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{Agri – Food Security – 19/07/02} Alternative crops for food security

[D2E](#) | 02-07-2019 | GS3 > Issues of buffer stocks and food security

- India has not realised the role of millets in enhancing food security.
- It is more focused on strategies like building buffer stocks, developing drought-tolerant varieties and boosting irrigation, etc.

Importance of alternative crops (millets like finger millet, maize, pearl millet, sorghum)

- Erratic monsoon patterns and frequent extreme climate events are posing a threat to food security in India.
- The overall monsoon rainfall has decreased, and the frequency of droughts have increased.
- Almost all crops are sensitive to these changes. However, **coarse grains (millets) are more resilient**.
- Adding more millets in crop production mix may help food supply withstand vagaries of climate change.
- In general, the yields of alternative grains are lower than rice, but in **rainfed** conditions millets perform better.
- Compared to rice, alternative grains experience smaller decline in yields under climate extremes.
- This means there is an opportunity to increase both **climate resilience** and grain production.
- **Health and nutrition benefits** of millets could be an additional advantage.
- Also, alternative grains help save water, reduces energy demand and GHG emissions from agriculture.

Challenges in enhancing the role of alternative crops (millets) in the food basket

- Millets are mostly **rain dependent crops** and grown during the **kharif season**.
- Rice accounts for 44% of annual grain production & 73% of grain production during the kharif season.
- The rest 27% comes from maize (15%), pearl millet (8%), sorghum (2.5%) and finger millet (1.5%).
- Replacing rice with millets is not going to be easy as agriculture is intimately linked with socio-economic factors and market forces (subsidies, MSP, free power), all of which affect crop choice.

- Moreover, food habits have changed in favour of rice and replacing rice with millets is not realistic.
- Also, the government's focus is mostly on food security and **nutritional security** is completely ignored.

{Agri – Law – 19/08/11} Certification of seeds to be made mandatory

[The Hindu](#) | 11-08-2019 | GS2 > Government policies and interventions for development in various sectors

- More than half of all seeds sold in India are not certified by any proper testing agency.
- Most often, the uncertified seeds are of poor quality.
- GOI hopes to mandate uniform certification by pushing through a replacement to the **Seeds Act, 1966**.

Need for an upgrade to the act

- The very definition of what is a seed has changed.
- Planting materials such as cuttings, grafting, tissue culture, etc. needs to be brought under the ambit of law.
- There is need to bring uniformity to the process of quality regulation.
- Companies need to be held accountable for the quality of the seeds they sell, and the claims they make.
- If a seed fails at the germination, seed-setting process, the company which sold it must be held liable.

What will change?

- The 1966 Act deals with "regulating the quality of certain seeds for sale...".
- The new Bill removes the word "certain" and aims to regulate the quality of **all seeds sold in the country**.
- Some seeds sold by the companies are self-certified. The new law mandates proper lab process of certification for all seeds.
- The new Bill will raise the penalties for non-compliance. Currently, the fine ranges from ₹500 to ₹5,000. The bill intends to raise the penalties to the tune of ₹5 lakh.

New proposed measures

- The Centre hopes to roll out a software to **barcode seeds in order to ensure transparency and traceability**.
- The software system will be able to track seeds through the testing, certification and manufacturing process.
- By connecting to a dealer licensing system, seeds will be tracked through the distribution process as well.

{Agri – Sustainable Agriculture – 19/08/05} Protected Cultivation of Horticulture Crops

[NABARD](#) | [TH](#) | [ET](#) | [ET](#) | [THBL](#) | [Forbes](#) | [HSW](#) | 05-08-2019 | Agriculture > Sustainable Agriculture | New Agricultural Practises.

- Protected cultivation practices are cropping techniques wherein the microenvironment is controlled partially/ fully as per plant need during their period of growth to maximize the yield and resource saving.

