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Agriculture, Food Challenges and potential solutions

By:

Fahad Kimera

Senior Manager and Agricultural researcher

Fahad.kimera@aucegypt.edu

Center for Applied Research on the Environment and Sustainability

The American University in Cairo



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Agenda

- Food Security
- Food Insecurity
- Key Challenges to Agricultural Food Security
- Potential Solutions
- Modern Farming
- Types of Modern Agriculture
- Benefits of Modern farming
- Greenhouses
- Importance of Greenhouses
- Integrated Aquaculture Agriculture
- Modes of Integrated Aquaculture Agriculture



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Definition

Food security (FS) - A concept originated only in the mid-1970s. For decades, there have been multiple definitions of FS, by different institutions such as FAO, WFP, WB and others was primarily focused on both physical and economic access to food while associating it with continued poverty and low-income levels.

However, the current definition by FAO is a situation that exists when all people, **at all times**, have **physical, social and economic** access to **sufficient, safe and nutritious** food that meets their dietary needs and food preferences for an active and healthy life.



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- The WFP referred to year 2022 as the Year of Unprecedented Hunger. It estimates about 828 million people who go to bed without a meal. Amongst these, 345M are under acute food insecurity.
- Meaning all these people are unable to provide themselves with enough food for a healthy life. To a bigger extent, Covid-19 pandemic has worsened the situation. Shifting from 135 – 345M people from 2019 to 2022.



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MENA Region

- The MENA region accommodating to 21 countries, stood at 472M people as of 2021, with Egypt sharing up to 22% of the population. In a joint report between FAO, WFP, WHO etc, it was reported that a third or 137 million people, did not have regular access to sufficient, safe and nutritious food.
- Malnutrition stood at 22.5% by 2019. Findings show that MENA region is faced with a "triple burden of malnutrition" consisting of undernutrition, overweight and obesity, and micronutrient deficiencies (often linked to poor diets) continue to increase at an alarming speed.
- The region also ranked second for adult obesity in the world in 2019, with 27 percent of the adult population obese.



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Food Insecurity

- “the lack of secure access to sufficient amounts of safe and nutritious food for normal human growth and

To meet global food demand by 2050, agricultural production must **INCREASE BY 60%**

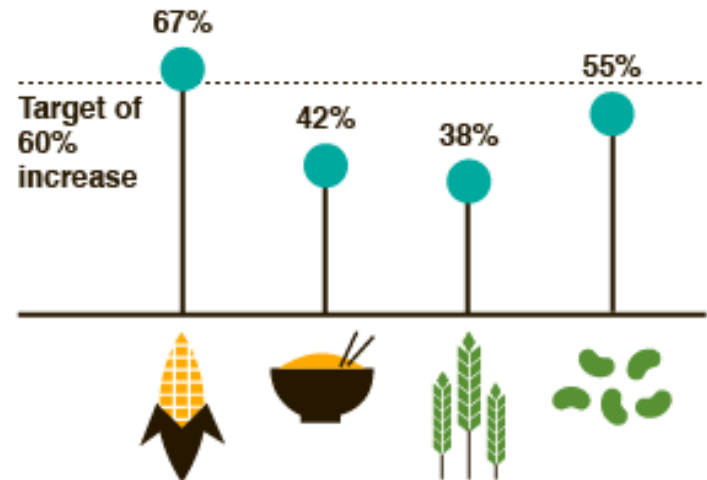
NOW



2050



Yields of maize, rice, wheat, and soybean all need to **INCREASE BY 60%**, by 2050 to meet demand but current growth in yield are falling short of the target.





