Income

- Per area income increase by multi-cropping system
- Healthy food for family
- Additional income sources through Poultry, Livestock, Fisheries, Beekeeping etc.
- Ecosystem services through Agroforestry such as Honey, Bay leaves, Bamboo, Spices etc.

Benefit of livelihoods & income :

Integrating livestock, using locally produced inputs, practicing multi-cropping and mulching not only reduces the input cost but also provides an additional source of income. The integrated approach of natural farming thereby provides an increase in the per area income through a multi-cropping system. Additional income sources through livestock, fishe ries, poultry, beekeeping etc.

Additionally, natural farming practices are hugely dependent on the local ecology. For a forested region, designing an agroforestry model farm not only supports a variety of crops and improves local biodiversity. But they also come with ecosystem services such as honey, bay leafs, bamboo etc which are non food crops and have high market value.

Above all, diversity of crops produced and due to usage of no external synthetic chemicals, the nutrient quotient of the produce is known to be high. The farmer's family is thereby ensured with a high nutrient diet - healthy food with a more balanced diet thereby better health for the family.

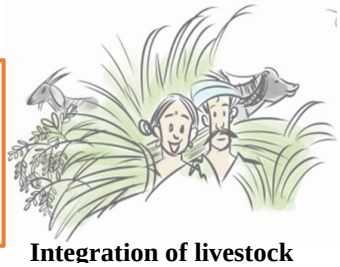
365 days of biodiversity cover

Bio-stimulants as catalysts

Usage of Indigenous Seed

Diverse crops & trees

Principles of Natural Farming



Integration of livestock

No synthetic fertilisers, pesticides, herbicides, weedicides etc

Minimal disturbance to soil

Pest management through better agronomic practices & botanical extracts

Core principles of Natural Farming :

1. 365 days of biodiversity cover
2. Diverse crops and trees
    - Increasing cropping intensity (horizontal and vertical) through crop rotations and inter/multiple/poly crops
    - Designing farms taking an integrated farming systems approach
    - Managing living roots and green cover for 365 days
    - Staggered production system for fresh fruits and vegetables
    - Cropping pattern must be based on the local water resource and weather parameters
    - Rainwater harvesting practices such as grid block, trenches, ponds etc must be adopted
    - Harvest atmospheric moisture by increasing soil cover, designing cropping patterns for 365 days
    - Increasing soil water and moisture holding capacity by increasing soil organic matter
    - Improving water use efficiency through micro-irrigation systems, life saving irrigation plans, efficient cropping systems
    - Monitoring weather and soil moisture

3. Bio-stimulants as catalysts
4. Minimal disturbance to soil

Soil quality indexes such as the physical factors (soil structure, water holding capacity etc), chemical factors (EC, pH, Available nutrients etc) and Biological factors (Organic microbial diversity, soil fauna etc) are to be managed

- Prevent erosion
- Prevent compaction; minimising tilling, shift to animal drawn tools
- Manage soil salinity and pH; Organic amendments, cropping pattern changes, increasing soil organic matters
- Increasing soil organic matter; composting, mulching, manuring
- Biological nutrient management using home made bio-fertilisers, EMOs/IMOs

5. Use of indigenous seeds
    - Identifying, conserving and documenting local diversity; mapping and characterisation
    - Participatory varietal selection to establish value for cultivation and use: Diversity blocks, generating data on local performance, user preferences, seed catalogues etc
    - No GMOs to be used due to biosafety issues

