MULTILAYER FARMING: A SOLUTION OF MANY PROBLEMS

Abstract

Human want is indefinite that never satisfy. For that reasons they burned anything for their need. We can see it from our periphery that industrialization is occur more and more day by day. Understanding that human population is increasing rapidly from past few decade and urbanization is possible way to give stay for that population but not in cost of agriculture land. Farmers often try new ideas in their fields based on deep knowledge of their local environment and develop many ecologically and environmentally sound local technologies/ farming practices by innovations and adaptations. One of these practices is known as Multilayer Farming. It is based on space and time annidiation. Generally the practices of planting two or more crop on same piece of land is more common in tropical region where more rainfall, high temperature and longer growing season are more favourable for continual crop production. Multilayer farming is a method of simultaneously cultivating crops of various heights on the same plot of land. Other names for it include multi-tier cropping and multi-storied cropping. This kind of cropping is typically used to maximise the use of solar energy even with dense plant populations. Using the resources at their elimination, the farmers can use the same plot of land to produce a good crop and increase their revenues. Additionally, it addresses the issue of feeding a growing population with limited cultivable land. The primary goal of this kind of farming is to make better use of vertical space. The tallest components in this system have foliage that requires intense light and high evaporative demand, while the shorter components have foliage that requires shade and high humidity. The other goals of multilayer farming are maximising

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productivity per unit of land, harvesting crops on a regular basis throughout the year, and water conservation

Keywords: Multilayer farming, verticle space, land, annidiation

I. INTRODUCTION

Human want is indefinite that never satisfy. For that reasons they burned anything for their need. We can see it from our periphery that industrialization is occur more and more day by day. Understanding that human population is increasing rapidly from past few decade and urbanization is possible way to give stay for that population but not in cost of agriculture land

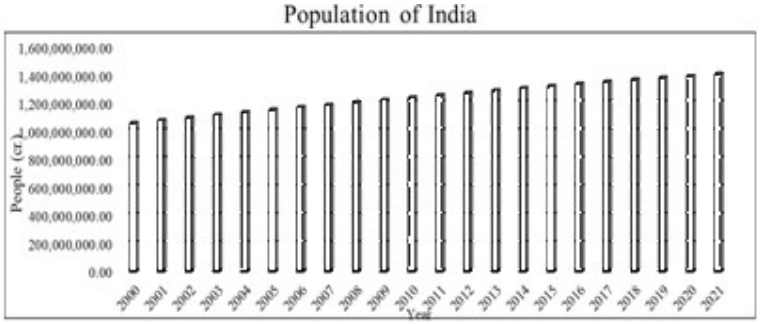


Figure 1: https://www.worldometers.info/world-population/india-population/

According to the most recent United Nations data, India has surpassed China to become the world's most populous country with 142.86 billion inhabitants. China has 142.57 billion people as per the most current data, making it the second most populous nation.

A recent UNFPA research states that 25% of India's population is under the age of 14, 18% is between the ages of 10 and 19, 26% is between the ages of 10 and 24, 68% is between the ages of 15 and 64, and 7% is older than 65. Experts claim that whereas the populations of Uttar Pradesh and Bihar are young, those of Kerala and Punjab are ageing. According to numerous analyses from various organisations, India's population would continue to grow for about three decades before reaching a peak of 165 crore. (https://economictimes.indiatimes.com/news/india/india-population-to-surpass-china-mid-year-un-estimates/articleshow/99605379.cms)

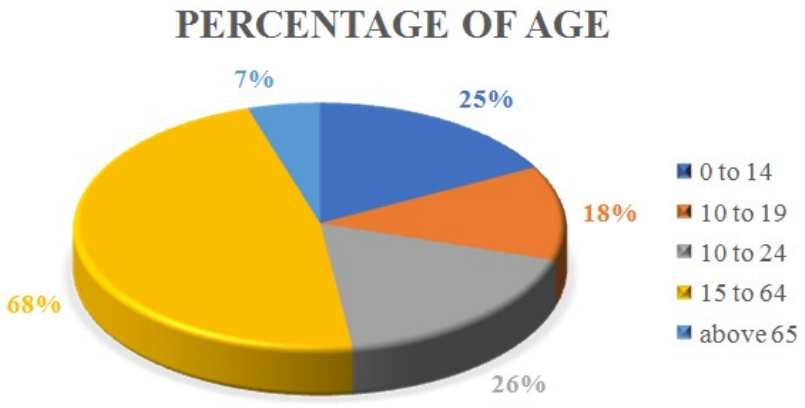


Figure 2: https://www.worldometers.info/world-population/india-population/

II. SITUATION OF LAND HOLDING IN INDIA

Between 2010–11 and 2015–16, the average size of farmland in India decreased by more than 6%, with operational holdings throughout the nation falling to 1.08 hectares from 1.15 hectares in 2010–11. In heavily populated and intensively farmed states like Kerala, West Bengal, Bihar, and the eastern half of Uttar Pradesh, where typical land holding sizes are less than one hectare and, in some places, even 0.5 hectare, the issue of tiny and fragmented holdings is especially problematic.