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Food Security Video

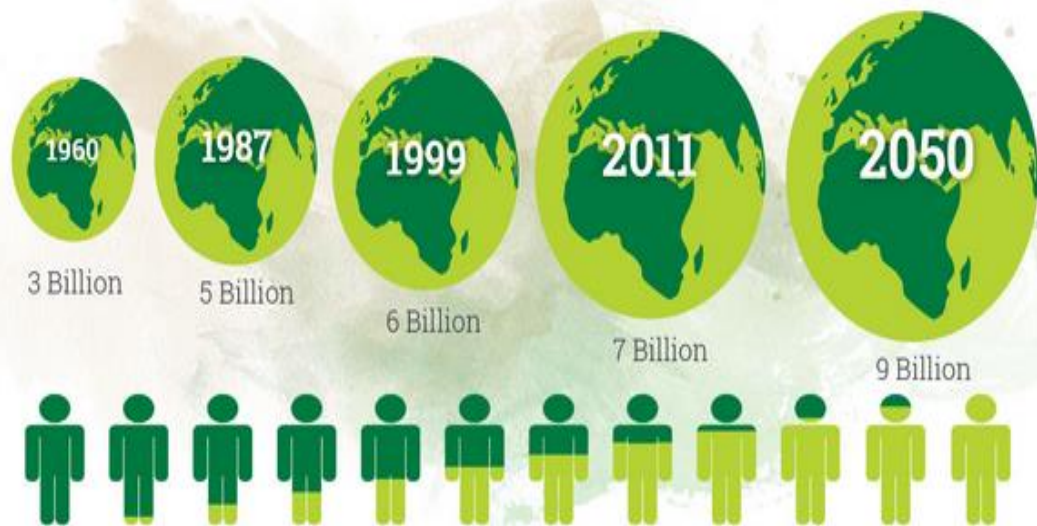
- <https://www.youtube.com/watch?v=9rkE-gAUhBk&t=84s>



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Key Challenges

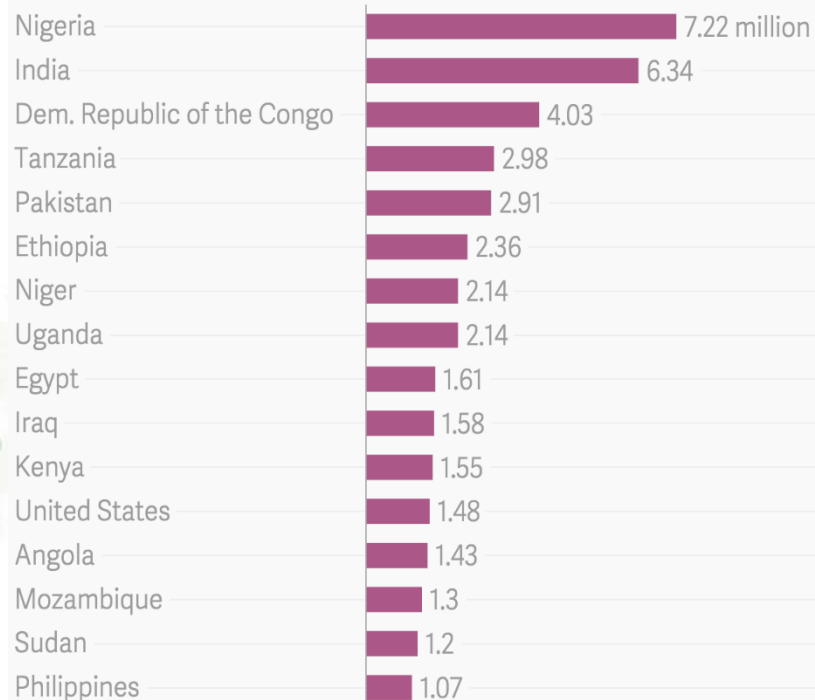
The world's population is expanding & food production **must** rise



