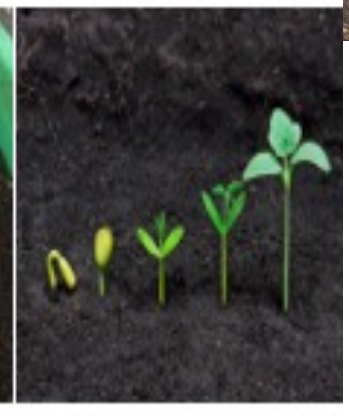
Circular Economy for Sustainable Agriculture



Circular Economy & Agriculture

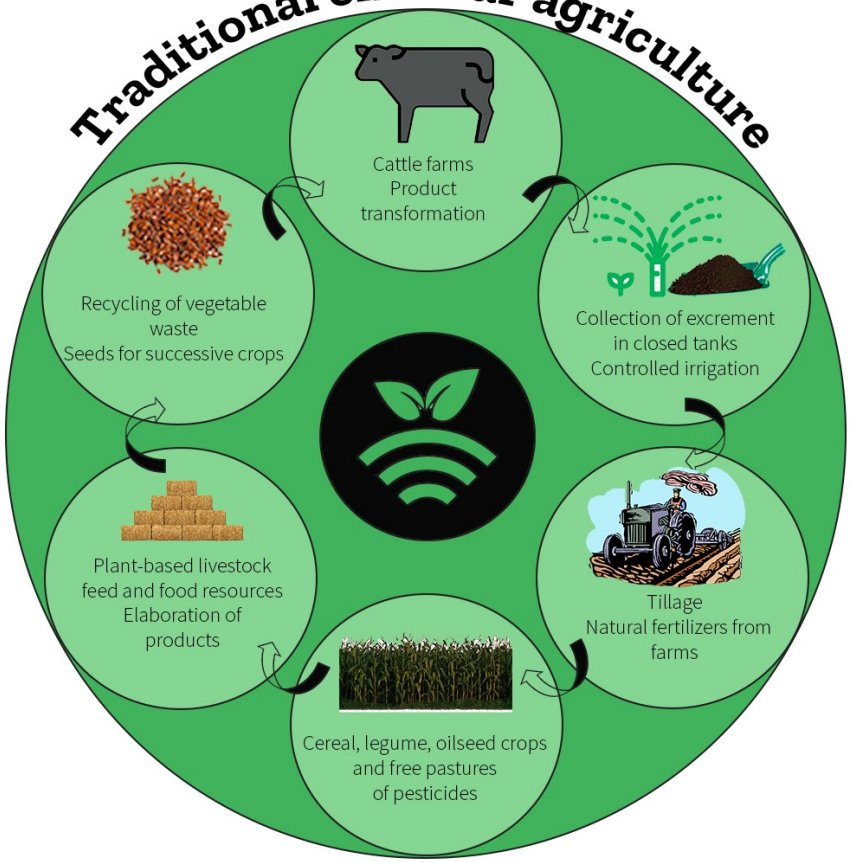
A circular economy is an economic system that aims to keep materials in use and reduce waste.

The 3Rs-

- Reduce
- Recycle
- Reuse

A well-known concept in resource efficiency, that helps us "return" materials and resources to the lifecycle of a product, ensuring that we use less energy and produce less waste/pollution and emissions.