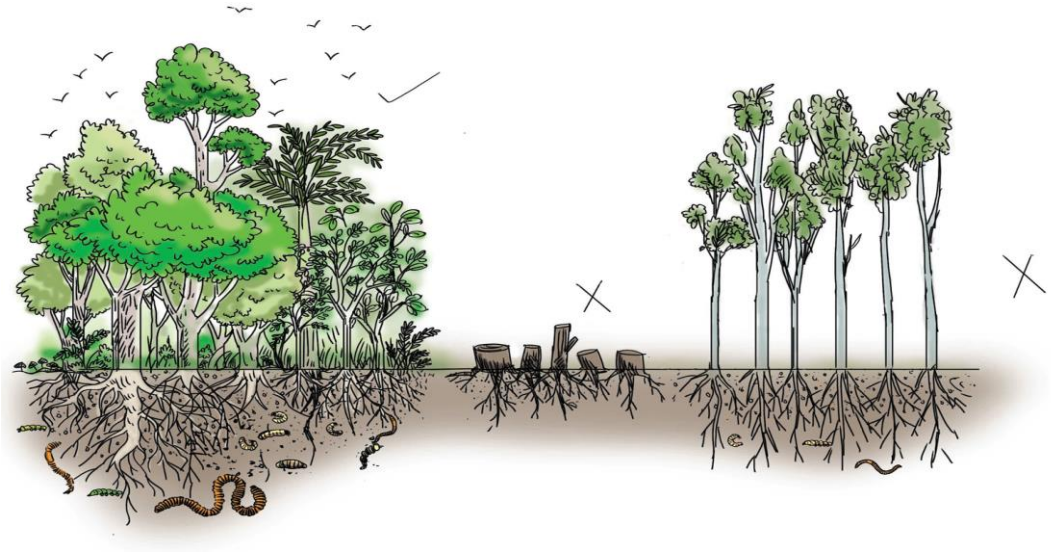
- Organic seed hub; Manage parental lines, maintain breeding, training, capacity building on seed production, coordinating between conservators, breeders, seed producers and markets
- Institutionalising production and distribution through community seed banks, community seed enterprises, farmer service centres for local production and distribution
- Open source seed licensing; arrangements that facilitate and preserve freedom of access and use of plan genetic material, prohibit exclusive rights and apply to any subsequent derivatives of those materials
- Creating value for diversity by developing processing and value addition in production to increase use

6. Integrating livestock to increase soil organic matters and for production of inputs
7. Pest management through agronomic practices and botanical extracts
8. No synthetic fertilisers, pesticides, herbicides, weedicides etc

- Integrating management practices to prevent insects, diseases and weeds from reaching damaging stage or proportions
- A natural ecological balance will ensure that pests do not reach a critical number in the field that engages the yield
- Nature can restore ecological balance if it is not meddles with too much, hence no chemical pesticides at all
- Understanding the insect biology and crop ecology is important to take up right management practices - botanicals or microbials, farm made or commercial
- Pest surveillance : Farm level and village level surveillance to identify pests and disease using various traps to give alerts and advisories
- Simple tools such as flip charts, apps, manuals etc for problem diagnosis
- Building local entrepreneurship for production and sale of bio-fertilisers and inputs
- Weekly advisories based on local surveillance

Is our soil dying?

What is a dead soil & what is alive soil?



Is our soil dying?

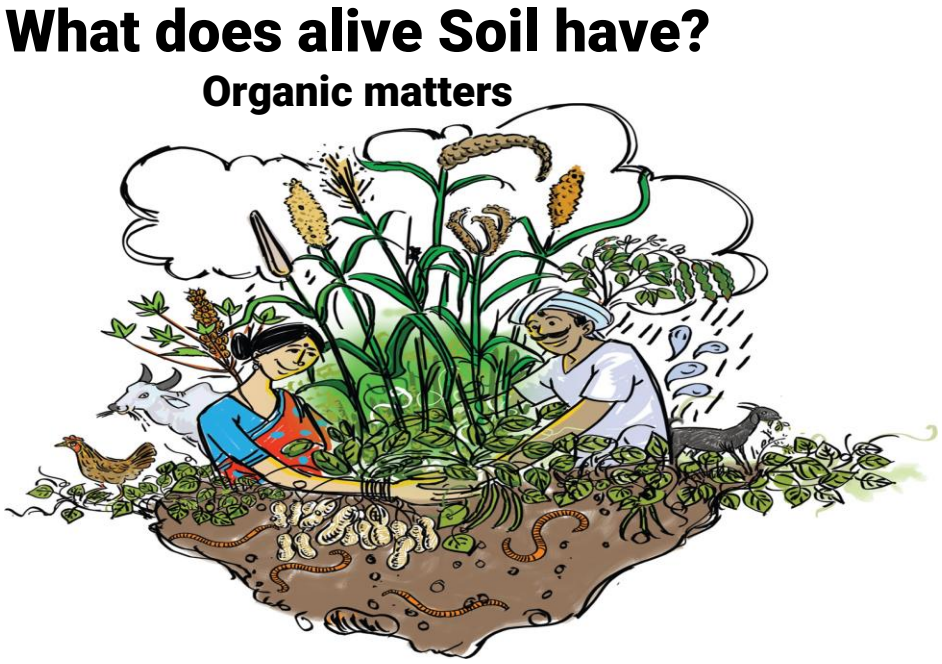
Soil is fundamental to crop production. Without soil, no food could be produced on a large scale, nor would livestock be fed. Because it is finite and fragile, soil is a precious resource that requires special care. In most parts of sub-Saharan Africa, the under-use of fertilizer means that soil nutrients exported with crops are not being replenished, leading to soil degradation and declining yields. This means that **ESSENTIALLY SOIL ARE DYING**!!!!

