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Growing seed

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CONTRACT FARMING: A WIN-WIN FOR BOTH FARMERS AND BUYERS

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In an age of market liberalization, globalization, and expanding agribusiness, there is a danger that small-scale farmers will find difficulty in fully participating in the market economy. In many countries, such farmers could become marginalized as larger farms become increasingly necessary for a profitable operation. A consequence of this will be a continuation of the drift of populations to urban areas that is being witnessed almost everywhere.

Attempts by governments and development agencies to arrest this drift have tended to emphasize the identification of "income generation" activities for rural people. Unfortunately, there is relatively little evidence that such attempts have borne fruit. This is largely because the necessary backward and forward market linkages are rarely in place, i.e., rural farmers and small-scale entrepreneurs lack both reliable and cost-efficient inputs such as extension advice, mechanization services, seeds, fertilizers and credit, and guaranteed and profitable markets for their output. Well-organized contract farming does, however, provide such linkages, and would appear to offer an important way in which smaller producers can farm in a commercial manner. Similarly, it also provides investors with the opportunity to guarantee a reliable source of supply, from the perspectives of both quantity and quality.

Contract farming can be defined as an agreement between farmers and processing and/or marketing firms for the production and supply of agricultural products under forward agreements, frequently at predetermined prices. The intensity of the contractual arrangement varies according to the depth and complexity of the provisions in each of the following three areas:

- **Market provision:** The grower and buyer agree to terms and conditions for the future sale and purchase of a crop or livestock product;

- **Resource provision:** In conjunction with the marketing arrangements, the buyer agrees to supply selected inputs, including on occasions land preparation and technical advice;
- **Management specifications:** The grower agrees to follow recommended production methods, inputs regimes, and cultivation and harvesting specifications.

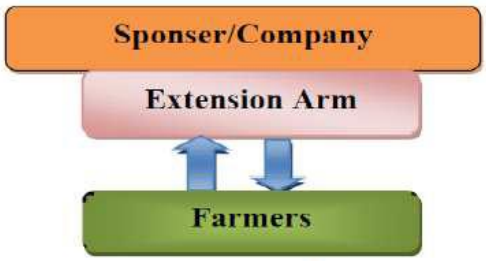
Contract Farming Has Four Important Ingredients As

i. Predetermined quantity of produce
ii. Predetermined quality of produce
iii. Pre-agreed price of produce
iv. Delivery of produce at particular point of time

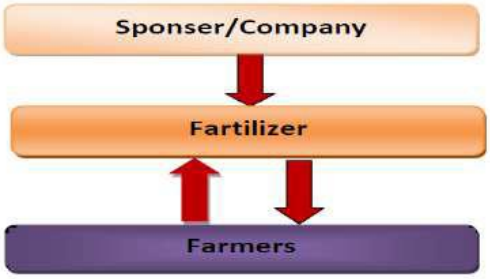
Contract Farming Models

1. **The centralized model**: Involves a centralized process and/or packer buying from a large number of small farmers. Generally, it is used for tree crops, annual crops, poultry and dairy.
2. **The nucleus estate model:** It is a variation of the centralized model where the sponsor also manages a central estate or plantation i.e., no intermediary is found.
3. **The multipartite model:** It may involve different types of organizations.
4. **The informal model:** It is characterized by individual entrepreneurs or small companies. It involves informal production contracts, usually on a seasonal basis but generally, it requires government support, and it may involve greater risk.
5. **The intermediary model:** Involves sponsor in subcontracting linkages with farmers to intermediaries. This model has disadvantages that the sponsor may lose control over production and quality as well as prices received by farmers.

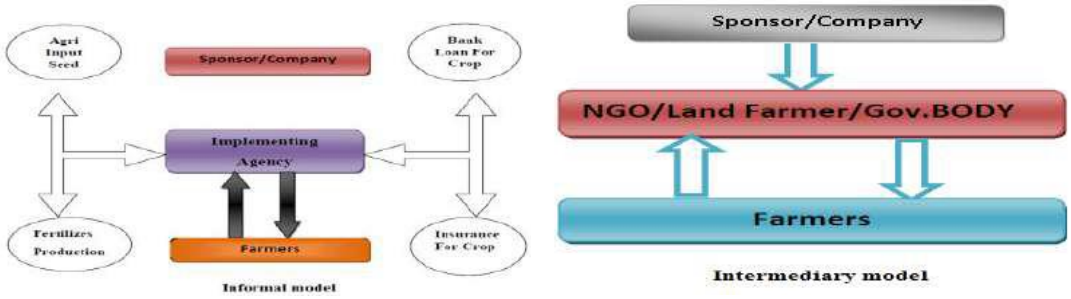
In agriculture, contract farming is most commonly found in tomato, tea, basmati rice, sugarcane etc.



Centralized model



Multipartite model



Advantages for Farmers

- Inputs and production services are supplied by the sponsor.
- Timely availability of credit from the sponsor.
- Often introduces new technology and also enables farmers to learn new skills.
- Farmers price risk is often reduced.
- Contract farming can open up new markets which would otherwise be unavailable to small farmers.

Problems Faced by Farmers

- Particularly when growing new crops, farmers face the risks of both market failure and production problems.
- Inefficient management or marketing problems can mean that quotas are manipulated so that not all contracted production is purchased.
- Sponsoring companies may be unreliable or exploit a monopoly position.
- The staff of sponsoring company may be corrupt.
- Farmers may become indebted because of production problems & excessive advances.

Advantages for Sponsors

- More consistent quality can be obtained than if purchases were made on the open market.
- Timely availability of produce.
- Production is more reliable than open-market purchases.
- Working with small farmers overcomes land constraints.
- Risk can be diverted or transferred.

Problems Faced by Sponsors

- Contracted farmers may face land constraints due to a lack of security of tenure, thus jeopardizing sustainable long-term operations.
- Social and cultural constraints may affect farmers ability to produce to managers specifications.
- Poor management and lack of consultation with farmers may lead to farmer discontent.
- Farmers may sell outside the contract.
- Farmers may divert inputs supplied on credit to other purposes, there by reducing yields.

Summary and Conclusion

Contract farming is one of the possible solutions to establish an agrarian economy that ensures food and nutrition security to a billion populations. It is a viable alternative farming model in India, which can provide assured and reliable input services to the farmers and desired farm produce to the contracting firms. However, in the present context, for both the companies and the farmer's contract farming is a win-win situation. The prospects of contract farming in India is fairly encouraging due to increasing consciousness about food safety and quality among the rising middle-class population and the quality demands of the export market in the developed countries. It offers a possible solution to the present situation by providing market guarantees to the farmers and insuring supply to the traders. Therefore, the government should establish a monitoring mechanism and a dispute settlement body to ensure that both parties adhere to the terms of the contract.

References

Chakrabarti, M. (2015) An Empirical Study on Contract Farming in India. *International Journal of informative & Futuristic Research*, 2 (5), 1464-1475.

Chandra,S., Kumar,S and Bairwa,K.C. (2013) An Introduction to Agricultural SocialSciences.New Vishal Publications, New Delhi.

Ray,R.K., Kumari.M., .Problem and Prospect of contract Farming in India. *Food and scientific reports*, ISSN:2582-5437.

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HI-TECH AGRICULTURE- A BOON FOR INDIAN ECONOMY

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Horticulture has a crucial role in food and nutritional security. It is a crucial component of the stakeholder's economic security. Hi-tech horticulture is a modern, environmentally friendly, and capital-intensive technique that can boost productivity and profitability for farmers. In the new era of climate change, hitech horticulture has become a requirement for Indian farmers to maintain production and economic stability. Hi-tech horticulture is beneficial not only in the production of fruits, vegetables, and flowers, but also in conservation, plant protection, and post-harvest management, including value-adding. The current essay examines many facets of high-tech horticulture and speculates on future possibilities.

Hi-tech horticulture refers to the application of advanced technologies such as integrated pest management, integrated nutrient management, hybrid seeds, genetically modified planting materials, protected cultivation, plasticulture, micropropagation, microirrigation, fertigation, hydroponics, precision farming, high density planting, advance mechanisation, and others to the management and qualitative production of horticulture produce for a high economic return.

High-tech farming refers to agricultural enterprises that use cutting-edge technology. It is a capital-intensive agriculture since it necessitates a high capital outlay for the acquisition of specialised equipment, asset maintenance, labour training, and so on. Hi-tech agriculture mostly refers to a commercial farming system designed to meet the needs of both domestic and international markets. It makes use of farming technology to boost yields, ensure excellent quality (typically without pesticides), and raise market value.

Potential Areas of Hi- Tech Horticulture

1. Protected cultivation

Solar and photovoltaic systems are used in a greenhouse. Pumps, UV filters, and lighting may all be made more environmentally friendly and sustainable by utilising modern solar technology. They can also be supported and operated autonomously. The aquaponic solar greenhouse enables for the production of crops, fish, and solar energy all at the same time. As a result, the food produced has an extremely low or even negative CO_2 footprint (CO_2 sink).

2. Soil less agriculture

A vertical hydroponic farm that grows underground uses 70% less water than a traditional farming operation. It uses a closed-loop ebb and flow system, in which water with nutrients floods the sprout beds a few times a day, then is recycled and reused through a reservoir.

3. Hydroponics

The idea of hydroponics is to eliminate any potential barriers to optimal growth that may exist between the roots, water, nutrients, and oxygen. It is a method of growing plants that does not require the use of soil and instead relies on mineral fertiliser solutions in a water solvent.

4. Aeroponics

Aeroponics is the process of growing plants without the use of soil or aggregate medium in an air or mist environment.

5. Vertical farming

Vertical farming, which involves growing vegetables in temperature, moisture, and nutrition-controlled indoor conditions, can boost yield while limiting environmental externalities.

Hi-Tech in India

Horticulture is no longer just a way of diversification; it is now a key part of food and nutritional security, as well as an important component of economic security. Many states,

including Maharashtra, Karnataka, Andhra Pradesh, and Kerala, have benefited from the adoption of horticulture (Singh, 2014). According to the growing population, there is a significant strain on natural resources, which is compounded by global warming and climate change, shrinking land holdings, and a strong demand for high-quality horticulture fresh produce. Cryopreservation offers a lot of potential for horticulture plants, but it's not being used. Cryopreservation protocols for pollen and vegetatively generated explants of horticultural crops are being developed. (Benelli, 2013).