By 2050 we will need to **increase** food production by 70%

Countries accounting for 75% of global population growth 2045-2050

Estimated annual increase



Δ T L Δ S | Data: United Nations, World Population Prospects 2015 Revision



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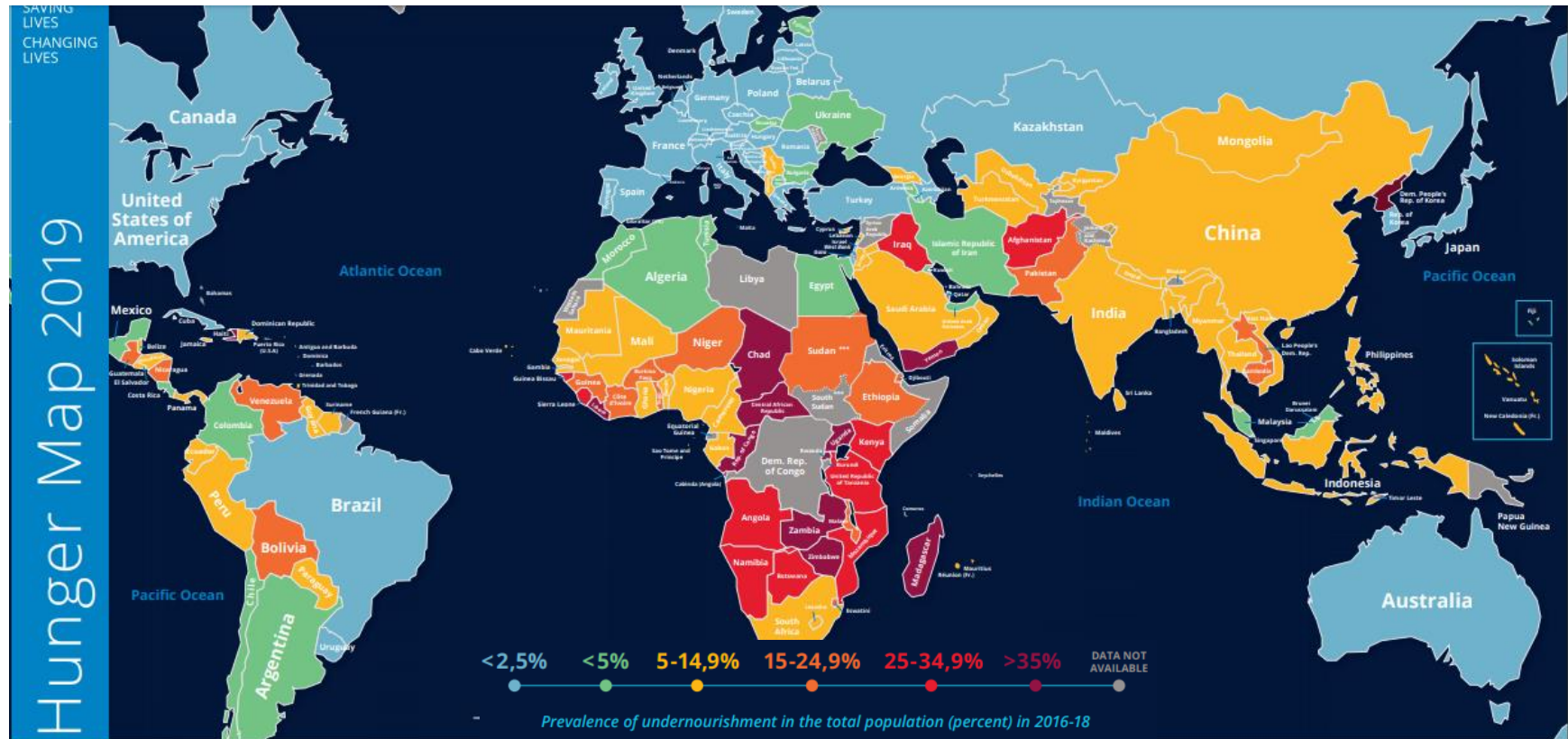


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Political Unrest & Conflict



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Intensified competition over Natural Resource

- Expansion of cities and urban settlements, deforestation for new agricultural lands or recreational grounds, industrial use of fresh water, competition among various agricultural sectors.



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Climate change and Global warming

- Increasing global temperatures, abnormal precipitation patterns, extreme weather events and water unavailability all destabilize the whole agricultural production chain.

Urban Sprawl and Informal Settlements



Shrinking arable/
Agricultural land!