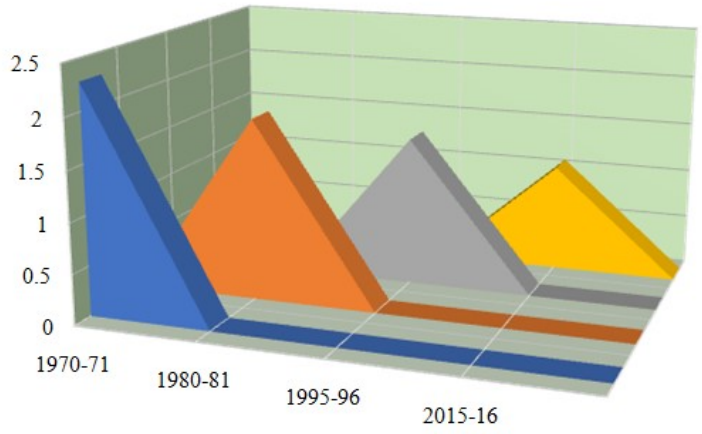


Figure 3: Press Information Bureau: Ministry of Agriculture and Farmers Welfare, 2021

From the forgoing data its facts that we have to increase the production per unit land area to feed that increased population. For that there`s so many technique via which we can increase productivity of agriculture land.

- Sustainable agriculture
- Selection of high quality seeds
- Plant more density
- Manuring and fertilization
- Precision agriculture
- Credit and insurance
- Smart water management
- Heat-tolerant variety
- Farm management software
- Implementation of land reform
- Hydroponic agriculture
- Intercropping

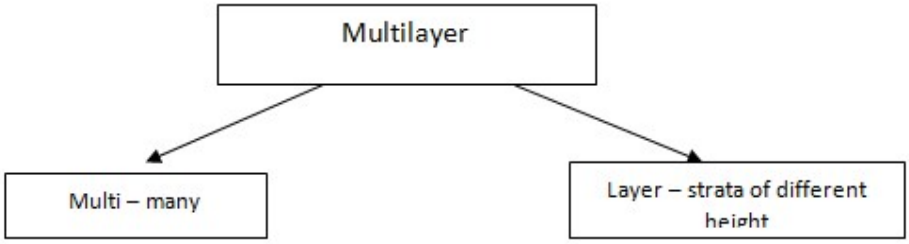
III. INTERCROPPING

Intercropping is a method of increasing agricultural productivity by planting two or more crops simultaneously on a specific plot of land in a specific row pattern for utilizing efficient sunlight, nutrient, land, water and space in economic way. Small farmers who depend on rain for higher production are more likely to use it. This procedure has a specific row pattern, such as 1:1 or 1:2, which having the base crop and second one is intercrop. These crop having different nutrient needs are blend with each other. It guarantees the best possible use of the nutrients given.

Figure 3

IV. MULTILAYER FARMING

Farmers often try new ideas in their fields based on deep knowledge of their local environment and develop many ecologically and environmentally sound local technologies/ farming practices by innovations and adaptations. One of these practices is known as Multilayer Farming. It is based on space and time annidiation. Generally the practices of planting two or more crop on same piece of land is more common in tropical region where more rainfall, high temperature and longer growing season are more favourable for continual crop production. Multilayer farming is a method of simultaneously cultivating crops of various heights on the same plot of land. Other names for it include multi-tier cropping and multi-storied cropping.



This kind of cropping is typically used to maximise the use of solar energy even with dense plant populations. Using the resources at their elimination, the farmers can use the same plot of land to produce a good crop and increase their revenues. Additionally, it addresses the issue of feeding a growing population with limited cultivable land. The primary goal of this kind of farming is to make better use of vertical space. The tallest components in this system have foliage that requires intense light and high evaporative demand, while the shorter components have foliage that requires shade and high humidity. The other goals of multilayer farming are maximising productivity per unit of land, harvesting crops on a regular basis throughout the year, and water conservation

Figure 4

Why this interest increased so dramatically in such a short time?

Shortage of food in many parts of the world, as well as the threat of insufficient supplies in the near future, continue to stimulates more intensive agricultural investigation in a research for more productive alternative

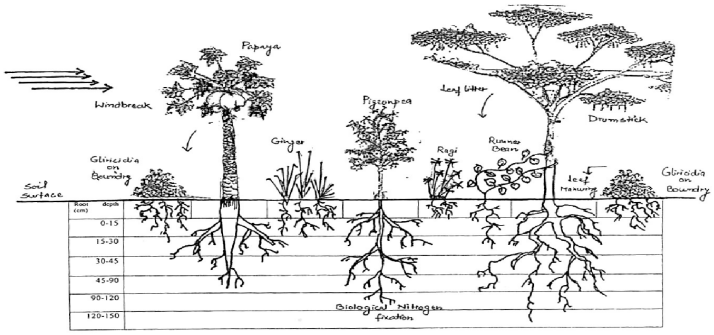


Figure 5

1. Growth Pattern of Crops

- Different (4-5) crops in multilayer farming have varying heights and rates of growth.
- The first crop develops and flourishes in the soil. Deep-rooted crop germination should take the longest amount of time.
- The following crop should emerge from the soil's middle layer sooner than the deeply rooted crop and later than the uppermost crop.
- The following crop should reach maturity at ground level and grow and mature the quickest if all other crops are removed to make room for them.
- Maximum height should be reached by the final harvest. It is a fruit that takes a long time to grow. This must be grown in specific locations and in smaller quantities.