Geoponic	<ul style="list-style-type: none"> • refers to growing plants in normal soil
Aeroponics	<ul style="list-style-type: none"> • growing plants in mist environment without the use of soil medium
Hydroponics	<ul style="list-style-type: none"> • growing plants using mineral nutrient solutions, in water, without soil.
Aquaponics	<ul style="list-style-type: none"> • symbiotic environment of aquaculture and hydroponics

Green House

- Green houses are climate controlled with cooling and heating system.
- It is mainly used to grow exotic vegetables, off-season growing of vegetables, floriculture, planting material acclimatization and plant breeding and varieties improvement under adverse agro-climatic conditions.
- The degree of sophistication of greenhouses include fully automated systems with poly carbonate sheet roofing (double walled), heating and cooling systems, etc.

Poly House

- Poly house is less sophisticated version of green house with **naturally ventilated climate controlled as against the fully climate controlled green houses.**
- Usage of poly houses are similar to green houses.

Hydroponics

- Hydroponics is a method of **growing plants without soil**, using water enriched with balance mineral nutrients essential for plant growth and yield.
- The nutrients and PH level are maintained suiting to the selected crop for better growth.
- With increasing water scarcity due to frequent droughts and declining land availability for farming, government agencies are promoting hydroponic for growing vegetables, fruits and fodder.

Advantages of hydroponics

More yield in a smaller patch of land

- Hydroponics supports **vertical farming** and is ideal to grow crops in congested urban environment.
- Vertical farming: The plants are grown on raised beds that stand a few feet from the ground, making it possible to cultivate several rows on either side of the bed.

- The increase in output happens because the **cropping cycle is reduced, and the plants doesn't have to grow long roots in search of nutrients.**



Picture Credits: [The Better India](#)

Allows one to tailor crops as per market demand and this reduces wastage

- In hydroponics, cropping cycle is reduced and harvesting times are a lot shorter.
- In traditional farming, sometimes crops grown are not really required in the market at that point of time. This leads to wasted produce.

Significantly reduced water usage yet superior yield

- Hydroponics systems require only around 10 percent of the water that soil-based agriculture requires.
- In traditional farming, water and nutrients are lost in soil. This leads to groundwater contamination.
- In hydroponics, the nutrient solution is mixed into the water and is supplied directly to the roots.
- Since the water directly reaches the roots, it is absorbed much better and **nothing is lost in soil absorption.**

- The plants are provided with maximum possible nutrients which results in multi-fold growth.

Better quality control and better environment

- Hydroponics reduces both cost on transportation and emissions.
- Hydroponics makes the application of organic farming techniques very simpler.
- Sticky pads and a solar powered insect trap can be used to trap insects. This reduces the use of insecticides.
- Soil-borne diseases and pests are also low as the crops are grown in a closed environment free of soil.
- Also, natural ingredients such as neem oil can be used much more effectively to control pests. This reduces the use of pesticides.

Better nutritional value of crops

- Fodder produced through hydroponics is more nutritional than the regular fodder.
- As food production is closer to the consumer, time is not lost in logistics & hence there is no loss of nutrients.

Better cultivation techniques and application of sci & tech

- The farms can be indoors or outdoors (a greenhouse).
- Suitable for vertical farming under greenhouse conditions and other modified structures.
- Each hydroponic crop can be given a favourable and individual climatic condition through an automated temperature and humidity controlled greenhouse.
- The farm can be managed remotely using the **internet of things** (IoT – schedule a fertigation session, actively monitor the plants remotely, automated humidity and temperature control, nutrient and input control, etc.).
- The crop can use natural light or artificial lighting (day and night – 24/7 growth period).

Opportunities

- Demand for chemical-free food is increasing with rising awareness among consumers.
- The organic market in India at present is estimated to be \$1.3 billion (about Rs 9,000 crore), expected to double by 2021.
- Ministry of Agriculture has subsidy programme for hydroponics.

Disadvantages of Hydroponics

Capital-intensive

- Though hydroponics is typically much cheaper over time, it does require a substantial upfront cost to establish any sort of larger system.