Sustainable Agriculture



Sustainable Agriculture for Food Security



Availability :

- Water and Soil Conservation
- Good management
- Production and Processing
- Trade and stockpiling

Access:

- Transport and Equitable Distribution
- Marketing
- Affordability
- Purchasing power

Utilization and Stability:

- Good health & Nutritious food
- Quality and safety
- Clean water and Hygiene
- Sustainable production



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Sustainable ways of Farming



Agroecology



Organic Agriculture



Integrated Agriculture



Agriculture intensification



Permaculture



Precision Farming



Transgenic Technology



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Modern Farming

- “Refers to an evolving approach to agricultural innovations and farming practices that help farmers **increase efficiency and productivity** while **reducing inputs** such as water, land, and energy necessary to meet the world's food, fuel, and fiber needs. These forms might be related to plants or animals, commercial or home use, food or non-food etc.
- Modern agriculture is driven by continuous improvement, using **technology, digital tools and data** to do so



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Urban Farming:

- Even-though urban farming is practiced in and around the cities, its striking feature isn't the urban location, it's the possible integration of urban socio-economic and ecological systems.
- The system utilizes urban resources and the products are consumed by the urban citizens.
- The system depends and bases entirely on the urban conditions which considers urban planning, city laws and regulations, food prices in the city, market size, etc.





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Types of Modern Agriculture

- Rooftop gardens and farms
- Hydroponics and vertical farms
- Aquaponic farms
- Landscaping and nursery establishments
- Ground outdoor urban gardens
- Modern livestock farms
- Green buildings
- Modern bee keeping
- Greenhouses
- Conventional Commercial Farming



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Rooftop gardens

- Rooftop farming is the practice of growing plants at the rooftop of buildings, commercial malls, industries etc.
- Its not a new concept, ancient civilizations used to grow shrubs on raised terraces, balconies, and roof tops.
- These can range from roof farms, hydroponics or aeroponics and pot plants.





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Hydroponics and vertical farms

- Hydroponics is a horticultural method of growing crops without soil, but using mineral nutrients dissolved in water solutions various inert growing media called substrates,





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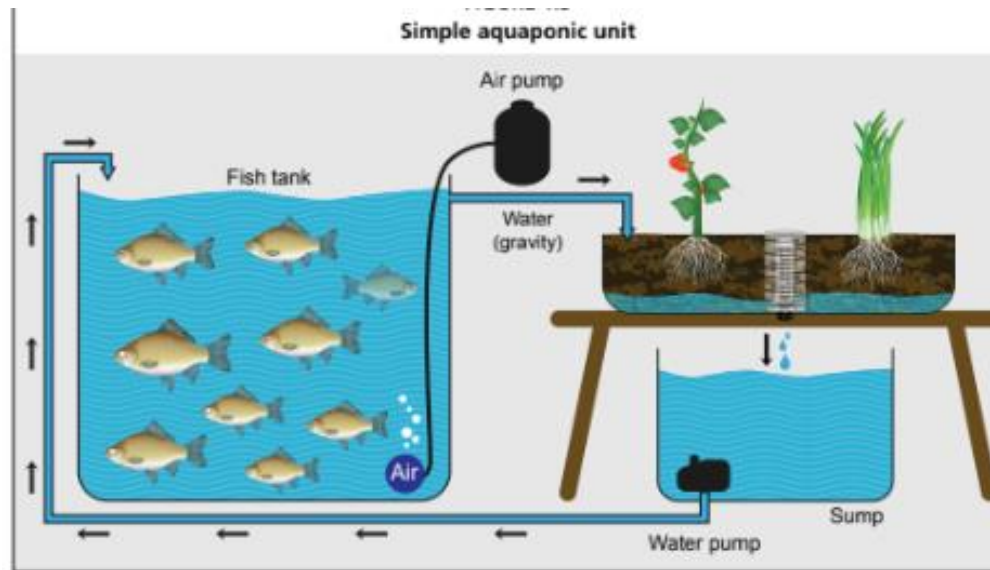


- Hydroponics can be cultivated using different systems and different techniques such as Deep water culture, Wick System, Ebb and Flow, Drip, N.F.T. (Nutrient Film Technology), Aeroponic systems.