Sustainable Agriculture

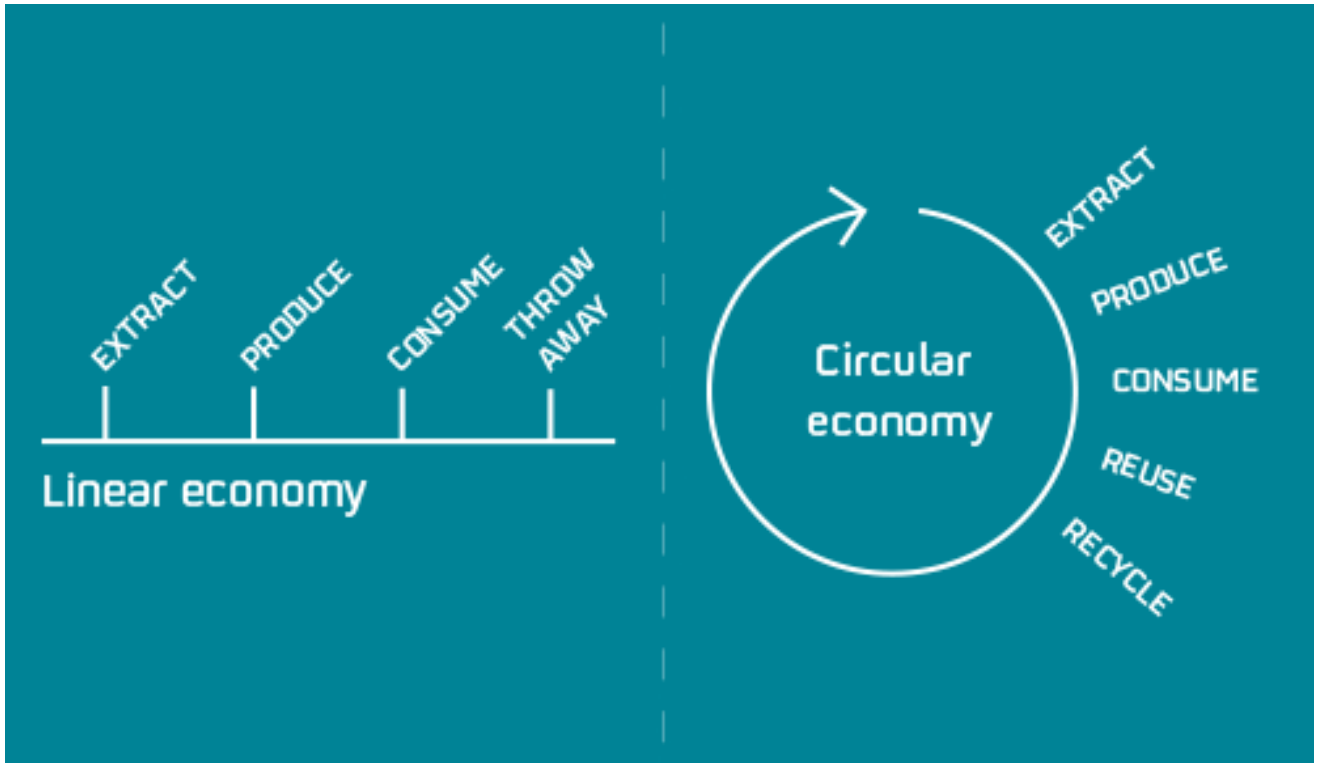


Crop Nutrition

- The goals for managing crop nutrition are profitable yield, high-quality products for specified markets, low disease impacts, avoidance or alleviation of crop stress, optimal symbiotic N_2 fixation (for legumes), nutritious food, and minimal environmental impact.
- In many parts of the world, inadequate crop nutrient supply results in pronounced yield losses and low product quality; by contrast, oversupply of nutrients causes unnecessary environmental impacts such as elevated nitrate leaching or gaseous N emissions.
- Optimizing nutrient supply to crops is critical to
  - satisfying the growing demand in the global market for sufficient amounts of nutritious food,
  - limiting fertilization costs,
  - minimizing potential environmental problems caused by agriculture, and
  - increasing resistance of crops to drought, waterlogging, frost, salinity, and climate variability.

Crop Nutrition & Circular Economy

The circular economy establishes a more sustainable production and consumption model in which raw materials are kept longer in production cycles and can be used repeatedly, therefore generating much less waste. As its name suggests, the essence of this model is that resources are kept in the economy for as long as possible, making it possible to use the waste we generate as raw material for other industries.



Benefits of Circular Economy

Protects the environment

It reduces emissions, minimizes the consumption of natural resources and reduces waste generation.

Drives employment growth

It stimulates the development of a new, more innovative and competitive industrial model, higher economic growth, and more employment