Hi-Tech Propagation

A reputable horticulture firm cannot thrive without the availability of high-quality planting material. Micro-propagation is a useful technique for rapidly growing a large number of plants. It has previously benefited banana (*Musa spp.*), bell pepper (*Capsicum annum*), tomato (*Solanum Lycopersicum*), chilli (*C. annum*), and other ornamental plants. Crop micropropagation, particularly ornamental crop micropropagation, has a lot of potential in India.

Plug-plant propagation is beneficial for producing healthy, virus-free seedlings that shorten the pre-bearing phase, ensure uniform crop growth, and make harvesting easier.

Grafting is a novel hi-tech approach for vegetable crops, particularly watermelon (*Citrullus lanatus*), capsicum, and brinjal. Vegetable grafts are grown on a big scale in states like Chhattisgarh.

Advantages

- Enhancement of yield by 5 to 8 times, high productivity per unit area
- Improved quality growth and uniformity
- Optimal applications of key inputs including water (up to 50 percent), fertilizers (up to 25 percent), and pesticides.
- Increase of probability of cultivation in problematic areas like undulating terrains, saline, and waterlogged areas.
- Availability of production during off-seasons
- Benefits can be obtained throughout the year
- Reduction of impacts in the natural ecosystem
- Reduction in runoff of chemicals into rivers and ground waters.

Future Prospects

Hi-tech horticulture is a potent instrument for doubling horticultural crop output, and it can also be used to double farmers' income (DFI). To stay up with modern information-based judgments, real-time data from the crops must be recorded and instantly disseminated to decision makers as a successful hi-tech horticulture enterprise. Sensor networks, cloud computing, augmented reality, unmanned air vehicles, and control area networks are some of the cutting-edge technologies that can be used in hi-tech horticulture (Ahrary and Ludena, 2015). The combination of such technologies with indigenous expertise will have far-reaching implications, ensuring that hi-tech agriculture achieves new heights.

Conclusion

Hi tech, horticulture provides the scope for cultivation of different exotic genotypes. This also promotes the cultivation under protected condition thereby allowing adaptations as well as hardening of planting materials to extreme environmental conditions.This also provides the farmers the supply of products during off season as well as throughout the year.Therefore, in this modern era, when most of the research are targeted towards development of climatic resilience, hi tech horticulture have a pioneering role in this regard.This technology has fortified the income of farming society to great extent.

References

Ahrary, A. and Ludena, D.A.R. (2015) A cloud-based vegetable production and distribution system. In Intelligent Decision Technologies, Smart Innovation, Systems and Technologies – Proceedings of the 7th KES International Conference (R. Neves-Silva et al., Eds.), 11-20 pp.

Benelli, C., De Carlo, A. and Engelmann, F., (2013) Recent advances in the cryopreservation of shoot-derived germplasm of economically important fruit trees of Actinidia, Diospyros, Malus, Olea, Prunus, Pyrus and Vitis. *Biotechnology Advances*, *31*(2), pp.175-185.

Singh, K., Singh, B., Verma, S.K. and Patra, D.D., (2014) Jatrophacurcas: a ten year story from hope to despair. *Renewable and Sustainable Energy Reviews*, *35*, pp.356-360.

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ROLE OF FLY ASH IN AGRICULTURE: A SCIENTIFIC WAY TO IMPROVE SOIL HEALTH

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Intensive cultivation leads to meet the food demand of present generation but overexploitation of natural resources like soil and water bodies in relation to their capabilities results in decreasing level of organic matter and soil health. Sustainability is necessary to meet the demand of present generation as well as keep the soil fertile and healthy for future generations without deteriorate its quality. Scientific management, timely and safe disposal of fly ash is a unsolved problem. At present time, there is a need of safe and profitable disposal of fly ash is needed. Fly ash contains various essential plant nutrients. Fly ash is a cheaper and easily available source of plant nutrients. Utilization of fly ash in agriculture will be a milestone in timely disposal of fly ash with reduction in cost of cultivation. Fly ash improves the soil health which results in higher crop yield. Fly ash is a cheaper and easily available source of plant nutrients as compared to costly chemical fertilizers, which reduce dependency on chemical fertilizers as well as reduce the cost of cultivation.

In the last decades, rising population of our country enforced on traditional sources of energy to produce more outcome to fulfil the demands of present generation. With the time, various alternate source of energy production come into limelight like solar energy, wind, turbine, thermal plant, nuclear power generation plants. Even with discovery of such type of energy sources, the hyperbolic use of coal cannot be counterbalanced in various developing countries like India. In India, per year about 175 million tonnes of fly ash is produced from various thermal power generation plants and it is expected to production of 300 million tonnes fly ash in near future (Pani *et al.*, 2015). Every year, during the combustion of coal in thermal power plants, Bricks kilns and other industries, various by products produced.

Among these, fly ash is a major important by product, which management and safe disposal is an unsolved problem. The generation of electricity leads to anthropogenic emission of CO_2, SO_2, NO_x along with fly ash in huge quantity by thermal power plants (Singh and Pandey, 2013). Every year more than 100 million tonnes of fly ash is produced in more than 1800 thermal power plants and bricks kilns units. Presently the utilization of fly ash on global basis is about only 25% of total fly ash produced, remaining is landfilled and surface impounded (Lea*et al.*, 2021).

Fig 1: Coal-based fly ash

Disposal of Fly Ash

In general fly ash is disposed either by dry or wet method. In dry method, fly ash is disposed through dumped it in landfills and dry basins, While in wet method, fly ash is washed out in artificial lagoons with the help of water, which commonly called Pond Ash. Both these method of disposal of fly ash is costly and harmful to human health along with lead to soil quality and health degradation. Landfilling of fly ash adversely affect the soil fertility and pollute the quality of ground water also.

Fig 2: Fly ash pond

Effect of Fly Ash on Soil Properties

1. Soil Texture

The application of fly ash to heavy black clay soils can be alter their texture and make them more friable to easily plough them and favour to enhance germination of crop seeds and minimize soil crusting. An application of fly ash improve the soil texture (Panda and Biswal 2018).

2. Soil Structure

With the application of appropriate quantity of fly ash can be make soil crumby and granular with improve soil structure, which favour crop growth and yield. Fly ash improves the soil structure, when applied to soils (Dhindsa *et al*., 2016).

3. Bulk Density

Fly ash reduce the bulk density of soil, when applied to the soils. The impact of fly ash on soil physical properties on several soils mixed with 50% fly ash reveals that reduction in bulk density of soil. The particle of fly ash is very similar to silt, which alter the bulk density of soil, when applied to soils (Panda and Biswal, 2018).

4. Porosity (%)

Anaddition of fly ash to sandy soils alters the soil texture permanently with increased micro porosity and improved water holding capacity of such soils (Michel *et al*.,2004).

5. Electrical Conductivity

Anapplication of fly as 10, 20, 30 and 40% (w/w basis) in clay, sandy clay loam, sandy and sandy loam resulted in increased electrical conductivity (Panda and Biswal, 2018).

6. Infiltration Rate

Fly ash improve soil physical properties like soil texture, soil structure, aeration status.Moderate infiltration rate favour a great enhance soil aggregation and minimize runoff losses and protect the soil from erosion. So, fly ash can be used for enhanced water infiltration rate.

7. Soil Organic Matter

Fly ash is a good source of organic matter, when applied to soil, it has been enhancing the level of soil organic matter. Soil organic matter is a good source or store house of plant available nutrients. Soil organic matter hold the plant nutrients by chelate formation and minimize their leaching losses.

8. Water Holding Capacity

The application of appropriate quantity of fly ash improves the levels of water holding capacity of a soil(Dhindsa *et al*., 2016). Several field experiments reveals that soils mixed with 50% fly ash showed a higher water holding capacity as compared to other soil. An application of fly as 10, 20, 30 and 40% (w/w basis) in clay, sandy clay loam, sandy and sandy loam resulted in increased water holding capacity (Panda and Biswal, 2018).

9. Soil pH

Fly ash can be used to correct both the soil acidity and soil alkalinity. Fly ash can be acidic or alkaline which is depends upon the source and combustion process.The application of fly as 10, 20, 30 and 40 % (w/w basis) in clay, sandy clay loam, sandy and sandy loam resulted in increased soil pH (Panda and Biswal, 2018). Fly ash when applied to acidic soils, act as a liming material to neutralize soil acidity which enhance the available nutrient status of the soil. The principal beneficial characteristics offly ash is due to carbonate and hydroxide salt present in it.

10. Cation Exchange Capacity

Fly ash contains various cations and anions, when fly ash is applied to soil, these cations and anions replace otherion on exchangeable sites and enhanced cation exchange capacity which favours certain plant nutrients availability. An application of fly ash increase the level of cation exchange capacity of soil (Tomar *et al*., 2015).

11. Soil Fertility level

Fly ash is also a rich source of various micronutrients including Fe, Mn, Zn, Cu, Boron and Molybdenum (Meena *et al.*, 2019). Higher concentration of essential plant nutrients including K, Ca, Mg, Na, Zn and Fe in fly ash increased the yield of agricultural crops.An application of fly ash with municipal biosolids prove N and P to the soil with leading to better crop

production (Sahoo *et al*., 2021).So, fly ash can be used as a source of nutrient. An application of fly ash with municipal bio-solids prove N and P to the soil with leading the better crop production (Sahoo *et al*., 2021).

12. Microbial population and enzymatic activities

Fly ash is when applied to acidic soils, it corrects the soil acidity by rise the soil pH which create a favourable environment for bacterial and other certain microbial population resulted in nutrient transformation and nitrogen fixation. The soil applications of fly ash increase activity of invertase, amylase, dehydrogenase and protease enzyme in soil system (Sarangi *et al*., 2001). There was a significant effects on soil health in terms of microbial populations, enzyme activities with improved bacterial community diversity (Lea*et al*., 2021).

13. Better Crop Yield

Fly ash contains essential plant nutrients in higher quantities**.** Higher concentration of essential nutrients in fly ash including K, Ca, Mg, Na, Zn and Fe increased the yield of agricultural crops. An application of fly ash with municipal bio-solids prove N and P to the soil with leading to better crop production (Sahoo *et al*., 2021).