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Aquaponics



- Aquaponics is the integration of recirculating aquaculture and hydroponics in one production system. In an aquaponic unit, water from the fish tank cycles through filters, plant grow beds and then back to the fish. *FAO Aquaponics*



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Aquaponics in AUC



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Modern livestock farms



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Benefits of Modern/Urban Agriculture

- These may be classified into Socio-cultural benefits, Environmental, economic, health, and educational.



Socio-Cultural benefits





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Socio- Cultural benefits

- Community gathering areas
- Building social capital
- Cultural interaction
- Educational venues
- Community activism and expression
- Relaxation



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Economic benefits





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Economic benefits

- Revenues
- Employment opportunities
- Entrepreneurial opportunities
- Cutting down city maintenance costs
- Cheaper food
- Access and availability of different foods
- Household savings
- Adding value to housing structures



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Health benefits



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Health benefits

- Availability and access to fresh health foods
- Diversified food produce
- Food security
- Outdoor physical exercising
- Psychological well-being
- Meeting spots



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Environmental benefits



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Environmental benefits

Enhances air
quality

More urban
green spaces

Reduces urban
heat island

Connects the
community to
natural system

Reduces
runoff water

Encourages
composting

Reduces
carbon
footprint

Reduces food
wastage



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Challenges of Modern/urban agriculture



Access to
farmland



City laws and
regulations



High rental costs
for land in cities



Contamination
of soil and water



Competitive
edge

Greenhouses

- Greenhouses are mostly developed to grow plants in a protected environment against extreme climatic conditions, pests and disease exposure, etc.
- Greenhouse can be completely controlled or semi controlled.
- Most crops grown in greenhouses are leafy and fruity vegetables, flowers, herbs, etc.