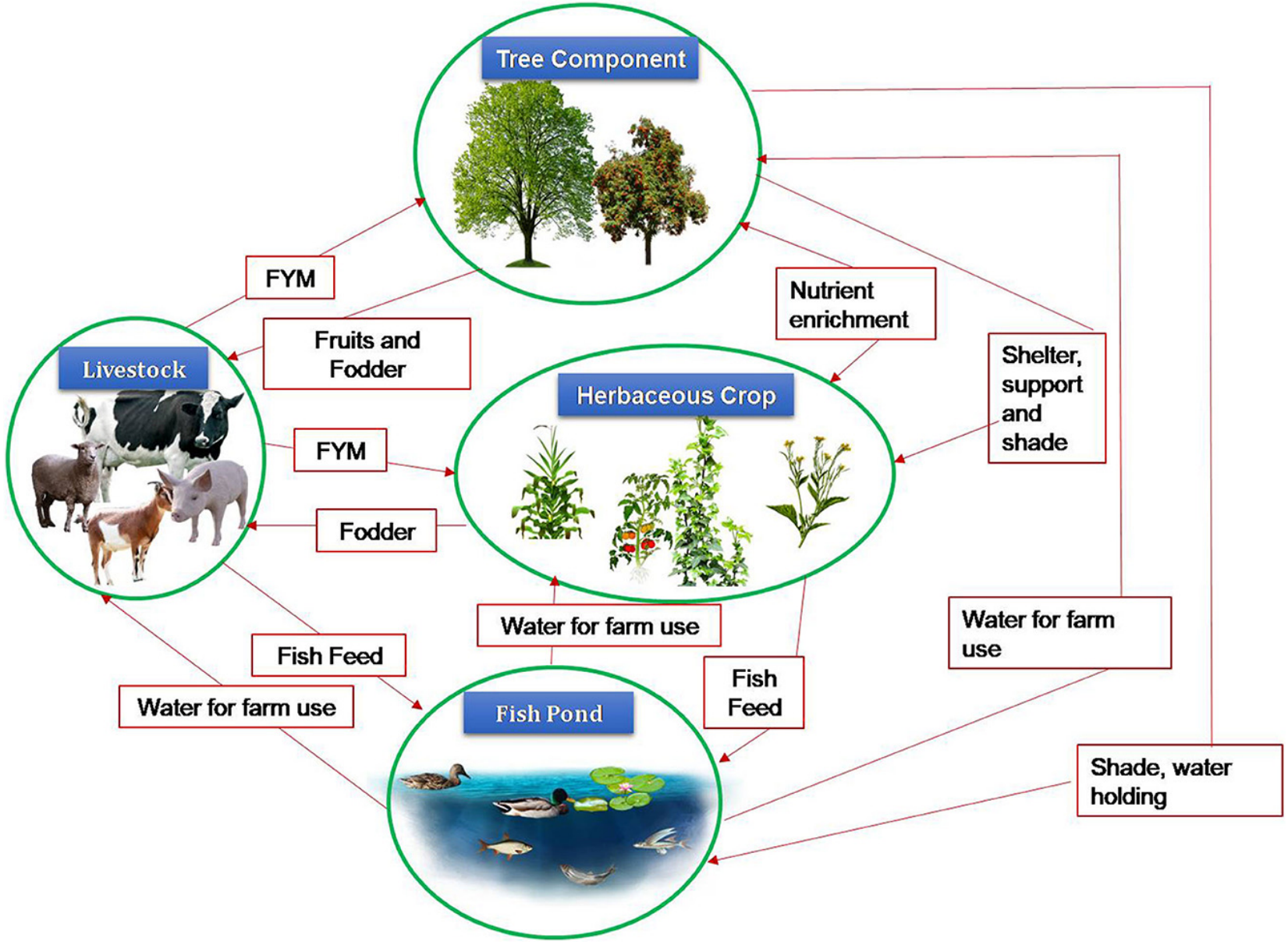
Benefits the local economy

It can benefit the local economy by encouraging production models based on the reuse of nearby waste as raw material.

Promotes resource independence

The reuse of local resources can lead to less dependence on imported raw materials.

Nature- a perfect model of Circular Economy



Organic Farm- Components of Circular economy

Current Scenario & Facts

It has been estimated that $12 trillion in hidden health, environmental and socio-economic costs are associated with the global food system, which is larger than the system's output at current prices (The Food and Land Use Coalition 2019).

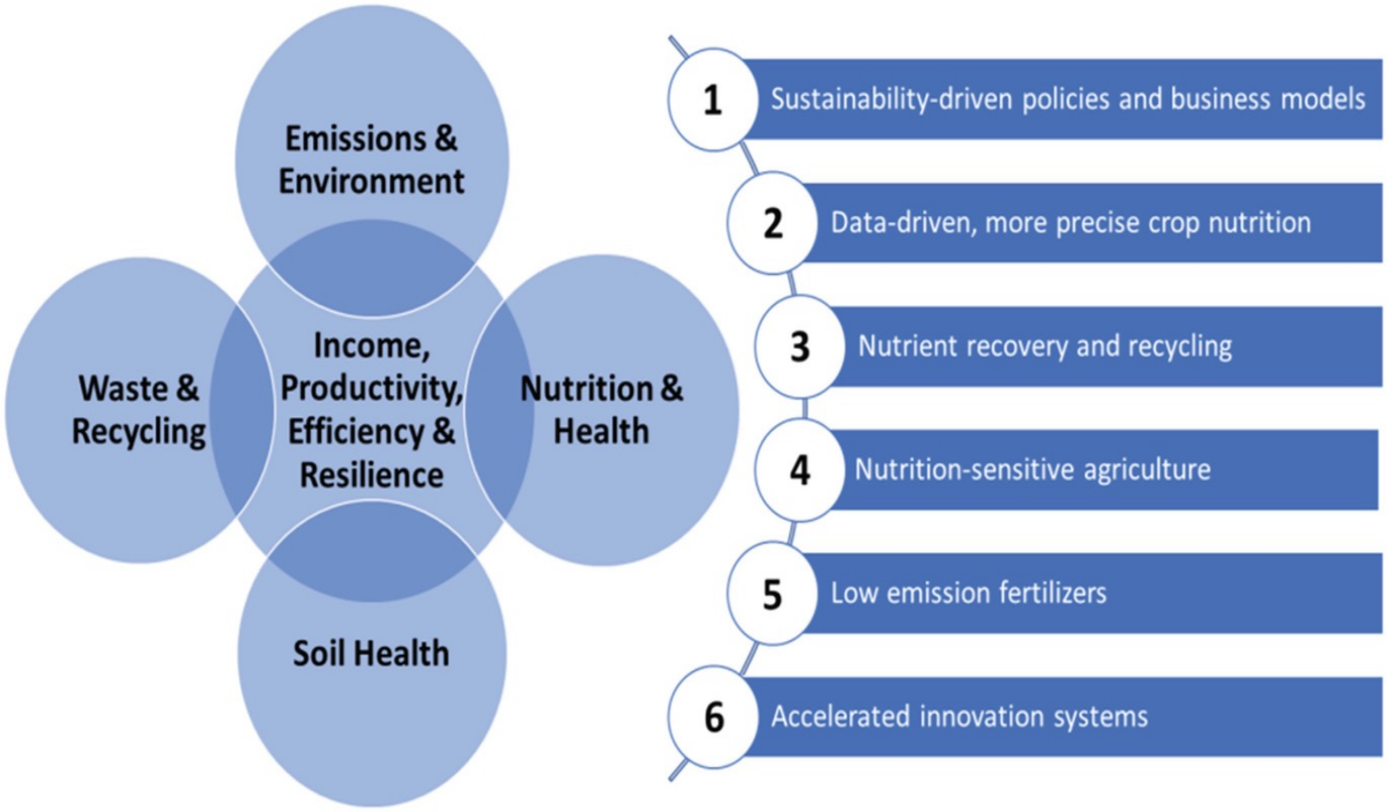
While food security through increasing crop and animal productivity will remain hugely important in light of an expected population of about 9.5 billion by 2050 (Vollset et al. 2020), it is no longer the only objective.

The transition to a more sustainable global food system requires all stakeholders to manage nutrients and their entire life cycle in a more holistic manner.

Future plant nutrition solutions will have to address multiple global and regional challenges related to nutrients in the food system.