14. Act as Pesticide

Astudy reported that more than 50 species of insect pest of major agricultural crops found susceptible to fly ash treatment. Fly ash can be used to control both chewing and sucking pests of field crops like leaf folder, grasshopper, brown plant hopper, yellow caterpillar, brown bug, red ear head bug, black bug. Soil application of 5% fly ash to tomato crop found root knot nematode infestation.

Conclusion

Fly ash contains various essential plant nutrients in a wider range, which make it an alternate source of plant nutrients and as a soil ameliorant to improve the soil quality and health. Fly ash is a cheap and easily available source of plant nutrient. Fly ash application in various soils has been showed an admirable positive effect on various physic-chemical and biological properties as well as plant biomass and nutrient uptake by crop plants. Fly ash can be used as ameliorant in both acidic and sodic soils depends upon nature of fly ash. Applications of fly ash alone or combinations of with appropriate doses improve soil health and subsequently crop yields.

References

Dhindsa, H. S., Sharma, R. D. and Kumar, R. (2016). Role of fly ash in improving soil physical properties and yield of wheat (*Triticum aestivum* L.). *Agricultural Science Digest-A Research Journal.* **36**(2): 97-101.

Lea, T. V., Ngoa, C. N. and Futamatab, H. (2021). Effect of fly ash amendment on sandy soil properties and peanut yields. *Science Asia*, **47**(3): 357-365.

Meena, R. K., Meena, R. and Ram, B. (2019). Effect of fly ash, phospho-gypsum and chemical fertilizers on growth, yield and nutrient uptake of wheat (*Triticum aestivum* L.) in Inceptisol. *Journal of Pharmacognosy and Phytochemistry*. **8**(5): 733-736.

Michel C. Nolin, B. G. and Cambouris, A. N. (2004). Combined de-inking paper sludge and poultry manure application on corn yield and soil nutrients. *Canadian Journal of Soil Science*, **84**(4): 503-512.

Panda, R. B. and Biswal, T. (2018). Impact of fly ash on soil properties and productivity. *International Journal of Agriculture, Environment and Biotechnology*, **11**(2): 275-283.

Pani, N. K., Samal, P., Das, R. and Sahoo, S. (2015). Effect of fly ash on growth and yield of sunflower (*Helianthus annuus* L.). *International Journal of Agronomy and Agricultural Research.* **7**(2): 64-74.

Sahoo, C. R., Sahu, R. K. and Padhy, R. N. (2021). Growth, yield and element-analysis of rice (Oryza sativa L.), grown in soil amended with fly ash and municipal bio-solids. *Paddy and Water Environment*. **19**(1): 149-157.

Sarangi, P. K., Mahakur, D. and Mishra, P. C. (2001). Soil biochemical activity and growth response of rice (*Oryza sativa* L.) in fly ash amended soil. *BioresourceTechnology*, **76**(3). 199-205.

Singh, J. S. and Pandey, V. C. (2013). Fly ash application in nutrient poor agriculture soils: impact on methanotrophs population dynamics and paddy yields. *Ecotoxicology and Environmental Safety*, **89**: 43-51.

Tomar, D. and Khan, A. A. (2015). Physico-chemical properties of fly ash amended soils and their impact on potato crop.**5**(2): 87-95.

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IMPORTANCE OF SUMMER PLOUGHING IN AGRICULTURE

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Soil is main factor for crop growth and soil has property that is influence the crop growth and production. Soil property and crop production can be enhances by practise as soil ploughing. Summer Ploughing" is defined as the ploughing the field across the slope during hot summer with the help of specialized tools with primary objective of opening of the soil crust accompanied by deep ploughing and simultaneously overturning of the soil underneath to disinfect it with the help of piercing sun rays. To replenish the soil profile, do deep summer ploughing (off season tillage) with pre-monsoon rains (in May). It makes it easier to sow crops as soon as the southwest monsoon arrives. Tillage in the off-season enhances soil water content and decreases runoff. It also helps to keep pests and weeds at bay. Ploughs are used in farming to loosen or stir the soil in preparation for spreading seeds or planting. Ploughs were once pulled by working animals like horses or cattle, but now they are pulled by tractors (Alliaume *et al.*, 2013). The frequency and depth of ploughing depends on the severity of the weeds. Prior to the arrival of the monsoon, at most two summer ploughings are done, separated by 15-20 days. After the first monsoon rain, a third ploughing can be done using a harrow or cultivator to pulverize the soil and prepare field beds for sowing/transplanting.

When a soil is farmed or tilled, the aggregates in the soil are broken up and aerated. This exposes soil organic matter, accelerates its disintegration, and harms soil structure (Campiglia *et al.*, 2010). Cultivation that combines surface and subsurface soil dilutes organic materials and lowers the frequency of soil-borne diseases (Luna *et al.*, 2012; Kabir *et al.*, 2013). Ploughing improves the soil characteristics particularly preparation of good seedbed, elimination of weeds and as a result it affects the agronomical attributes like seed germination, seedling growth and crop yield (Kumar and Chopra, 2013).

Tool or Implements Used for Summer Ploughing

Local plough (Hal) and blade harrow (Bakhar) are traditional implements used for loosening of soil. These are simplest tools designed to break the topsoil and multi-passes are carried out to prepare seedbed. Mould board plough, disc plough, soil stirring plough, ridger plough, tool frames/carriers with mouldboard plough or tillage sweeps, etc. are improved implements designed for breaking soil. Ploughs are used to break soil and invert furrow slice to control weeds, etc.

Local plough (Hal)

MB plough

Disc plough

Soil stirring plough

Benefits of Summer Ploughing

- Ploughing breaking of hard crusted upper layer of the soil and deep ploughing the infiltration capacity and permeability of the soil increases which increases in-situ moisture conservation. Consequently plant roots will get more moisture with less effort.
- Summer ploughing improves soil structure due to alternate drying and cooling.

- Ploughing improves soil aeration which helps in multiplication of microorganisms. Organic matter decomposition is hastened resulting in higher nutrient availability to the plants.
- Increased aeration aids in the breakdown of herbicide and pesticide residues as well as damaging allelopathic compounds released by the roots of prior crops and weeds, which hinder the development of nearby plants.
- As the soil's ability to absorb precipitation grows, atmospheric nitrate combined with water penetrates the soil, increasing soil fertility.
- During the hot summer months, many insects and pests hibernate beneath the soil crust or stubbles. The strong rays of the sun enter the soil due to overturning during summer ploughing, killing the eggs, larvae, and pupae of soil borne insects and pests, reducing the risks of insects and pests on succeeding crops. As a result, the cost of insecticides and pesticides for the farmer is reduced.
- Exposed to the heat of summer, many dangerous bacteria spores and fungal microorganisms die. Because of the suppression of plant diseases caused by summer ploughing, farmers may save money on fungicides and insecticides.
- Plant parasitic nematodes are tiny creatures that live in the soil and damage succeeding crops to the point where total crop loss is a possibility. Nematode management can be accomplished by summer ploughing and crop rotation. Nematicides are rarely used to control nematodes because of their high cost, whereas summer ploughing does it for free.
- Weeds are uprooted by deep ploughing and overturning. As a result, the weeds' roots and stems get dessicated and die. As a result, one of the key advantages of summer ploughing is weed control and fewer weedicide treatment. As a result, competition between crops and weeds for the same plant nutrients is minimized, resulting in increased output.
- Ploughing a field over a slope destroys the continuity of the soil slope, diminishing the ability of the soil to carry run-off water. As a result, soil erosion is reduced. Clods cover more of the ground surface, limiting the effect of wind erosion on nutritious soil particles.

Conclusion

Plough change the soil environment and inhibiting the weeds germination and establishment and by moving their seeds vertically and horizontally. Deep plough also help

on storage of rain water and nutrients balance which help in getting higher crop yield and maintain the soil funna and flora So deep ploughing in summer is the best practices in field to enhance the soil properties and crop production.

Refeernces

Alliaume, F. Rossing, W.A.H., Garcia, M., Giller, K.E. and Dogliotti, S. (2013). Changes in soil quality and plant available water capacity following systems re-design on commercial vegetable farms. *Eurasian J. Agron.*, 46: 10-19.

Campiglia, E., Mancinelli, R., Radicetti, E. and Caporali, F. (2010). Effect of cover crops and mulches on weed control and nitrogen fertilization in tomato (*Lycopersicon esculentum* Mill.). *Crop Prot.*, 29: 354-363.

Luna, J.M., Mitchell, J.P. and Shrestha, A. (2012). Conservation tillage for organic agriculture: evolution toward hybrid systems in the western USA. *Renew. Agric. Food Syst.* 27(1): 21-30.

Kabir, M.A., Rahim, M.A., Majumder, D.A.N. and Iqbal, T.M.T. (2013). Effect of mulching and tillage on yield and keeping quality of Garlic (*Allium Sativum* L.). *Bangladesh J. Agr. Res.*, 38(1): 115-125.

Kumar, V. and Chopra, A.K. (2013). Reduction of weeds and improvement of soil quality and yield of wheat by tillage in Northern Great Plains of Ganga River in India. *Int. J. Agr. Sci. Res.*, 2(8): 249-257.

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FAIRY RING SPOT- A DEVASTATING DISEASE IN CARNATION

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Floriculture is one amongst the foremost potential parts of the gardening industry, being vital from aesthetic, social and economic points of view. it's the potential for generating employment opportunities round the year and earning exchange.

- Carnation (*Dianthus caryophyllus* L.) is one amongst the foremost widespread and ancient cut flowers worldwide. This species has been used extensively by breeders for hundreds of years, and as a result several cultivated hybrids exist.
- Globally, carnations have larger stipulation within the cut-flower business. However, their productivity is hampered because of varied diseases. vital diseases of carnations embrace stem rot (*Sclerotinia sclerotiorum*), wilt (*Fusarium oxysporum* f.sp. *dianthi*), doughnut spot (*Cladosporium echinulatum*) and blossom blight (*Botrytis cinerea*).
- Among them, fairy ring spot of carnation is notable and causes extensive injury.
- In 1870, Berkeley identified and named the causative organism as *Helminthosporium echinulatum*.
- Later the name was replaced as *Cladosporium echinulatum*.
- Host range of the infective agent includes carnation, sweet williams, lychnis, genus Saponaria and different members of caryophylloid dicot family. In India, the infective agent was 1st known in Himachal Pradesh..