Importance of greenhouse



Water requirements are
very limited



Can be grown In any season



More crops and production



More quality of
production



Low chance of insects and
plants' diseases



Efficiently usage of chemicals
and pesticides

Climate control categories

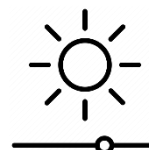
– Inside conditions



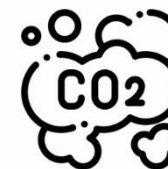
Temperature



Humidity



Light Levels



CO₂



pH



EC

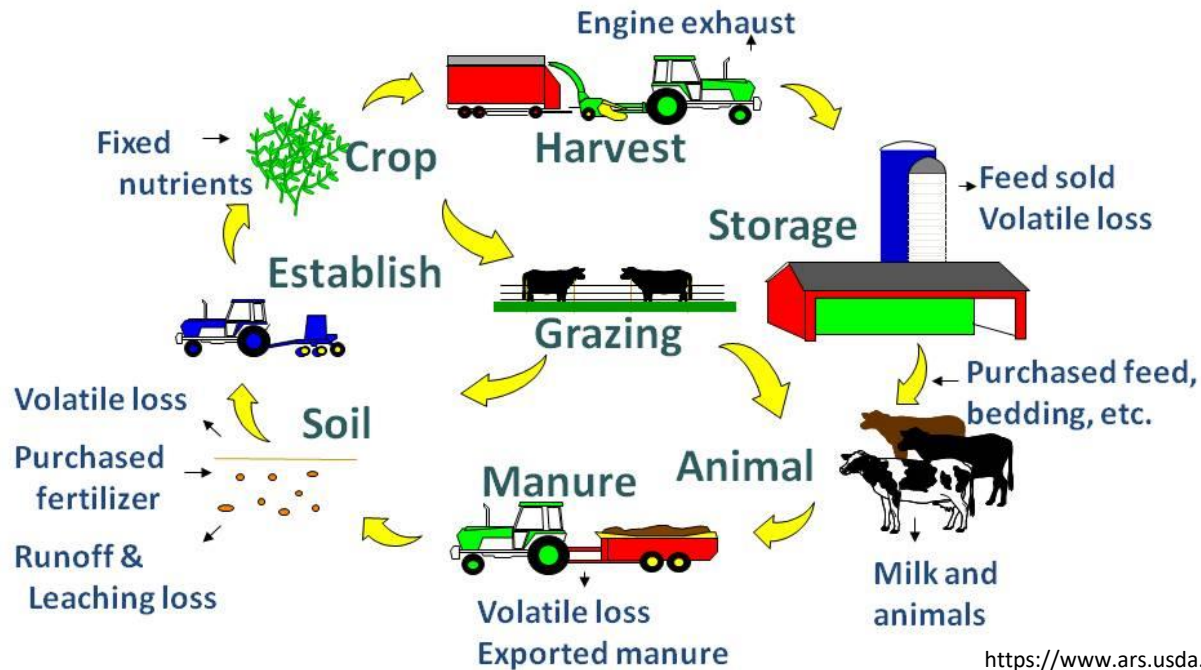


Nutrient Concentration



Moisture Levels

Integrated Agriculture?



<https://www.ars.usda.gov/northeast-area/up-pa/pswmru/docs/integrated-farm-system-model/>

What is Integrated Farming System ?

- Integration of two or more appropriate combination of enterprises like crop, dairy, piggery, fishery, poultry, bee keeping etc., for each farm according to the availability of resources to sustain and satisfy the necessities of the farmer.
- The Integrated Farming System (IFS) has revolutionized Conventional Farming of Livestock, Aquaculture, Horticulture, Agro-Industry.



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What is Integrated Farming System ?

- Farming all over the world is not very performing unless relatively big inputs are added to sustain yields
- IFS can turn all those existing disastrous farming systems, especially in the poorest countries into economically viable and ecologically balanced systems that will not only alleviate poverty,

Integrated Agriculture



CARES, Integrated system 2019

Different modes of integration

- Agricultural + livestock
- Agricultural + livestock + poultry
- Horticulture + fish culture + poultry
- Pig cum fish culture
- Agricultural + silvipasture
- Sericulture + fish culture
- fish culture + sericulture
- Agricultural(rice) + fish+ mushroom cultivation
- Agricultural + duckery + poultry
- Poultry + fish culture
- Integrated chicken cum fish farming
- Integrated goat cum fish farming

Quiz: Assign a name for the below systems



<https://agronomy.unl.edu/range-pasture-forages/integrated-crop-livestock-systems>



<https://www.pashudhanpraharee.com/integrated-poultry-fish-farming/>

Quiz: Assign a name for the below systems



<http://fishconsult.org/?p=15353>



<https://guardian.ng/features/integrated-farming-backward-integration-as-sustainable-agribusiness-strategies/>

Quiz: Assign a name for the below systems



<https://en.engormix.com/agriculture/articles/integrated-farming-model-small-t42786.htm>

<https://www.agriculturenigeria.com/manuals/research/articles/integrated-farming-systems/>



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Main components of an Integrated System

- Water source
- Physical boundaries where necessary
- Field crops
- Agri-horti system/multi storied cropping
- Olericulture:
- Livestock
- Poultry
- Aquaculture unit
- Composting unit

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Advantages of Integrated Farming

- Increase productivity & profitability
- Ensure food & nutritional security
- Provide a cleaner & pollution free environment
- Impart sustainability to the ecosystem Recycle un-utilised resources efficiently
- Enhance employment opportunities
- Provide chemical-free pesticides

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Advantages of Integrated Farming

- Generate income round the year
- Adopt innovative technology
- Solve energy & fodder crisis
- Avoid deforestation
- Enhance opportunities for agriculture-based industries
- Improved standard of living of the farm families in spheres of food, clothing, shelter, health & education.



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Why Integrated Farming systems

- Shrinkage in area under cropping:
- Small & Fragmented farm holding:
- Seasonal nature of income & employment & out-migration:
- Deterioration of resource base:
- Maximizing synergies between systems
- Sustenance of the farm

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