How can we overcome the current global nutrient imbalance?

For many decades, rising crop and livestock production was closely coupled with increasing input of nitrogen and other nutrients, as well as international trade of feed and food. This has led to a global divide, ranging from large nutrient input-output surpluses and environmental pollution in some regions to large nutrient deficits in others.



No. 1- 5 are interconnected aims of responsible plant nutrition, and 6th is key actions to be taken

Sustainability-driven nutrient policies, roadmaps, business models and investments that create added value for all actors and beneficiaries in the nutrient chain

Nutrient policies and roadmaps must be tailored to the specific food systems in every country, including ambitious goals for nutrient use, losses and efficiency. Specific targets and priorities for managing nutrients will vary, depending on each country's history and sustainable development priorities.

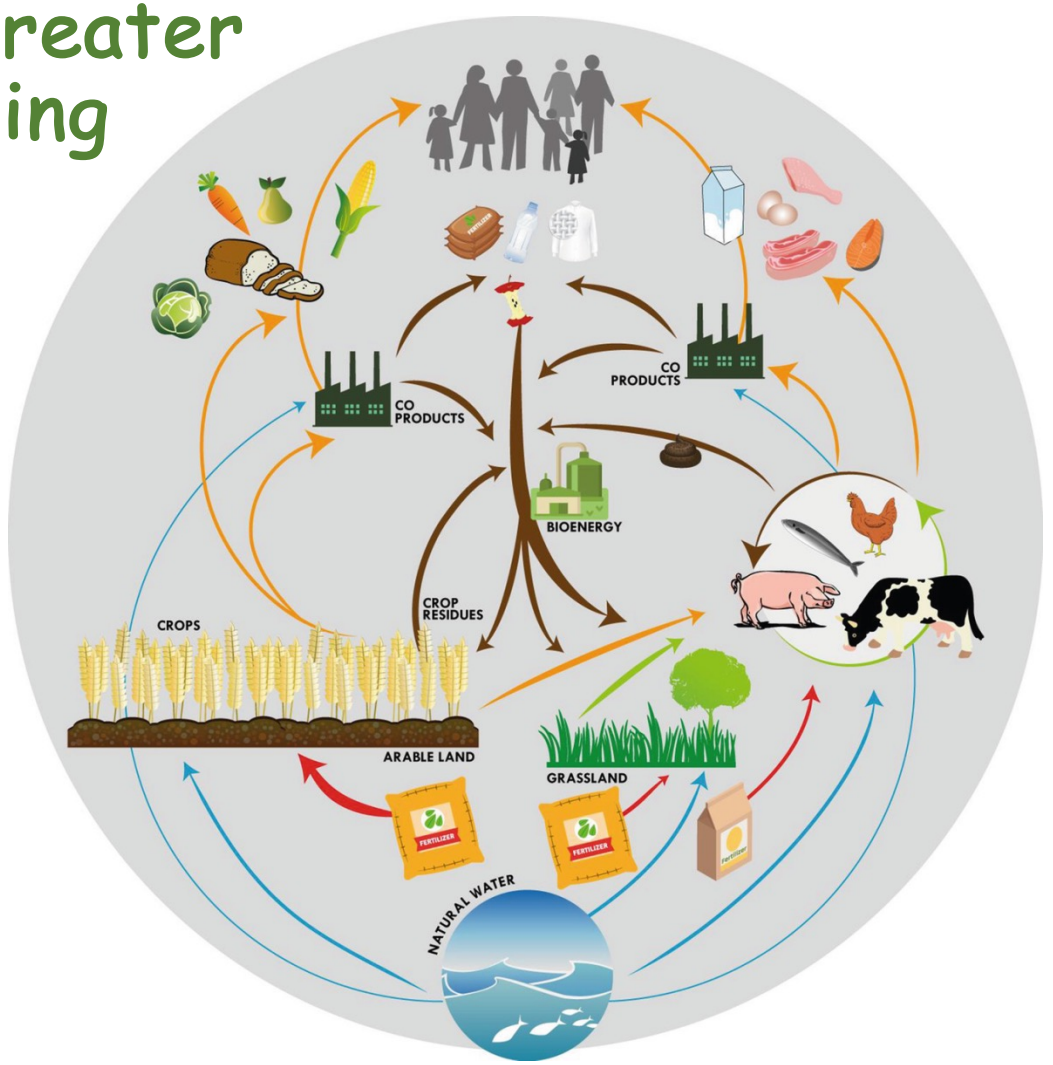
Certification schemes with progressive science-based monitoring and stewardship will guide performance and reward the farmers.

Improvement of soil health, enhancement of biodiversity, businesses for innovation, reduction of nutrient losses and provision of other ecosystem services.

Need to promote "low-tech" site-specific ITK based nutrient management approaches have shown consistent, large increases in crop yields and profits and nutrient use efficiency in many crops grown by smallholder farmers, besides modern high-tech solutions for commercial farming.

Circular economy solutions for greater nutrient recovery and recycling

- Crop-livestock integration, less food waste, use of by-products and increased nutrient recovery and recycling are key measures to optimize nutrient use efficiency across the full food chain.
- Political incentives, novel technologies and shifts in behavior will drive greater nutrient recycling from multiple waste streams, as a key contribution to circular, bio-based economies.
- Such circular systems need to be safe and healthy for animals, humans and the environment, but they also allow for the creation of novel business models, including side-streams within the agricultural sector for the up-cycling of materials and the nutrients that they contain.
- Improved full-chain nutrient flow monitoring, life-cycle analysis, benchmarking and certification will support the development of such solutions.