Symptoms

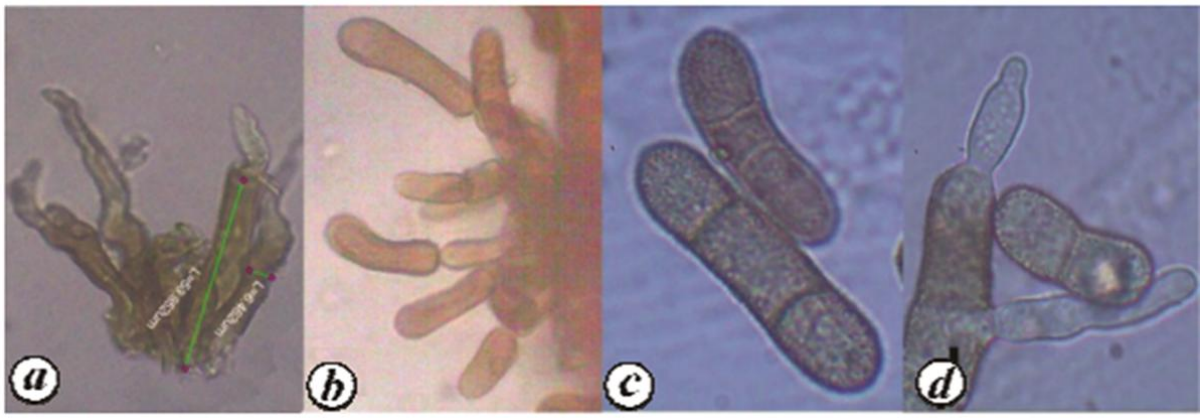
- The disease causing pathogen affects the aerial organs of the plant, particularly leaves and flowers
- In leaves, minute pin head lesion as initial symptoms. Then it enlarges as circular to oval spots with dark, purplish margin with grey centre.

Fairy-ring Leaf Spot Symptoms on Leaves and Flower

- During rainy seasons, dark brown, spore mass was observed at the centre of the spot.
- Under extreme conditions, the spots coalesce, causing the plant to completely dry up.
- Typical dots on the calyx, epicalyx, leaf, and petiole of all plant components.
- A severe calyceinfection affected the quality of marketable flowers.
- The disease was called 'fairy ring' spot because of the brownish growth in the form of dull and dark bands.
- The spots' edges were distinct and purple to dark purplish.
- In severe situations, the spots clump together, causing the entire plant to blight and die, resulting in significant losses.

Pathogen

- ✓ Fairy ring spot – *Cladosporium echinulatum*
- ✓ Teleomorph: *Mycosphaerella dianthi*
- Conidiophore – brown, thick-walled, geniculate with granulation
- Conidia - yellowish brown, 1–4 septated, broadly ellipsoidal to cylindrical or soleiform, echinulated conidia with basal bulbous cell.



a. Geniculate conidiophores;

b. Geniculate conidiophore bearing yellowish brown, soleiform conidia;

c. Echinulate conidia;

d. Germinating conidia.

Spread and Survival

- Conidia are spread by wind, cultural practices, workers, diseased plants, or infected harvest residues

Epidemiology

- It is increased by high humidity during wet weather or wet leaves in greenhouses.

Management

- Regulating condensation in greenhouses, utilising ventilation and heating judiciously, and irrigating only in the morning would help to reduce the disease.
- For disease management, removing senescing and dead plant tissue that provides a ready substrate for *Cladosporium* sporulation.
- Mancozeb is a contact and preventative fungicide that prevents spore germination.
- Tebuconazole, propineb, captafol, zineb, tricarbamix, chlorothalonil, and triforine are examples of fungicides.
- Bioagent: *Bacillus amyloliquefaciens*, which is beneficial against carnation fairy ring spot.

Conclusion

Fairy ringspot is most important devasting disease in carnation and causes extensive damage to carnation cultivation in all over the world. By adopting the disease management practices as the initial stage, the farmers could reduce disease infestation and increase the flower production.

References

Cedeno L and Carrero C. (1997) *Cladosporium echinulatum* causingspots in leaves and flowers of carnation in Merida, Venezuela. *Rev. ForestalVenezolana*, **41(1)**: 91–92.

David JC. (1988) CMI descriptions of pathogenic fungi and bacteria no. 951.*Mycopathologia*, **103**: 117–118.

Dhancholia S and Paul YS. (2001) Fairy ring leaf spot of carnation from Himachal Pradesh. *J. Mycol. Plant Pathol.*,**31(1)**: 91.

Vinodkumar S and Nakkeeran S. (2018) *Bacillus amyloliquefaciens* (VB7) with diverse antimicrobial peptide genes. *Current Science*, **115(8):**1519-1524

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ECO FRIENDLY MANAGEMENT TOOLS FOR AN INVASIVE PEST SPECIES MAIZE FALL ARMYWORM (FAW) *Spodoptera frugiperda* (J. E. SMITH) (LEPIDOPTERA: NOCTUIDAE)

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The fall armyworm (FAW), *Spodoptera frugiperda* (J. E. Smith), is a polyphagous pest native to North America that was first discovered in West Africa in 2016. (Harrison, et al., 2019). For the first incidence in India, it was reported in 2018. (Sharanabasappa and Kalleshwaraswamy *et al.*, 2018). It was initially seen feeding on maize fields at Sabour in the Bhagalpur district of Bihar in August of this year. (2020, Reddy *et al*.) The fall armyworm is a well-known pest with a broad host range (over 80 plant species) and great fertility, making it one of the most economically damaging pests. The larval stage is the most destructive in nature, affecting crop production by 70 percent in the entire economy. Maize, sorghum, various millets, rice, sugarcane, as well as other vegetable crops and cotton, are all affected from it. The cultural method is the most effective, accounting for 56 percent of pest control, whereas the push and pull method controls 82.2 percent of larvae per plant. Azadirachta indica seed powder was shown to prevent 70% larval mortality in the lab, whereas *Nicotiana tabacum* and *Lippia javanica* seed powder controlled the larvae by 66% in contact toxicity. *Metarhizium anisopliae*, a bio-control agent, kills 87 percent of eggs and 96.5 percent of newly hatched larvae. Small-holder farmers can use chloropyrifos combined saw dust to control 20% of pests and spinosad to control 90% of larval population, allowing them to take precautions on time and avoid crop loss**.** Integrated pest management strategy is best for the management of the fall armyworm.

It is an invasive and noxious pest of maize, which is native to tropical and sub-tropical regions of America. The pest invaded to West and Central Africa in 2016 and the spread to all the countries of sub-Saharan Africa. In India incidence of FAW first reported from

Karnataka on maize crop in 2018. Later its presence was confirmed in Maharashtra, Andhra Pradesh, Gujarat, Tamil Nadu and Telangana States. In Bihar FAW is now reported from Sabour in Bhagalpur district in 2019. It is polyphagous pest which can feed on about 186 different plant species including crops such as maize, paddy, sorghum, cotton, sugarcane etc. It cause huge yield loss in maize up to 57% to 58% (Dhar *et al.*, 2019). Damage done in India on maize crop during July-December. As a result, crop mismanagement and crop pests have a significant impact on crop output and profitability, and there is a clear need to manage crops from FAW properly and efficiently to ensure the long-term viability of any agriculture-based business. Farmers utilise a variety of management strategies in different countries, regions, and locations, all of which have no harmful impact on the environment or human health.

Eggs Stage

Female moths lay their eggs on the underside of the leaves towards the plant's base, near the junction of the leaf and the stem. White, pinkish, or light-green eggs have a spherical shape and are white, pinkish, or light-green in colour. The number of eggs in each mass ranges from 100 to 200. After emergence, each female lays 1500 to 2000 eggs over a period of days. The eggs are dome-shaped and range in size from 0.3 to 0.4 mm in diameter. A layer of scales is also laid down by the female between the eggs and over the egg masses. During warm weather, the egg stage lasts only two to three days.

Larvae Stage

Larvae emerge three to five days after oviposition and move to the whorl. There are six phases of larval development. Larvae in the second and third instar stages are commonly cannibalistic, resulting in a whorl with only one larva. The first instar larvae are greenish with a black head, which changes to an orange colour in the second instar. The mature larvae are 30 to 40 mm long and come in a variety of colours. A white inverted "Y" shaped suture can be seen on the face of an adult larva. During the summer, the larval phase is 14 days and in the winter, it is 30 days.

Pupa Stage

Pupation takes occurs in the earth, at a depth of 2 to 8 cm, and the pupae are reddish brown and may be hard. The larva spins a loose cocoon that is 20 to 30 mm in length and is oval in shape. If the soil is too hard, the larvae may weave leaf litter and other materials

together to form a cocoon on the surface. The pupal stage lasts about 8 to 9 days in the summer and 20 to 30 days in the winter.

Adult Stage

Adult moths are 20 to 25 mm long with a 30 to 40 mm wing span. Adults are nocturnal and most active in the evenings when it is warm and humid. The male moth's forewing is dark grey, whereas the female's is light brown. Silvery white hind wings with a small dark marking on the margins. Adult life is expected to last about 10 days on average, with a range of 7 to 21 days. In 35-60 days, the entire life cycle is accomplished. Each season, 6-12 generations are found**.**

Damaging Symptoms

- **Elongated papery windows:** Elongated papery windows of all size are seen spread all over the leaves in a few adjacent plants the crop might have been infested with FAW. This symptom is caused by 1st and 2nd instar Fall Armyworm larvae which feed by scraping on leaf surface.
- **Ragged-edged holes:** Once the larvae enter 3rd instar, its feeding caused ragged-edged round to oblong holes on leaves. The size of holes increases with growth of larvae.
- **Extensive leaf damage:** Once the larvae enter 5th instar, it feed faster and damage large area of leaves. Sixth instar larvae extensively defoliate the leaves and produce large amount of faecal matter.

Integrated Management

1. Monitoring

Pheromone is mostly used in monitoring of FAW because pheromones can travel by air over very long distance. Installation of pheromone trap @ 5/acre in current and potential area of spread in crop season and off-season.