How can we bring back life in soil?

One of the possible solutions is using Compost applications like FYM, Vermicompost, NADEP compost, Industrial compost, Green Manure & using Soil conservation. However, all these solutions require Cow dung & with the decreasing use of livestock in comparison to the land where most of the degradation happens.

<u>Strategies to incorporate:</u>

- Reduce the soil temperature by crop cover at the top for 365 days/long period.
- Reduce surface hardness for rainwater to infiltrate into the soil
- Increase more organic matter in the root zone which can help to harvest more water.
- Increase the root zone for penetration to take place.

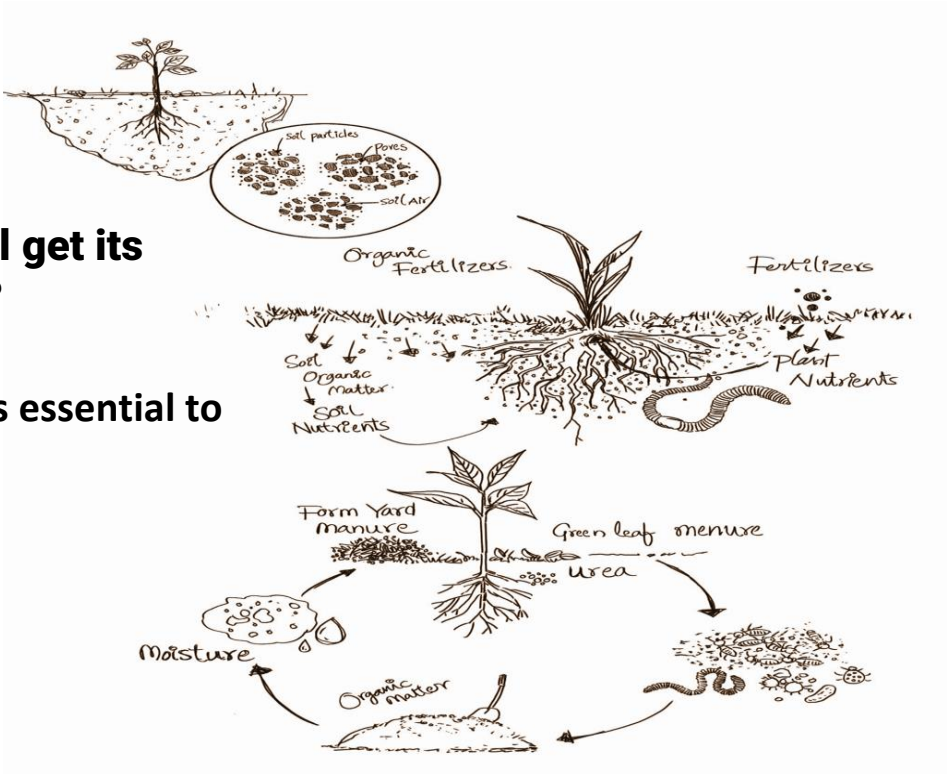


What does alive soil have?