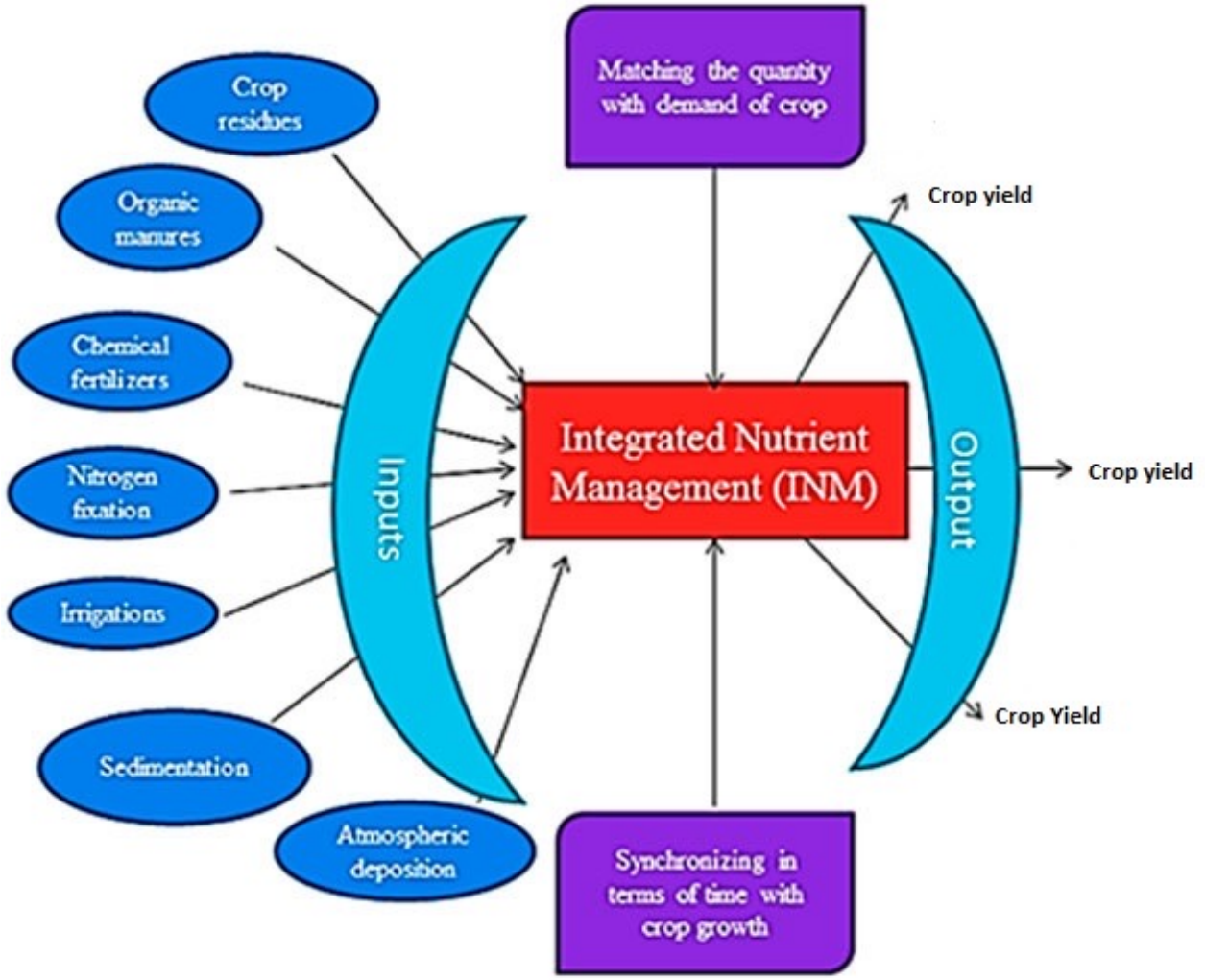
Major nutrient flows in circular crop-livestock-human systems. Red arrows indicate fertilizer inputs into the system. Fertile land is primarily used to produce food for humans and some supplementary feed for livestock, as are crop residues (orange arrows). Grassland is primarily used for livestock, including grazing. By-products and waste are recycled back to agriculture or used to make new bio-based products (brown arrows). Leakages out of the circular system are minimized. (Source: van Zanten et al. 2019)

Integrated Nutrient Management(INM)

Integrated Nutrient Management (INM) refers to the maintenance of soil fertility and of plant nutrient supply at an optimum level for sustaining the desired productivity through optimization of the benefits from all possible sources of organic, inorganic and biological components in an integrated manner.