2. Scouting

Start scouting in ‘W’ MANNER as soon as maize seedlings emerge. At Seedling to early whorl stage (3-4 Weeks after emergence)- Action can be taken if 5% plants are damage. At the mid whorl to late whorl stage (5-7 weeks after emergence) – Action can be taken if

10% whorls are freshly damaged in mid whorl stage and 20% whorl damage in late whorl stage. At tasselling and post tasselling (Silking stage)- Do not spray insecticides. But 10% ear damage needs action.

3. Cultural control

- Before sowing, deep ploughing is recommended. This will make FAW pupae vulnerable to predators. Sowing at the right time is recommended. Staggered sowings should be avoided. Maize intercropping with regionally appropriate pulse crops. 3-4 rows of trap crop (e.g. Napier) are sown around the maize field.
- Clean cultivation and balanced use of fertilizers. Cultivation of maize hybrids with tight husk cover will reduce ear damage by FAW.

4. Mechanical control

Hand-picking and mass killing of egg masses and neonate larvae using kerosine water or smashing. Bird perches were erected at a rate of 10 per acre throughout the early stages of the crop. Dry sand was applied to the whorls of afflicted maize plants shortly after FAW was discovered in the field. Male moths are mass trapped using pheromone traps at a rate of 15 per acre.

5. Bio-control strategies

Release of egg parasitoid *Trichogramma pretiosum, Telenomus remus, Chelonus insularis* and larval parasitoids *Cotesia margiventris* @ 50,000 per acre at weekly intervals. Application of biopesticide such as *Metarhizium anisopliae* @ 5g/litre or *Nomuraea rileyi* @ 3g/litre whorl application at 15-25 days after sowing. Another 1-2 spray may also be given at an interval of 10 days. Application of *Bacillus thuringiensis* var *kurstaki* formulation @ 2g/litre or NSKE (Neem formulation 1500 ppm) @ 5 ml/lit. of water for control of early instars. If infestation is more than 10%, whorl application of *Bt var. kurstaki* formulation (400g/acre) @ 2g/lit. or *Metarhizium anisopliae* or *Beauveria bassiana* with spore count of 1 x108cfu/g (1kg/acre) @ 5g/lit. or entomopathogenic nematode (EPN) (4kg/acre) @ 10g/lit. of water is recommended

Natural Enemies of Fall Army Worm

- **Predators** – ground beetles, carabid beetles, ladybird beetles, tiger beetles, soldier bugs, ear wigs, birds, bats, spiders, ants and rodents, 60 to 90 % 0f pupae are predated by birds, bats, and rodents.
- **Parasitoids**- The important parasitoids are wasps and flies among them *Cotesia marginiventris* , *Chelonus texanus* and *Archytas marmorantus* (Diptera) are potential parasitoids.

6. Chemical control

- Seed treatment with Cyantraniliprole19.8%+ Thiamethoxam 19.8% FS @ 6ml/kg of seed will be effective for 15-20 days.
- **First Window (seedling to early whorl stage):** Spray 5% NSKE / Azadirachtin 1500ppm @ 5ml/l of water.
- **Second Window (mid whorl to late whorl stage):** To manage 2nd and 3rd instar larvae having more than 10% foliar damage use of Spinetoram 11.7% SC @ 0.5ml/litre of water or Chlorantraniliprole 18.5% SC @ 0.4 ml/litre of water or Thiomethoxame 12.6% + Lambda cyhalothrin 9.5% ZC @ 0.25ml/litre of water.
- For late instar larvae, poison baiting is suggested. Ferment the 10kg rice bran + jaggery mixture with 2-3 litres of water for 24 hours. Just half an hour before field application, add 100g Thiodicarb. The bait should be injected into the plant's inflorescence.
- **Third window (8 week after emergence to tasselling and post tasselling):** Insecticide management is not cost effective at this stage. Bio-pesticide as recommended above to be applied. Hand picking of the larvae is advisable.

Conclusion

Fall armyworm is one of the most destructive pests on the planet. This insect has a greater chance of spreading over the world, resulting in a major drop in agricultural production and productivity. Fall armyworm control necessitates an integrated management strategy, with early field inspection and identification of the regulating mechanism being critical. A pest awareness campaign involving advisory services on pest identification, damage signs, and control procedures with suitable measures will help to minimise the pest's incidence. Small holder farmers around the world might benefit greatly from locally accessible resources and

approaches, hence there is a pressing need to educate them about fall armyworm control measures. The approaches can help to reduce the number of pest invasions and losses, as well as contribute to world stability. It may be suggested that a communal activity be recommended to help manage the armyworm.

Reference

Dhar, T; Bhattacharya, S; Chatterjee, H; Senapati, SK; Bhattacharya, PM; Poddar, P; Ashika, TR and Venkatesan, T. (2019) Occurrence of fall armyworm *Spodootera frugiperda* (J.E. Smith) on maize in West Bengal, India and its field life table studies. *Journal of Entomology and Zoology Studies*. 7(4): 869-875.

FAO and CABI (2019) Community-Based Fall Armyworm (*Spodoptera frugiperda*) Monitoring, Early warning and Management, Training of Trainers Manual, First Edition. 112pp.

Government of India, Ministry of Agriculture & Farmers Welfare Department of Agriculture, Cooperation & Farmers Welfare Krishi Bhawan, New Delhi-110001. (2019) Management of Fall Armyworm in maize.

Harrison, R. D., Thierfelder, C., Baudron, F., Chinwada, P., Midega, C., Schaffner, U., & van den Berg, J. (2019). Agro-ecological options for fall armyworm (Spodoptera frugiperda JE Smith) management: Providing low-cost, smallholder friendly solutions to an invasive pest. *Journal of Environmental Management*, *243*, 318-330.

Reddy, K. J. M., Kumari, K., Saha, T., & Singh, S. N. (2020). First record, seasonal incidence and life cycle of fall armyworm, Spodoptera frugiperda (JE Smith) in maize at Sabour, Bhagalpur, Bihar. *Journal of Entomology and Zoology studies*, *8*(5), 1631-1635.

Sharanabasappa, M., Lavanya, N., Kalleshwaraswamy, C. M., & Shivanna, B. K. (2018). Udonga montana (distant)(hemiptera: pentatomidae), and it's swarming on forest plants in Shivamogga district. *Indian Journal of Entomology*, *80*(1), 102-107.

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AQUAPONICS- SOIL LESS INDOOR FARMING SYSTEM

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Aquaponics is a low-input, low-waste food production method that employs circular economy principles and a biocompatible natural system. It is a diligent technique that perfectly integrates with intensive agriculture's long-term expansion. Aquaponics is sustainbale farming system involving two production system i.e. recirculating aquaculture system (RAS) and hydroponic cultivation. Fish and crustaceans are farmed in a tank in recirculating aquaculture, whereas vegetables are grown in a media other than soil in hydroponic cultivation. The water of recirculatory tank containing fish waste (rich in nitrogenous waste) used as fertilizer in hydroponic unit. In the context of climate change, Aquaponics is emerging as a crucial technology with the potential to transform agriculture and improve food security, particularly in dry places.

Basic Components of Aquaponics System

Fish-Fish are a key aspect of an aquaponics system since they supply natural fertilizer for the plants; therefore selecting the correct fish to raise in your aquaponics system is critical.

Plants-We may grow a number of plants in an aquaponics system, and deciding which ones to cultivate can be a fun part. Plants, on the other hand, have distinct needs and may flourish in a variety of conditions. The selection of the right aquaponics plants is crucial to the system's success.

Bacteria-In an aquaponic system, fish and plants need a healthy bacterial population to survive. Bacteria are required for an aquaponic system to function properly. Nitrification is the process by which bacteria convert fish waste into nutrients for plants.

Nitrification is the conversion of organic compounds to nitrites, which are then converted to nitrates. This is accomplished by Nitrosomonas converting ammonia to nitrite. Nitrobacter then transforms nitrites to nitrates. They can be absorbed by plants once they have been transformed to nitrates.

Fish Tanks-The fish tank is place where the fish kept in aquaponic system , so the selection of right fish tank to will help the fish to thrive well and to make an aquaponics system run smoothly.

Grow Bed-Plants can be cultivated in a grow bed, nft pipes, or floating rafts, depending on our aquaponics design. Because this is where our plants develop, the grow bed is the cornerstone of our aquaponics system. As a result, the grow bed we choose is important to the success of our aquaponics system.

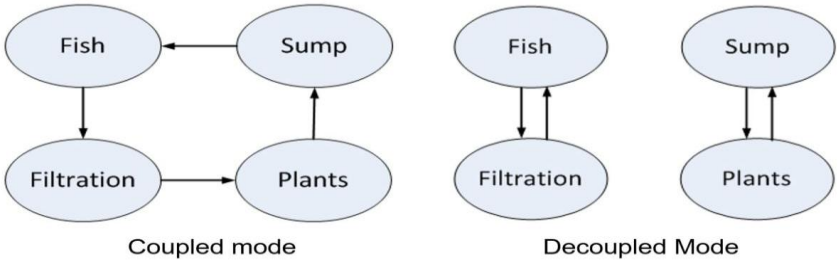
Water Pump- The selection of suitable water pump will ensure the continuous flow of water throughout the whole aquaponics system, to maintain the continuous movement of nutrients from fish tank to plants or vice versa.

Plumbing- The plumbing or pipe works are an integral part of an aquaponics system. Plumbing provides a platform for the plants and fish to coexist symbiotically by maintaining the continuous movement of nutrients in the system.

How an Aquaponics System Works?

Plants are cultivated in the grow bed, while fish are kept in the fish tank in Aquaponics. The ammonia-containing water from the fish tank is fed to the grow bed, where billions of naturally occurring helpful bacteria break it down into nitrites and ultimately nitrates. Nitrates and other nutrients are absorbed by plants to aid their growth. The roots of the plant clean and filter the water before it returns to the fish tank to survive. The oxygenated, fresh water recirculates back to the fish tank, where the cycle begins again.

The fish system can be controlled independently of the hydroponic plant system in an aquaponics farm that is "de-coupled." Water from the fish tanks flows through a series of filtering



tanks before entering the hydroponic system in normal operation. This filtered, clean water is returned to the fish system by a single pump. In de-coupled mode, water from the fish tanks passes through the filtering system normally, but it does not pass into the hydroponic troughs; instead, it returns to the fish tanks via a separate line.