Needs uninterrupted power supply

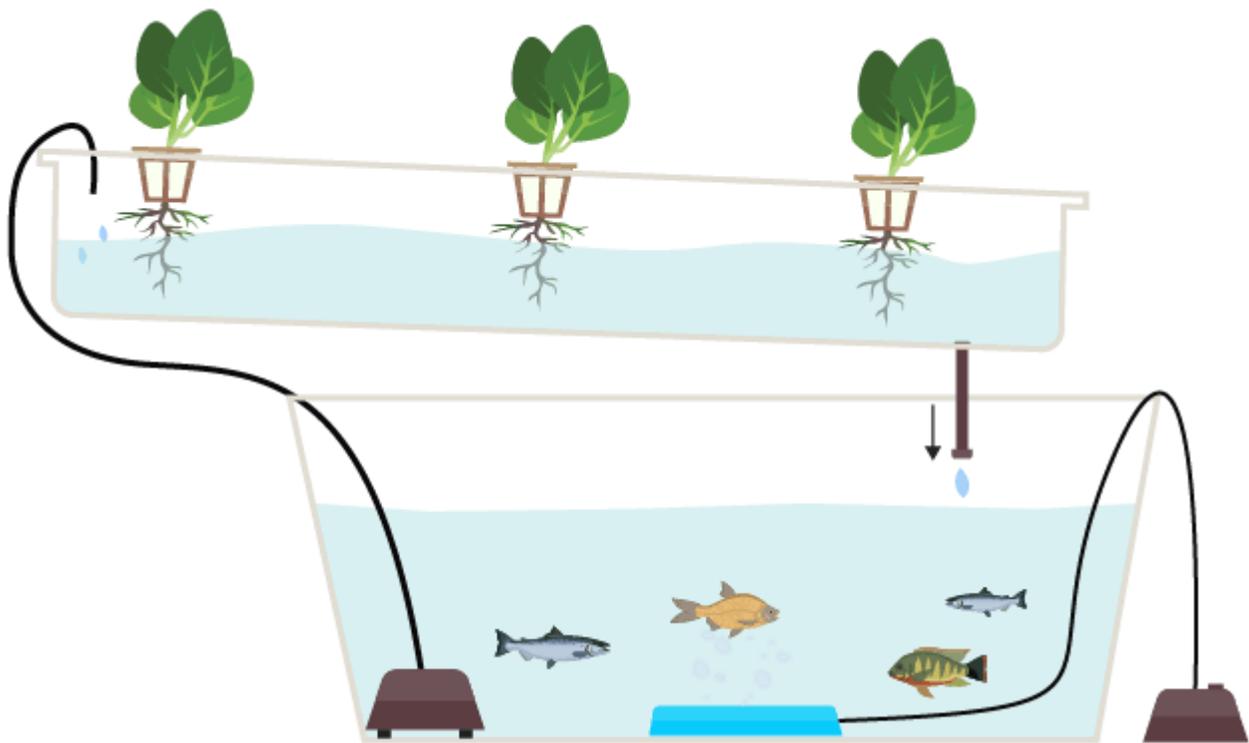
- Power failure can cause pumps and equipment to stop working.

Lack of awareness

- Many people fear that hydroponics requires substantial know-how and research, when in fact, it's very similar to traditional gardening.

Aquaponics

- The method combines aquaculture — **cultivating fish and other aquatic animals in tanks with organic inputs — with hydroponics**, where plants are cultivated in water.