Concept of INM :-

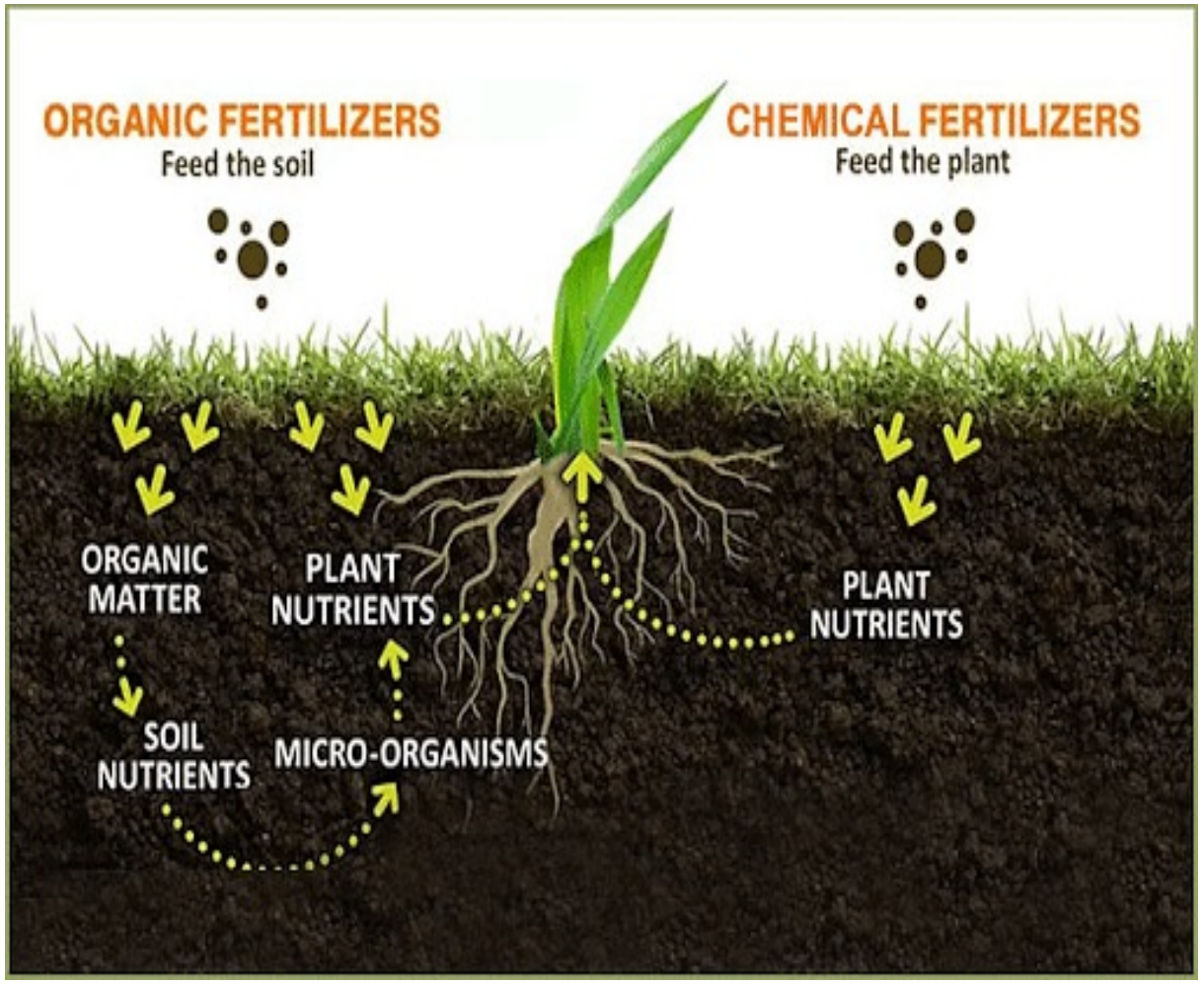
- Regulated nutrient supply for optimum crop growth and higher productivity.
- Improvement and maintenance of soil fertility.
- It is ecologically, socially and economically viable.