Suitable Fish Species for Aquaponics

Fishes are very important part of any aquaponics system. The fish species suitable for aquaponics system should have similar needs same as plants and also they should also tolerate high stocking density. Fish Species like Tilapia, Catfish, Koi, Pacu, Carps, Pangas and some ornamental fishes like angel fish, guppies, tetras, sword fish etc. are suitable for aquaponics farming.

Ideal Vegetable varieties for Aquaponics

Vegetable varieties which have higher nutritional demands and capable to survive in heavily stocked area suitable for Aquaponic farming. Vegetable varieties like Carrots, Beets, Radish, Cauliflower, Cabbage, Broccoli, and leafy Lettuce etc. are mostly used in Aquaponics Farming.

Table 1: General water quality tolerances for fishes, hydroponic plants and nitrifying bacteria in Aquaponic System.

Organism type	Temp (°C)	pH	Ammonia (mg/litre)	Nitrite (mg/litre)	Nitrate (mg/litre)	DO (mg/litre)
Warm water Fishes	22–32	6–8.5	< 3	< 1	< 400	4–6
Cold water fish	10–18	6–8.5	< 1	< 0.1	< 400	6–8
Plants	16–30	5.5–7.5	< 30	< 1	-	> 3
Bacteria	14–34	6–8.5	< 3	< 1	-	4–8

Merits of Aquaponics as a Food Production System

- Sustainable food production system.
- Two agricultural products (fish and vegetables) are produced from one nitrogen source (fish food).
- Extremely water efficient.
- Soil less farming.

- No requirement of Chemical or fertilizers.
- Production of good quality crops with high yield..
- Higher control on production leading to lower losses.
- Can be used on non-arable land such as deserts, degraded soil or salty, sandy islands.
- Creates little waste.

Demerits of Aquaponics System

- When compared to soil vegetable cultivation or hydroponics, the initial start-up expenditures are higher in Aquaponics.
- Each farmer must have knowledge of fish, bacteria, and plant production in order to be successful.
- Sometimes the needs of fish and plants do not always coincide.
- It requires daily management practice.
- Electricity, fish seed, and plant seeds must all be available on a consistent basis.

Conclusion

Aquaponics is a combination of aquaculture and hydroponics in which the aquaculture system's nutrient-rich waste water is redirected into the hydroponic system. Environmental regulations in the modern era are limiting the amount of water that can be consumed or disposed. Deserts and arid areas, sandy islands and urban gardens are the locations most appropriate for Aquaponics because it uses absolute minimum of water. As a result in the aquaponics system wastewater of aquaculture unit is purified and recirculated back into the hydroponics system. The wastewater comes from aquaculture unit is rich in nitrogen and other organic materials which is act as good organic fertilizer for the plants of hydroponic unit.

Now days Aquaponics arises an opportunity in the field of indoor farming by providing two sources of income i.e. fish and Vegetable for the marginal farmers to make more money by utilizing small area of land.

References

Somerville, C., Cohen, M., Pantanella, E., Stankus, A. & Lovatelli, A**.** **(**2014) *Small-scale aquaponic food production. Integrated fish and plant farming.*FAO Fisheries and Aquaculture Technical Paper No._589. Rome, FAO. 262 pp.

Blidariu, Flavius & Grozea, Adrian. (2011). Increasing the Economical Efficiency and Sustainability of Indoor Fish Farming by Means of Aquaponics-Review. Scientific Papers: Animal Science and Biotechnologies. 44.

https://gogreenaquaponics.com

Shafahi, M., & Woolston, D. (2014, November). Aquaponics: a sustainable food production system. In *ASME International Mechanical Engineering Congress and Exposition* (Vol. 46469, p. V003T03A073). American Society of Mechanical Engineers.

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CURRENT STATUS AND CONSERVATION OF MANGROVES IN INDIA: AN OVERVIEW

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Mangroves are the coastal trees or bushes that have evolved to thrive in a salty or estuary environment. The mangroves seem to be the only tree that can withstand salt concentrations in water. Mangal comes from the Portuguese word mangue, which means "tree stand." Mangroves are one of the most dynamic ecosystems that occur in shallow, sandy, or muddy regions (Alongi, 2008). According to the Global Forest Resource Assessment (FRA) report, mangrove forests cover approximately 14.79 million hectares across 113 nations. Only 6.9% of the world's mangroves are safeguarded under the existing conservation areas network, with 75 % of the world's mangroves occurring in just 15 countries (Giri et al., 2011). Asia has the largest mangrove area (5.55 million hectares), while Oceania has the smallest (1.30 million hectares). Only four countries were found to contain more than 40% of the total area of mangroves: Indonesia (19%), Brazil (9%), Nigeria (7%)and Mexico (6%) (ISFR Report, 2021).

Types of Mangrove

i. Red mangrove

The branching structure of airborne prop roots growing from the stem and basal branch of the soil distinguishes red mangrove. It can extend up to 25 – 38 meters (82 to 125 feet) in riverine woodland deltas, but most bordering shorelines are just 8 to 10 meters (26 to 33 feet). Wind pollinates the little white flowers with four petals and four bracts. Example - *Rhizophora mangle.*

ii. Black mangrove

The cable roots of the black mangrove radiate from the tree, with vertically upright shoots (pneumatophores) ranging 2 to 20 centimetres above the substrate. They have narrow, compact, or rectangular leaflets that are dark green on top and pale, almost cream green on the bottom, with short thick hairs. Example - *Avicennia germinans*.

iii. White mangrove

White mangroves can reach a height of 15 meters as a tree or a shrub. When developing in hypoxic or chemical disturbed soils, particular white mangroves become upright. Both the top and bottom surfaces are the same soft green tint. Mostly on terminal ends of branches, little yellowish blooms grow in alternate rows. Example - *Laguncularia racemosa*.

iv. Button wood

Buttonwood can reach a height of 12 to 14 meters (39 to 46 feet) as a shrub or tree. Their leaves are slender and pointed. The silver buttonwood is supposed to adapt to rocky, dry environments. The button is a seed cluster produced by them. Buttonwoods evolved to arid locations like buffer oceans and coastal strands thanks to mangroves' adjustments to the osmosis desert of saline water. Example - *Conocarpus erectus*.

Present Status of Mangroves in India

India has 4,992 square kilometres(sq.km) of mangrove forest, accounting for only 3.3 % of worldwide mangrove forests (ISFR Report, 2021). Around 70% of the population lives along the eastern coast (Bay of Bengal), 12% live along the west coast (Arabian Sea), and 18% live in the Andaman and Nicobar Islands. Sundarbans have the most extensive mangrove cover, accounting for 43 % of the total area in India, whereas Gujarat has the second-largest cover, accounting for 23 % (Ghosh *et al*., 2015). Surprisingly, the Andaman and Nicobar Islands boast India's third-largest mangrove forest, accounting for 13% of the country's total cover area. The Sundarbans, which span India and Bangladesh, are the world's biggest mangrove forest and the only mangroves colonized by Royal Bengal Tigers, Gangetic dolphins, crocodiles, horseshoe crabs, lizards, and river terrapins are all found in the Sundarbans. After Indonesia and Australia, India is the world's third-richest country in mangrove biodiversity. The mangrove forest is divided into three categories - Very Dense

Mangrove, Moderately Dense Mangrove and Open Mangrove are shown in Table 1. The total cover area of mangrove forests is given in Table 2.

Table 1: Mangrove covers Assessment 2021

(Area in sq.km)

S. No.	State/UT	Very Dense Mangrove	ModeratelyDense Mangrove	Open Mangrove	Total	Change concerning ISFR 2019
1.	Andhra Pradesh	0.00	213.00	192.00	405.00	1.00
2.	Goa	0.00	21.00	6.00	27.00	1.00
3.	Gujarat	0.00	169.00	1,006.00	1,175.00	-2.00
4.	Karnataka	0.00	2.00	11.00	13.00	3.00
5.	Kerala	0.00	5.00	4.00	9.00	0.00
6.	Maharashtra	0.00	90.00	234.00	324.00	4.00
7.	Odisha	81.00	94.00	84.00	259.00	8.00
8.	Tamil Nadu	1.00	27.00	17.00	45.00	0.00
9.	West Bengal	994.00	692.00	428.00	2,114.00	2.00
10.	A&N Islands	399.00	168.00	49.00	616.00	0.00
11.	Daman & Diu and Dadra & Nagar Haveli	0.00	0.00	3.00	3.00	0.00
12.	Puducherry	0.00	0.00	2.00	2.00	0.00
	Total	**1,475.00**	**1,481.00**	**2,036.00**	**4,992.00**	**17.00**

Source – ISFR Report, 2021

Table2: Mangrove distribution in India

Rank	States/UTs with the highest mangrove cover	Total mangrove cover in sq. km
1	West Bengal	2114
2	Gujarat	1140
3	Andaman and Nicobar Islands	617
4	Andhra Pradesh	404
5	Maharashtra	304
6	Odisha	243
7	Tamil Nadu	49
8	Goa	26
9	Kerala	9
10	Karnataka	10

Source - ISFR Report - 2021

Reason for Increase in Mangrove Cover

Odisha – Natural regeneration and plantation initiatives in Kendrapara, Jagatsinghpur, and Balasore have improved eight sq km. **Maharashtra** – Natural regeneration is responsible for the gain of four square kilometres. **Karnataka** - Conservation measures such as planting and revitalization have resulted in an improvement of three sq km. **West Bengal**- The increase of

threesq km is primarily due to rehabilitation in the South 24 Parganas district (41.74%) (ISFR Report, 2021).

Importance of Mangroves

Mangroves are vital and provide many benefits to the environment. Mangroves have a complex root structure that effectively dissipates sea wave energy, safeguarding coastal regions from tsunamis, storm surges, and soil erosion (Kathiresan, 2010).Mangrove roots help sediment deposition by slowing water flows. They also prevent coastal erosion and contamination of the sea and play an essential role in the food chain (Nagelkerken *et al*., 2008).The decaying leaves of mangrove trees are decomposed by fungi and bacteria, providing food for shrimp and crab. Large fish consume these marine crustaceans, and large fish are captured and consumed by animals. They offer a significant source of income for coastal populations that rely on honey, tannins, wax, and fishing (Hussain and Badola, 2010).