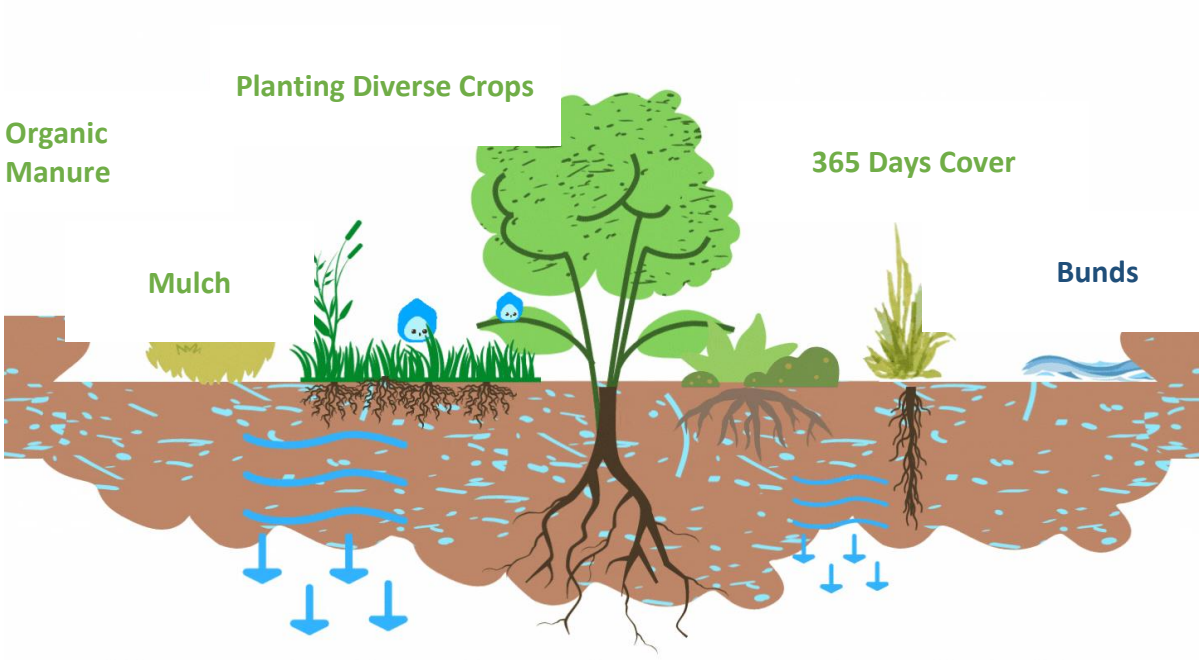
The pictures show multiple micros & macro-organisms like earthworms, bacteria, fungi etc present in the Soil. The system of Soil biology is interlinked where one is dependent on the other for survival. Therefore, it is important to ensure such a food web for better health of the soil. These organisms leave behind exudates and enzymes that add nutrients to the soil. In other words, these are all together called organic matter. This concept is associated with the **living roots.** The theory behind it is that plants produce Sugar. Out of the total plant sugar produced, 40% of the plant sugar is stored at the ground biomass either in the form of grain or leaves. The remaining 30 % of the sugar is stored in roots. From that 30%, 1/3rd of the sugar is released into the soil as Exudates which feeds the vast microbial population that makes plants healthy. This leads to a system of **interface between the Root, Soil & Microbes**. Therefore, we can say that a more diverse cropping system can contribute to better condition of the soil at a faster rate. Even after harvesting, if the roots are alive in the soil, the bacterial association will happen making the soil fertile. Scientifically, 1gm of carbon can hold 8 gm of water. Hence, more of the carbon content, will lead to more holding capacity of water in the Soil. Also the soil with organic matter like fungal hyphae or bacteria helps in the formation of porous spaces, thereby leading to increase in the absorption of water. Therefore, water adheres to the surface of particles or organic matters leading to water infiltration & increase in the holding capacity.

Where does soil get its nutrients from?

Organic matter is essential to keep soil alive



How can we improve soil moisture?