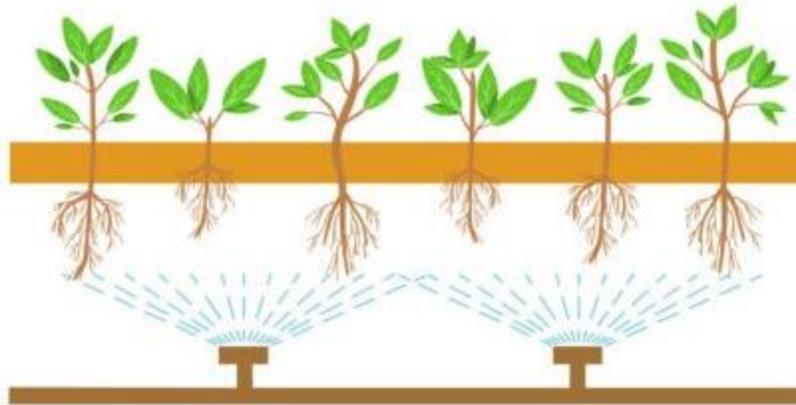


[Source and Credits](#)

- The water from the fish tank is pumped onto the beds where plants grow.
- While the **fish excretions provide nutrients for the plants** (hence no chemical fertilizers are needed), the clean water is recirculated back to the fish tank.
- While the initial cost to set up the facility would be high, the recurring cost is low in aquaponics.
- The difference between aquaponics and hydroponics is that **synthetic fertilisers are used in hydroponics for providing nutrients to plants and hence cultivation of fish is not possible in hydroponics.**

Aeroponics

- Unlike in hydroponics, the **roots of plants grown in an aeroponic system are suspended in the air and the spraying of water and nutrients leads to an oxygen-rich, misty environment.**
- Aeroponics has been implemented as an alternative to water intensive hydroponic systems worldwide.



[Picture Credits](#)

Advantage of aeroponics over hydroponics

- Aeroponics can limit disease transmission since plant-to-plant contact is reduced.
- The enhanced oxygen availability at the root zone leaves disease-causing pathogens dormant.
- Improves uptake of minerals by plants and development of healthy root systems.
- Helps in faster and better growth of plants with a plentiful supply of oxygen, water and nutrients.
- Plants in a true aeroponic conditions have 100% access to the CO₂ concentrations for photosynthesis.
- This leads to a multi-fold increase in plant metabolism, which in turn results in a vast increase in production.
- Any species of plants can be grown in a true aeroponic system because the microenvironment of an aeroponic can be finely controlled.
- Aeroponically grown plants have high dry weight biomass (essential minerals).
- According to NASA, aeroponically grown plants require $\frac{1}{4}$ the nutrient input compared to hydroponics.
- Unlike hydroponically grown plants, aeroponically grown plants will not suffer transplant shock when transplanted to soil.

{Agri – Tech – 19/08/12} App to aid farmers hire equipment

[The Hindu](#) | 12-08-2019 | GS3 > e-technology in the aid of farmers

- There are now more than 38,000 custom hiring centres (CHCs) across the country, which rent out 2.5 lakh pieces of farm equipment every year.
- GOI is planning to launch a new mobile app to efficiently connect farmers with these CHCs.

- The CHC app is open for registrations by the farmers, societies and entrepreneurs who run these centres.
- The system would help to track the usage of new technology that the government wants to promote, such as the **Happy Seeder** (to prevent stubble burning), or **solar dryers** (help farmers preserve their produce).

{Agri – Tech – 19/08/19} Precision Farming

[D2E](#) | 19-08-2019 | GS3 > e-technology in the aid of farmers

- India's agriculture is focused on production which isn't necessarily translating into productivity & profitability.
- Shrinking land, depleting water and other related resources in agriculture are a serious cause of concern.
- Hence, there is a need for promoting farmer friendly location specific production systems to achieve vertical growth in agriculture with judicious use of natural resources.
- In this regard, precision farming aims to have **efficient utilisation of resources** per unit of time and area for achieving targeted production of agricultural produce.

What is precision farming?

- Precision farming involves **efficient management of resources** through **location specific high tech interventions**.
- These high tech interventions include fertigation, greenhouse, soil and leaf nutrient based fertiliser management, mulching for moisture conservation, micro-propagation, high density planting, drip irrigation etc.

Micropropagation

- Micropropagation is the practice of rapidly multiplying a selected plant to produce a large number of progeny plants, using modern plant tissue culture methods.