Threats to Mangroves

Natural hazards and damaging human activities are the most common threats to mangrove forests.

(a) Natural hazards: -Particularly in the geographically fragile Andaman and the Nicobar Islands, cyclones, typhoons, and significant wave action. Wildlife animals' browsing and trampling are frequently let to graze freely, particularly in places near human habitation. Barnacle infestation attaches to immature seedlings and obstructs respiration and photosynthesis, slowing seedling growth. Weeds like *Acrostichum aureum* and *Acanthus* species invade deforested mangrove habitats and prevent the regrowth of economically important mangrove tree species.

(b) Human hazards: -Anthropogenic activities have largely degraded the wetlands and mangrove forests. Timber borers, caterpillars (which consume the mangrove foliage and harm the wood), and beetles are insect pests that reduce mangrove diversity. Deforestation for urbanization and industry development and trash disposal without treatment of bodies of water and soil reduce mangrove productivity.

Conservation and Management of Mangrove Forests

The increasing human population in coastal areas and the demand rising for small timber, fodder, fuel wood, or other non-wood forest products are putting strain on mangrove

ecosystems. In India, three management practices are used to efficiently maintain mangrove forests: promotion, regulation, and involvement. The Government of India is implementing the Management Action Plan (MAP) in 38 mangrove areas along the coast of the cape. India has a solid regulatory approach, with enough legal help for mangrove protection in National Parks, Wildlife Refuges, Reserved Forests, Protected Forests, and Community Reserves. However, successful implementation of the legislation is frequently hampered by a lack of human and financial resources and poor infrastructure (Pattanaik *et al*., 2009).Various states are implementing mangrove conservation and management initiatives to increase the biodiversity of mangroves. Direct seed planting, raised bed plantation, and fishbone bone channel plantation are some of the key strategies used in Gujarat to restore degraded mangrove habitats. Training for sustainable mangrove protection is also held regularly. Mangrove ecology and biodiversity have been conserved in Maharashtra through preservation, restoration, regeneration, and maintenance (Song *et al*., 2021).

Conclusion

From a productive, defensive, and social standpoint, mangroves serve various purposes. However, because of rising population constraints in coastal regions and a lack of understanding, mangrove lands have been converted to multiple uses on a vast scale. We can promote tourism by increasing the growth of mangrove trees. Furthermore, the primary goal of a fisherman is to catch fish. They are constantly working to keep the mangrove resources afloat. Even slight changes in water levels, on the other hand, can result in lower flood extents and, as a result, reduced property damage and loss of life.

References

Alongi, D. M. (2008). Mangrove forests: resilience, protection from tsunamis, and responses to global climate change. *Estuarine, Coastal and Shelf Science*, **76(1):** 1-13.

Ghosh, A., Schmidt, S., Fickert, T., & Nüsser, M. (2015). The Indian Sundarban mangrove forests: history, utilization, conservation strategies and local perception. *Diversity*, **7(2):**149-169.

Giri, C., Ochieng, E., Tieszen, L. L., Zhu, Z., Singh, A., Loveland, T., & Duke, N. (2011). Status and distribution of mangrove forests of the world using earth observation satellite data. *Global Ecology and Biogeography*, **20(1):** 154-159.

ISFR- India State Forest Report (2021), Forest Survey of India, Ministry of Environment, Forest and Climate Change (MoEF & CC), Government of India.

Kathiresan, K. (2010). Importance of mangrove forests of India. *Journal of Coastal Environment*, **1(1):**11-15.

Nagelkerken, I. S. J. M., Blaber, S. J. M., Bouillon, S., Green, P., Haywood, M., Kirton, L. G., & Somerfield, P. J. (2008). The habitat function of mangroves for terrestrial and marine fauna: a review. *Aquatic botany*, **89(2):**155-185.

Pattanaik, C., Ready, C.S., Dhal, N.K. and Rashmita, D., 2009. Conservation and utilization of mangrove forests: a case study in Bhitarkanika Sanctuary, east coast of India. *Emerging trends in biological sciences*, pp.205-210.

Song, A.M., Dressler, W.H., Satizábal, P. and Fabinyi, M., 2021. From conversion to conservation to carbon: The changing policy discourse on mangrove governance and use in the Philippines. *Journal of Rural Studies*, **82**:184-195.

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STRATEGIES FOR CHANNELIZING TRANSFER OF TECHNOLOGY IN MEGHALAYA

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The Indian agriculture is the largest private sector business of the country where over 110 million farmers are engaged in doing business which lead to self-sufficiency in terms of food production as well as net exporter in some specific agricultural commodities. This is the result of untiring effort of agricultural scientists, hardworking Indian farmers and appropriate policy planning and project execution. Although we have achieved a greater milestone but it is the time to pay great effort in producing more diversified and quality food at affordable price to address both sustainability and development in Indian agriculture in the years to come for meeting the requirement of ever increasing population. Agriculture sector in the country has witnessed uneven production and productivity across the region and its allied sectors. The reasons for this uneven growth may be multiples like research breakthrough in limited crops, disparity in potential yields due to improper technology transfer mechanism, lower productivity from rainfed area, lower input use and its use efficiency, lack of food processing and value addition, high post-harvest losses, very low agricultural export, poor market infrastructure, unskilled human resources at grass root level etc. which need to be tapped to harness the great competitive advantages of India in agricultural export.

Meghalaya, being one of the North Eastern states of India, which have undulated topography with high amount of annual rainfall affecting mechanizations and scale of economy of production of food crops. Economic development of Meghalaya depends primarily on achievements in the agricultural and allied sectors where nearly 80 per cent of the population (predominantly rural) are dependent on agriculture for their livelihood. The management of available resources like land, water, forest resources for the economic development remains the major challenging problem for this state. Although as stated above, economic development is depending on agriculture and allied sector but still the state has to

realize its fullest potential by adopting the improved agricultural technologies and their package of practices which have potential to shift the farmers from subsistence to commercial farming which are primarily responsible for dragging down Meghalaya's economic position. So, in this article, we will discuss about them as well as some of causes and remedies to these technological gaps to lift the socio-economic status of the farmers of this state.

Most of the farmers of Meghalaya still practicing traditional farming at subsistence level due to their poor accessibility to improved and modern methods of agriculture like use of quality inputs including seeds of high yielding varieties/hybrids of major important crops, chemical fertilizers, plant protection measures and farm mechanization because of undulating topography, transport and communication problem, population dispersal pattern, inadequate credit support, poor marketing system, etc. The backwardness in agricultural income of rural people is due to low per capita availability of land under cultivation rather than lower productivity of land. Productivity of land in the state in fact, is 29.5 per cent higher (Rs. 47,401/ha) than the national average (Rs. 36,615/ha) which is due to the dominance of high valued horticultural crops and rearing of the livestock in the State.

Net sown area of Meghalaya is only 13 percent of its total available geographic area because almost all state is occupied by hills only and rice is the most cultivated crop for the people living in this state. The New Agricultural Policy of the state has projected area to be brought under fruits and spices. As against this scope, the challenges are the development of markets, cold storage and processing units from almost non-existent base. Provision of credit in the absence of land records (mostly owned by community rather than individual ownership) is also a serious constraint because it is very difficult for the bank authorities to give the loan and take back the same. The state cannot compete with other states as far as the productivity of various crops are less compared to other states due to poor penetration of improved agricultural technologies in the remote villages of Meghalaya. The cost of production, post- harvest, material handling, packaging, storage and transport will make agriculture a less profitable option as compared to the other highly economic opportunities utilizing the same resource base with more sustainability. The exploitation of mineral resources, quarrying and mining activities are already rampant with their ill effects but landowners prefer those activities to agriculture due to its overall low profitability, uncertainty and drudgery.

Research experiences with resources conservation and watershed management have also confirmed the fact that farmers are on the looking out for other economical options than agriculture. The farmers can be stopping not only the practice of *Jhuming* but also be persuaded to adopt such profitable ventures which will provide them the much-needed financial security, food security and long-term resource sustainability. The situation is further aggravated by the lack of proper marketing services, lack of adequate roads and transport facilities, lack of processing units, lack of organized marketing structures along with other factors have caused great inconveniences to the farmers who are compelled to dispose-off their produce often at uneconomical and uncompetitive prices in their local weekly village markets.

Meghalaya do not even have mere basic infrastructural facilities for marketing of agricultural produce such as meeting place for buyers and sellers, airport for handling agricultural produce, etc. By and large, these markets are owned and managed by local bodies which rarely pay any attention to their development. Post-harvest handling which are facilitating functions like sorting, grading and standardization, packaging, post-harvest treatments etc. are not commonly practiced which impact the shelf life of the produce in storage and long distant transportation. The losses in transit are estimated to be 35-51% in case of fruits and vegetables.

In the State of Meghalaya, the maintenance of completed Minor Irrigation schemes is being looked after by the Irrigation Department. Despite receiving highest rainfall in the state, the farmers are unable to take second crop in the terrace due to lack of irrigation facilities. The need for Participatory Irrigation Management (PIM) is being felt now, but the progress towards the implementation of the PIM is still in the infant stage. As the system is yet to be fully evolved, the achievement so far made in this respect is only to the extent of formation and registration of Water Users' Associations (WUAs) in the completed project areas.

The present central Govt. has given greater attention to the North East region to bring them in mainstream in terms of development and infrastructure and made a mandatory for all the programs and project to invest their some proportion for the development of the region. During the 12th Five Year Plan 2012-2017 they endeavor to enhance rice production by narrowing, if not bridging, the gap between demand and supply of rice (staple diet of the state) through implementation of the State Rice Mission with technical assistance of scientists

and rice experts of the International Rice Research Institute (IRRI), Los Banos, Manila. The Government has been promoting winter planting of rice, in the plains bordering Bangladesh, through assured irrigation in the form of small water harvesting structures, shallow tube wells and surface water pumping systems. Apart from Rice the various stakeholders have been engaged in popularizing Maize cultivation in the State through introduction of high yielding varieties and hybrids.