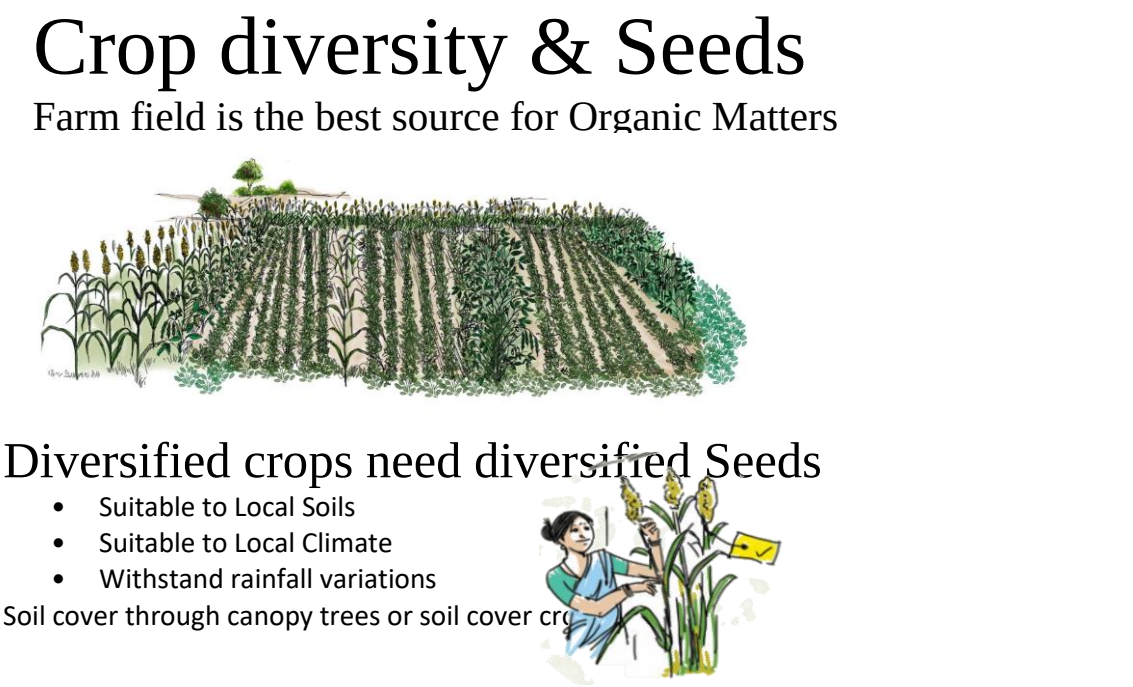


How can we improve soil moisture?

Increasing soil organic matter is one of the ways of increasing moisture content in soil. Additionally, practices such as mulching, diversity in cropping system, using organic manure, incorporating trees in the farm land, and having 365 days of plant cover are various other ways which improves soil moisture.

The mulch helps in trapping water vapour from escaping from the top soil, thus maintaining soil moisture. Trees, diversity in crops and 365 days plant cover help in preventing runoff, soil erosion and harvesting atmospheric moisture. While organic manure makes the soil porous, leading to increase in the absorption of water. Therefore, water adheres to the surface of particles or organic matters leading to water infiltration & increase in the holding capacity.

The above is effective when the cropping pattern is based on the local water resource and weather parameters. Rainwater harvesting practices such as bunds, grid block, trenches, ponds etc are also additionally adopted. Thus water use efficiency can be improved through micro-irrigation systems, life saving irrigation plans and efficient cropping systems.



Diversity in crops and seeds :

Crop diversity is an integral part of Natural farming where multi-cropping plays an important role. It emphasises on growing 8-10 crops to generate *situ biomass* which helps in mulching at various stages & improves the Soil health. It is easier to produce the same amount of biomass through multi-cropping both above & below the Soil without even using compost. That's why, NF focus is higher towards *situ biomass production*.

Some of the benefits of multi-cropping includes:

- Resilience from vagaries of weather
- Reduces risks & generates surplus income
- Provides nutrition diversity
- Strengthens soil structure

Because it requires one time sowing when there is monsoon and since, we sow different types of crops with different maturity time of each crop so, multiple harvest. The crop harvest starts from September- October and continues up to February.

The soil is covered with crop till February, so it is not exposed to sun for 9 to 10 months and heavy leaf litter in addition to soil improving quality of soil over time by retaining moisture and temperature of soil is maintained. Crops are designed in a multi-tiered canopy to harvest the maximum sunshine for each crop.

Diverse cropping system helps in maintaining bulk density, porosity, infiltration rate, moisture holding capacity, aeration, erosion, and surface runoff, hence, improves physical property of soil.

Most people complain that the nutrients required for crops are fulfilled when we are harvesting so many nutrients such as NPK but the nutrient cycles operate completely differently in natural farming. In natural farming many Phosphorus and Potassium solubilising bacteria get activated and they convert the non-available form of different nutrients to available form. Since diverse multi-tier crops are used in natural farming, nutrients from different crops are harvested at different depths in soil by crops. Hence, efficient use of nutrients happens in the soil.