Figure 6

2. **Basic Principles of Multilayer Farming:** Multilayer farming is built on the principle of high-density planting while utilising manure, water, land, manpower, and vertical space to the fullest extent possible. In order to reduce the use of pesticides, this farming system also focuses on minimising input costs and production costs, developing organic and sustainable farming methods, and providing the security of food and nutrition for every home.

Objective of multilayer farming

- One of the major objective is to maximize the use agricultural land, water, manures and fertilizers
- To promote sustainable agriculture
- To increase the production of different crops in a specific time
- To generate good income from one piece of land
- To minimize crop-weed competition
- To observe allelopathy phenomenon for further research purpose
- To minimize soil erosion
- To maintain soil texture and fertility

Management Practices

- Making the appropriate staking arrangements for climbing crops is necessary. The leafy crops that are surface-growing need to be collected on a regular basis.
- There should be space inside the structure designated for bug traps.
- This kind of cropping is not permitted in open areas. As a result, bamboo and wild grass should be used to build a shade structure.
- It is possible to train various crops to provide a good area underneath the building.
- Remove weak seedlings, and construct a trellis for climbers.
- Irrigation done in excess might be detrimental. In order to keep the moisture, adequate irrigation should be carried out.

3. **Steps to Perform Multilayer Farming**

- **Crop Selection:** A variety of crops are chosen for cultivation. Crops need to mature at different times and reach different heights.

- **Field Selection and Preparation:** Multi-tier farming is regarded to be best suited to geometric forms (Square and Rectangle).
- **Seed Selection and Treatment:** The ideal seed has a high production potential and is pure, healthy, and vigorous. To guard against soil- or seed-borne diseases, seeds are cleaned.
- **Irrigation:** To meet the needs for transpiration and photosynthetic activity, irrigation is essential. The ring basin method works well for irrigation.
- **Weeding:** Effective weeding techniques for multi-layer farming include hand weeding, hoeing, and sickling.
- **Adding Fertilisers and Manures:** Fertilisers and manures are used to guarantee that crops grow and develop appropriately. FYM, compost, and NPK are crucial for crop growth.
- **Harvesting and Post-harvesting:** The useful portions of crops are cut off and kept in a safe place.
- Materials are packaged and sold on the market in a profit-making manner.

4. Crops nature in Multi-layer Cropping

- Crops that are buried or planted below the surface of the earth should have deep roots and shade loving.
- Crops that are sown in the soil's top layer should have leaves. These green plants are promptly uprooted to be harvested.
- The climbing plants need to be properly anchored for development and growth. These climbing plants should be trained to be carefully controlled because they can climb onto roof structures.
- After everything has been harvested, the straight-growing plants should be clipped so that they don't take up additional area.

Advantages

- Multilayer farming generates employment and provides income round the year.
- Multilayer farming decreases the investment cost by 4 times and relegates the needs of expensive Polyhouse. The shade can be made with the help of local materials or without use of costly material like bamboo and leafy grass.
- The layered farming system aids in soil moisture conservation and ensures that crops r eceive the proper amount of sunlight, even during the peak summer days..
- It increase the nutrient use efficiency.
- The layered farming system aids in soil moisture conservation and ensures that crops r eceive the proper amount of sunlight, even during the hottest summer days.One of the main advantages of this type of agricultural system is that it has no impact on climate change.Weed germination is reduced by using a multilayer farming approach, which boosts output and productivity.
- It helps in the maximum utilization of available cultivated land for the agricultural production as the farmers can produce large number of agricultural commodities from small area.

Disadvantages

- Labour intensive.

- Difficulty in mechanization due to high density.
- Adverse effect by competitive or allelopathy.

5. Government Plans to Promote Multi-Layer Farming to Help Increase Farmers' Income

- In an effort to boost farmers' incomes, the government intends to promote multi-layer farming.
- Agriculture Ministry said multi-layer farming opens a new door for cultivators to earn all round the year as there is less risk of complete crop damage. In addition, it is a potential technology as it makes use of natural resources properly. The system helps in better use of environmental factors, better yield stability in different environmental conditions and conservation of soil and other resources.
- The Indian Institute of Farming Systems Research, which is based in Modipuram, Meerut, conducts research (on station) and technology validation through farmers' participatory research (on farm research) on Integrated Farming Systems and Cropping Systems in around 24 States. (Krishi Jagran, 2019)

Figure 7

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