In Meghalaya, floriculture is mostly practiced as a hobby by flower lovers however, high price for sale of planting materials, seeds, cut-flowers etc. and their increasing demand, has created awareness in the flower growers regarding their commercial aspects. Although commercial Floriculture is a recent development in Meghalaya, however, considering the natural advantages of having the most varied range of climatic conditions in the country, it has a very high potential for cultivation of all types of flowers. The rich flora and the many species of Orchids growing wild in the State which is the highest ever recorded in a single concentrated area is a testimony to this effect.

Suggestions for Effective Transfer of Technology

- To overcome the constraints of net sown area (only 13 per cent) and being a hilly state, Govt. may focus their efforts to increase the cropping intensity from the existing 120 per cent to 150 per cent by providing irrigation facilities, seeds of improved varieties/hybrids of important vegetable crops etc. to be cultivated in rice/maize fallow during *Rabi* season.
- Extension activities for agro advisory services should increase in these areas so that farmers can become aware of the other agriprenurial opportunities like backyard poultry/piggery, strawberry cultivation, fish rearing by digging pond to harvest and store natural water, integrated faming system etc. to energize their inner state to follow these advanced practices.
- Farmers should be mobilized into various formal/informal groups like SHGs, FPC, producer cooperatives, farmers' club etc. to increase their access to advanced technologies and marketing options for better income from the agricultural enterprises.
- Scientists should visit the farm or home of farmers to give proper guidance in adopting the newly introduced technologies by conducting demonstrations with them so that they will get the confidence in their adoption.

- Development of improved technologies by greater involvement of farmers and their multiplication and distribution with the help of SHGs for effective penetration and better utilization of these developed technologies in the farmers' field.
- Improving and expanding agricultural extension service through appropriate convergence mechanism among the State line departments and other pluralistic stakeholders to effectively demonstrate and transfer of proven yield-maximizing technology in the farmers' field developed by ICAR and SAU.
- Making small operational holdings of farmers economically viable and profitable through forming farmer-SHGs, participatory approach and community action on cluster basis and improving their knowledge and technical skill about the scientific agricultural practices through appropriate capacity building programme. The group based approaches of farming will empower the farmers through efficient learning of cultivation techniques, improved access to funding and achieving stronger bargaining power.
- The majority of farming in Meghalaya is by-default organic in nature therefore there is a need to identify the appropriate agricultural enterprise specially non-traditional and high value crops endemic to the region which has great economic potential in that particular area for up-scaling the agripreneurial venture.
- As the most of the farm of the hill region is by-default have the potential of converting into integrated farming system in the farmers' field where maximum input of different agricultural enterprises met from the by-product of farm itself. This will not only minimize the cost of production but also increases the input use efficiency and ultimately improve the livelihood security of the farmers.
- The hill agriculture is invariably has a niche for livestock based livelihoods for their dietary protein requirement as farmer finds larger area under rangelands and highland pastures and this is highly liquidable which attract more number of farmers towards these enterprises. Under mixed farming system followed by small and marginal farmers livestock not only supplement the family income but also improve the soil health by adding animal dung and their bedding material as manure and compost for the crops. Therefore there is need to pay major attention to these livestock sector while preparing the strategies for agricultural development.
- *Jhuming* need immediate attention to address the social and human aspects of the problem of *jhuming* and offer alternatives acceptable to the farmers in consultation with the local farming communities to minimize *jhuming* by timely provision of

quality planting material and production inputs and efficient extension and marketing services.

- The status of women in NER is relatively better than in many other States. Despite women actively participate in economic activities, particularly in the hill areas their participation in decision-making process is low. Focused attention should be paid to empower women through formation of SHGs to improve their credit worthiness and bargaining strength as a group.
- The entire Meghalaya is favorable for growing a wide range of horticultural crops like fruits, vegetables and other cash crops. Small areas with their own micro climatic conditions provide suitable sites for growing particular crops with unique geographical identification which can fetch higher prices in the market such as apples, citrus fruits, walnuts, plums, peaches, bananas, mangoes and pineapples.

Conclusion

Intensification of agriculture in Meghalaya needs to be taken up by considering their unique agro-ecological as well as socio-economic setting and identifying the ecologically & economically sustainable farming options with the integration of interdependency and synergy between allied sectors of agriculture, viz., crops, horticulture, livestock, fisheries, forestry and the associated natural resources. Commensurate strategies through enabling policy environment need to be developed by considering the basket of choices of suitable production systems capturing every niche.

Reference

B.C. Barah. 2007. Strategies for Agricultural Development in the North-East India: Challenges and Emerging Opportunities. *Indian Journal of Agricultural Economics.* Vol. 62(1), Pp13-31.

Meghalaya, 2010 India Brand Equity Foundation (IBEF) www.ibef.org pp. 1-53

https:// www. megagriculture.gov.in

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STORAGE TECHNIQUES FOR CEREAL GRAINS

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Seeds are suitably saved for proper and balanced public distribution throughout the year. It is perceived that around 10% post harvest losses of grains in our country are estimated. Cereal grains are most important alimentary, nutritional and energy sources for humans. They must be stored, transported and conveyed using methods that preserve their quality. Storage of different types of foodgrains varies with the period of time ranging from short-term storage on farm for drying to the long-term storage for strategic reserves. Storage can occur on farm or at large commercial facilities (Bucklin *et al*., 2013). Loss in stored grains is nearly 20% of the whole production due to population increases globally, a huge demand for the cereals and improper storage conditions (Miller, 2016 and Said and Pradhan, 2014).

Types of Storage Techniques

1. Bulk Storage - Different types of grains are stored and preserved as bulk or mass in both vertical and horizontal warehouses (Kemaloglu and Baran, 2011). In this method surface of bulk stacked cereals (eg.wheat, barley, rye, oat, corn, chickpea and lentil) is leveled properly. It has also various advantage such that in this it is possible to store more grain on unit area. Moreover, It also facilitates the control of grain samples easily, has less labor cost i.e. less laborious, cost effective and time-saving.

2. Storage Underground - Storage underground pits of this method are claimed to keep or preserve grain without damage or mutilate for multitude years. The pits or underground storage structure keeps the mass of grain cool, and some of them are comparatively airtight. This underground storage technique provides the grain a sealed or shut tight condition. (Bhardwaj, 2014).

3. Storage in Bag – If the moisture content percentage in cereal is increased, the number of sacks or bags in cereal stock is decreased. Besides, reduced or less amount of cereals are stored on per unit area when compared to the bulk storage technique. This method is more exorbitant or expensive due to high labor cost, time-consuming also also causes more rodent damages in comparision to other methods.

4. Storage in Warehouse (Sheds) – Sheds or storage in warehouse itself are consistently used by bulk handling companies, but need vigilant site preparation, labour for handling sizeable tarp covers and also machinery to move different types of grain on and off the grain stack. Effective treatment of insect infestation is tough task in sheds and bunkers. For on-farm sheds storage, foodgrain in bags may be a worthy and best short-term alternative. For storing grains in warehouse, the determination of location, control of moisture content percentage and supplement of adequate aeration of cereals are important strands of consideration. The damage from insects is the most customary problem in warehouses.

5. **Storage in Silo structure** - The most fancied and choosen storage technique in plants is to store the grain in silos structure. It has many advantages due to less labour cost, less time-consuming depending on easy discharge of grains and conveying different type of cereals and keeping hygienic conditions during these whole processes. As the silos structure are vertical, more products can be stored on the per unit area. There are three types of silos structure made up of wood, concrete and steel. Wood silos structure are not suitable for preservation, as they are susceptible to fire and most favorable for the insect surviving. Concrete silos are ideal to store different type of cereals, as they required less labor cost and less time for storage. Steel silos structure and galvanized silos structure are the most prevailing and accepted used in stores, because they are most resistant and easier controlled when compared with the others silo structure.

The Requirement of Good Grain Storage Structure

- The different type of grains produced should be thoroughly cleaned and graded.
- Storage structures should be constructed in the coolest portion of the farm or house.
- The grain storage structure should be able to take the load of seeds stored and should not allow any exchange of humid air.
- The seed storage structure should be cleaned, disinfected and sanitized.
- For the purpose of a safe storage period of 6 to 12 months, dried sseds to the safe moisture level(for cereals is 10-12%).

- structures should provide the security from floor moisture, rain, rats, birds, molds, rodents, ants, insects, *etc*.
- They need to be constructed in such a way that it may present the necessary facility for inspection & infection, loading and unloading, cleaning, and reconditioning.
- The storage structure should be constructed in such a way that it can protect grain from excessive moisture content or humidity and temperature.

Advantages of Grain Storage Structures

- More control and planning over crops and transportation.
- Improvement in quality of grains in origin.
- More control of weight and quality of shipment.
- Pricing can be done multiple times after harvest.
- Reducing the cost of arbitration.

Conclusion

Storage of grains is a very important aspect of agriculture as it is necessary to protect the grains from insects, rodents, *etc*. After harvesting they are often consumed and preserved for a longer period in grain storage structures. The choice of the most suitable and economical storage method has great importance on storage period of cereals to prevent deterioration caused by physical, chemicals and biological factors. In cereal industry, among the main storage methods (bulk storage, storage underground, storage in bags, storage in sheds), the most preferred storage technique is to store in silo, especially made from galvanized steel due to less labour cost, time-saving, easy discharge, storing more products on unit area, conveying of cereals under hygienic conditions during the processes and also easy transportation.

References

Bhardwaj, S. (2014). Grain storage structures for farmers. *Popular Kheti*, 2 (2): 202-5.

Bucklin, R., Thompson, S., Montross, M., & Abdel-Hadi, A. (2013). Grain storage systems designs. In Handbook of Farm, Dairy, Food Machinery Engineering. New York, USA: Elsevier, 123-75.

Kemaloglu, I., & Baran, B. (2011). Wheat in Milling. *In*: Handbook of Miller. Istanbul, Urkey: Parantez, pp. 23-47.

Miller, M. (2016). Grain Storage and Healthy Storage Conditions. Accessed August 5, 2016. http://www.millermagazine.com/english/grain-storage-an d-healthy-storage-conditions/.

Said, P. P., & Pradhan, R. C. (2014). Grain Storage Practices: A Review. *Journal of Grain Processing and Storage*, 1(1): 1-5.