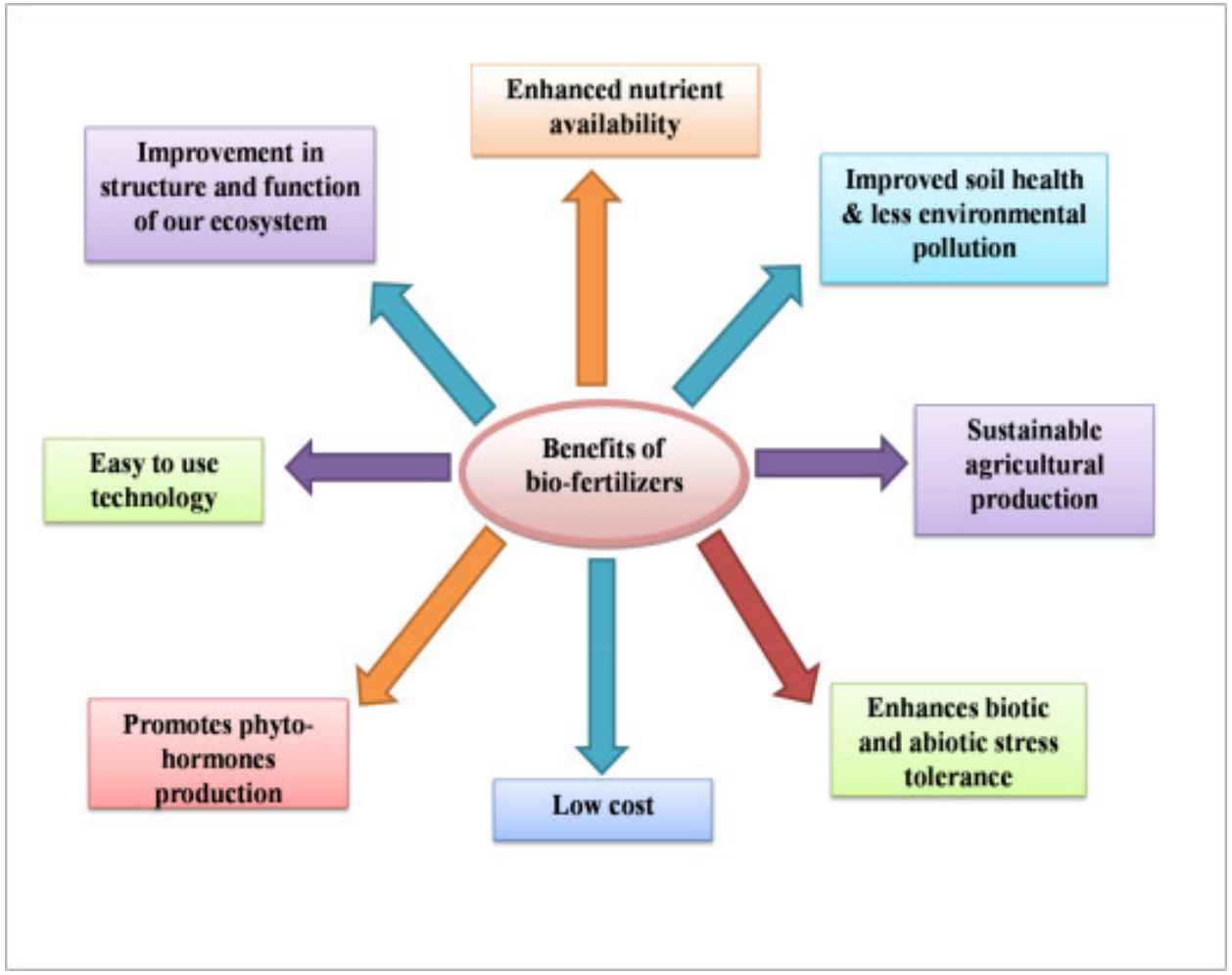


Components of INM

- **Soil Source:** Mobilizing unavailable nutrients and to use appropriate crop varieties, cultural practices and cropping system.
- **Mineral Fertilizer :**Super granules, coated urea, direct use of locally available rock PO4 in acid soils, Single Super Phosphate (SSP), MOP and micronutrient fertilizers.
- **Organic Sources :**By products of farming and allied industries. FYM, droppings, crop waste, residues, sewage, sludge, industrial waste.
- **Biological Sources :** Microbial inoculants can substitute 15 - 40 Kg N/ha under ideal conditions.

Organic Fertilisers & Bio-fertilisers Use





Organic Fertilisers

- Natural fertilizers derived from plants and animals are known as organic fertilizers.
- It adds carbonic chemicals to the soil, which are necessary for plant growth.
- Organic fertilizers boost the soil's organic matter content, promote microorganism growth, and alter the soil's physical and chemical qualities.
- It is one of the most important nutrients in green foods.
- The following products can be used to make organic fertilizers:
  - Agricultural Waste
  - Livestock Manure
  - Industrial Waste

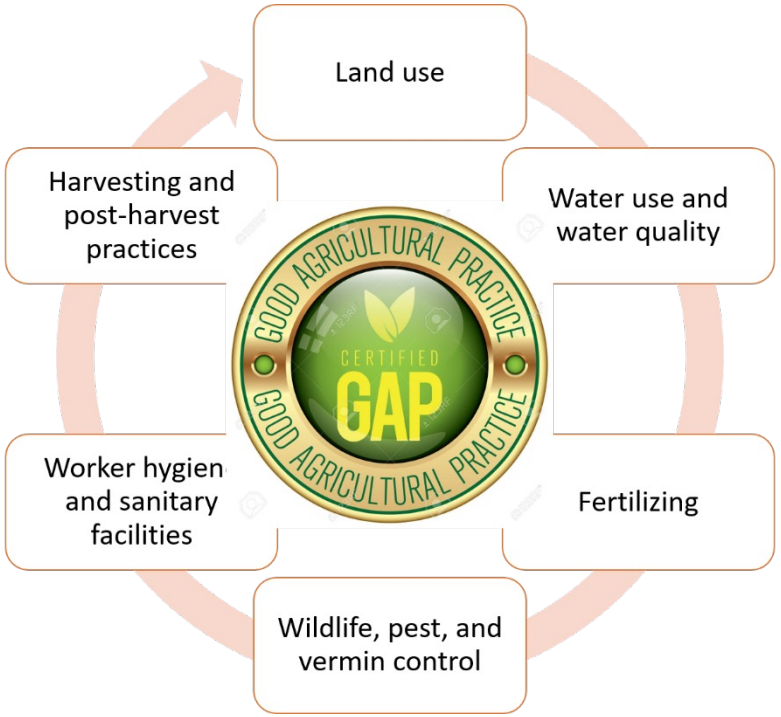
Bio-fertilisers

BENEFITS:-

- **Enrichment of soil:** They help to get high yield of crops by making the soil rich with nutrients.
- **Better suited than chemical fertilizers:** Chemical fertilizers disturbs the natural nutrient content of the soil, but biofertilizers maintain that like before.
- **Not harmful for plants:** Plant growth can be increased if biofertilizers are used, because they contain natural components which do not harm the plants.
- **Beneficial for soil microbes:** Useful microorganisms necessary for the growth of the plants can remain in the soil.
- **Protects natural fertility of the soil:** If the soil will be free of chemicals, it will retain its natural fertility which will be beneficial for the plants as well as the environment.
- **Plants are better adapted:** Biofertilizers destroy those harmful components from the soil which cause diseases in the plants. Plants can also be protected against drought and other strict conditions by using biofertilizers.
- **Economic:** Biofertilizers are way more economic and can be readily prepared or collected by the farmers can make use of them.
- **Eco-friendly:** They are environment friendly and protect the environment against pollutants.