In natural farming, plant protection is done by natural phenomenon by plant immunity and push -pull effect of insects by crop diversity. The plant immunity is dependent on the humus content and microbial diversity in the soil and plant Plants usually develop direct defence against insect herbivores and indirect defence to promote the effectiveness of natural enemies of insect herbivores.

Since, the soil will be covered for more than 9 months and the water requirement of some crops are minimal hence, the water requirement in diverse cropping system is very less so it will reduce the energy requirement by less use of bore well and in diverse cropping maximum foliage cover in soil, it will capture maximum amount of soil and it reduces the temperature of soil.

Principles to be considered for diversity in crops and seeds :

- Suitable to Local Soils
- Suitable to Local Climate
- Withstand rainfall variations

Soil Nutrition

Bio-stimulants are also needed to give nutrition to the plants

- Beejamrutam,
- Jeevamrutam
- Poultry manure etc

Soil nutrition :

Use of bio-stimulants increases plants tolerance to and in the recovery from abiotic stress. Mostly, it improves the quality of the produce & helps in the management of pest & diseases.

Benefits of using bio-stimulants to enhance soil nutrition :

- Higher Yields, diverse crops and Lower costs
- Enhanced soil fertility
- Soil carbon enhancement
- Reduce water requirement at for crops, harnessing atmospheric water
- Resilience to climatic shocks

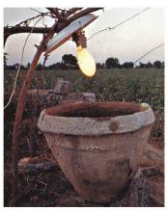
There are billions of microbial organisms that lives in the soil, by adopting chemical farming we are not giving them food. Through natural farming we can provide food and nutrients to the plants. Humus is increasing every year. Organic carbon content can be increased by natural farming.

Requirement	Strategy
• Increase in soil organic matter (soil sponge)	• In situ biomass generation through crop system
• Reducing evaporation, hardening of soil surface	• Soil cover, mulch, surface not exposed to direct sunlight
• Reducing soil temperature and desiccation of organic matter	• Soil cover 365 days
Life in Soil & Microbes	
• Enhanced biological activity in soils	• ***Living Roots****; Of Diverse crops, deep & shallow rooted*
• Enhanced microbial activity	• **Bio-Stimulants:** Beejamrutam • **Jeevamrutam,** (Ghana /Liquid) – soil & foliar applications
• Less disturbance to soil	• Light/ no till
Soil Conservation	
• Erosion through runoff	• Soil conservation - measures
	• Harvesting soils – stream terraces
	• Earthen/ pebble – Bunds
	• Lower velocity of runoff- safe discharge

Pest & Disease Management

Prevention through **natural methods** of management

- Trap crops
- Light and sticky traps
- Friendly pests
- Botanical extracts such as Neemastra,



Pest & Disease management :

In natural farming, pests are naturally controlled /managed by natural enemies and pathogens. The plant defence mechanism and immune system plays a critical role in plant protection, besides presence of natural enemies in the crop ecosystem.

There are only preventive approaches followed to minimise the pest incidence and reduce the crop damage. In case the pest population crosses threshold level, there are few curative measures by timely application of botanical concoction or by natural solutions.

The following are **PREVENTIVE APPROACHES**

- Seed Treatment with Beejamruth.
- Spraying of Panchagavya (Both Growth promoter and pest and disease resistant)
- Push-pull strategy by Crop diversity
- Border crops
- Trap crops
- Yellow, white, Blue sticky plates
- Light traps
- Pheromone traps
- Bird perches

Plant defence mechanisms and the immune system plays a critical role in plant protection, besides presence of natural enemies in the crop ecosystem. The outbreak of disease and spread of disease is controlled by periodical application of mulching and Drava jeevamrutham. Maintaining crop diversity with border crops and intercrops is also important practice to prevent plant diseases.

The following are preventive measures :

- Selection of Healthy seeds
- Selection of disease resistant varieties
- Seed treatment with Beejamruth
- Adjust sowing time
- Crop diversity with Border crops and Inter crops
- Mulching
- Frequent sprinkling of Drava Jeevamrutham on mulch material, as to increase diversity and numbers of useful bacteria in soil (Useful bacteria prevent spread of diseases and induce immunity in plants).