High density planting

- High density planting technique is a modern method of horticulture involving planting of trees densely, allowing dwarf trees with modified canopy for
 - ✓ better light interception and distribution and
 - ✓ ease of mechanised field operations.
- Control of pests and diseases, weeds and pruning of tree canopy is mostly mechanized.
- Irrigation and fertigation are automatically controlled.
- Such system has low labour requirement and produces high and regular yields of good quality fruits.

- Precision farming uses information based farm management for optimum profitability, sustainability and resource utilization.

- The required information for Precision farming is obtained with the help of technologies like **geographic information system (GIS), Global Positioning System (GPS), remote sensing (RS)**, etc.
- The success of Precision farming relies on the integration of these technologies into a single system that can be operated at farm level with sustainable effort.

Geoinformatics for Precision Farming

- Geoinformatics deals with integrating computer science & geosciences to solve complex scientific questions.
- It is the science of **gathering, analysing, interpreting, distributing and using geographic information**.
- Geoinformatics encompasses **surveying and mapping, RS, GIS, and GPS**.

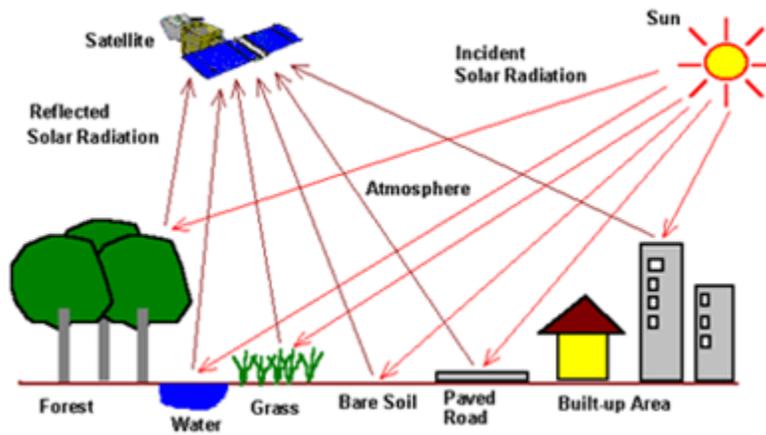
Global Positioning System (GPS)

- GPS provides continuous, real-time, 3D positioning and navigation worldwide in any weather condition.
- GPS-based applications in precision farming are being used in farm planning, field mapping, tractor guidance, variable rate applications (automated precise application of pesticides, fertilizers, etc. based on data that is collected by sensors, maps, and GPS) and yield mapping.
- GPS allows farmers to work during low visibility field conditions such as rain, dust, fog, and darkness.



Remote Sensing (RS) Technique

- RS is the science of making inferences about material objects from measurements, made at distance, **without coming into physical contact** with the objects under study.
- The RS system consists of a sensor to collect the radiation and a platform — an aircraft, balloon, rocket, satellite — on which a sensor can be mounted.



- Remote sensing is precision farming is used for crop yield modelling, identification of pests and disease infestation, soil moisture estimation, irrigation monitoring, assessment of crop damage, etc.

Geographic Information System (GIS)

- The GIS is a **computerised data storage and retrieval system**, which can be used to manage and analyse spatial data relating crop productivity and agronomic (study of crops and the soils) factors.
- It can integrate all types of information and interface with other decision support tools.
- **GIS can display analysed information in maps** that allow better understanding of interactions among yield, fertility, pests, weeds and other factors, and decision-making based on such spatial relationships.

Internet of things

- The computers and low latency internet (5G) are the most important components in precision farming as they are main source of information processing and gathering.

Future strategy

- Precision farming is practised in developed countries and it not yet practically adoptable in developing countries like India.
- Future strategy for adoption of precision agriculture in India should consider the problem of **land fragmentation, lack of highly sophisticated technical centres for precision agriculture, specific software for precision agriculture, poor economic condition of the farmers**, etc.