Good Agricultural Practices (GAP)

Good Agricultural Practices are some codes, standards, regulation followed in Farm Practices. The main aim is to deliver to the consumer healthy and safe high quality food and non food products. It will ensure sustainable yield, protect the environment with development of livelihood.



General Guidelines of GAP

Good Agricultural Practices (GAPs) are a set of principles, regulations and technical recommendations applicable to production, processing and food transport, addressing human health care, environment protection and improvement of worker conditions and their families. GAP, as defined by FAO, are a "collection of principles to apply for on-farm production and postproduction processes, resulting in safe and healthy food and non-food agricultural products, while taking into account economic, social and environmental sustainability".

Implementing GAP also helps promote sustainable agriculture and contributes to meeting national and international environmental and social developmental objectives.

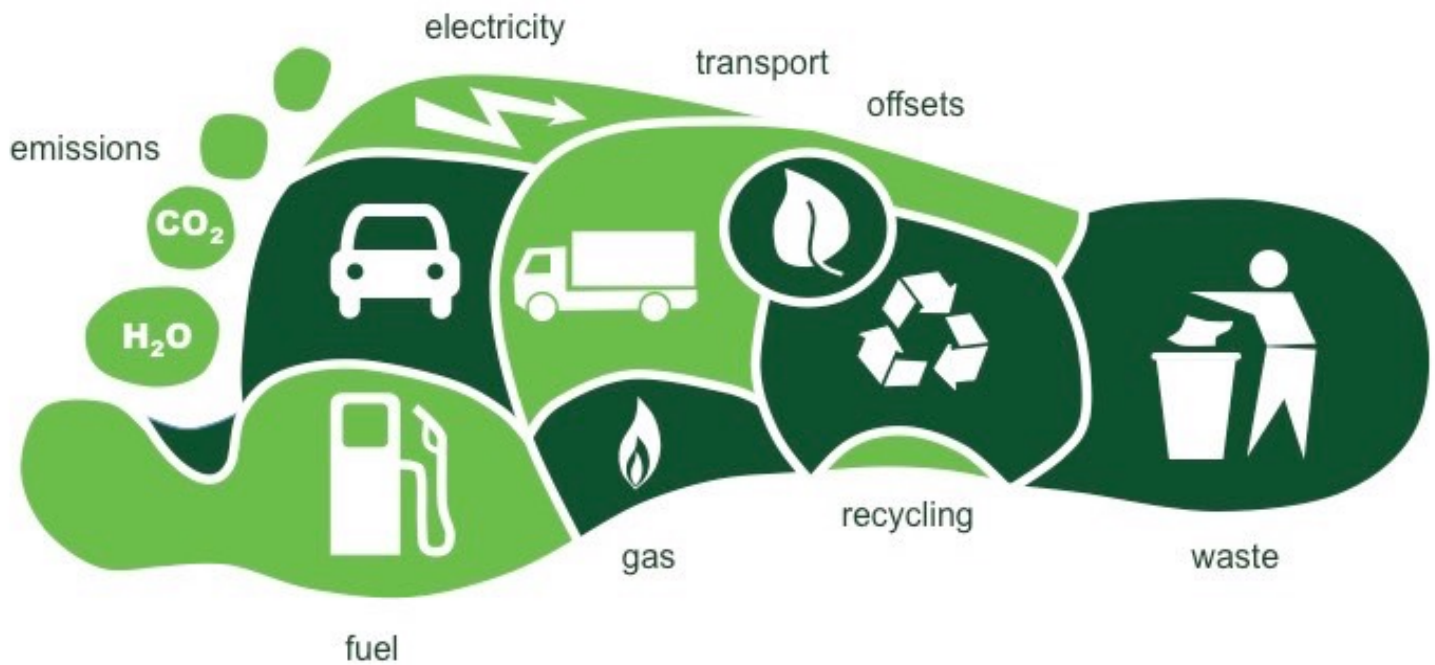
It has been documented that implementation of GAP encourages promotion of the optimum use of resources such as pesticides, fertilizers, and water, and eco-friendly agriculture. Its social dimension would be to protect the agricultural workers' health from improper use of chemicals and pesticides.

The guidelines are applicable to the production, harvesting, storage, etc. of specific crop (currently for Cotton & Soybean). Farmers can adopt appropriate measures to produce safe and premium price.

FOOD MILES


SHORTEN YOUR
FOOD CHAIN
HOME GARDEN
GARDEN
PLATE
FARMER'S MARKET
FARM
TRANSPORTATION
MARKET
PLATE
SUPERMARKET
FARM
TRANSPORTATION
PACKAGING + DISTRIBUTION
STORE
PLATE
FOOD DELIVERY SERVICE
FARM
TRANSPORTATION
DISTRIBUTION
PACKAGING
DELIVERY
PLATE

Carbon Foot Print



Conclusion

- On global basis, so far we have achieved little out of the goals of Circular economy in crop nutrition, despite of many scientific and technical solutions that have existed for decades.
- Achieving it now, within one generation, will require a far more concerted effort by everyone involved, from the fertilizer industry to farmers and consumers of food and other agricultural products.
- Fast action – grounded in long-term sustainability thinking – is needed to facilitate the transition towards a new paradigm for plant nutrition.
- So far with the experience Organic & Natural Farming approaches giving promising results in India. So need to move ahead with these Strategies.
- Ways to shorten the Food Chain to avoid possibilities of waistage at every level.