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Healthier food: Using agronomy to improve nutrition

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Abstract

Malnutrition remains a major global challenge, particularly in developing countries where diets are often dominated by staple crops with low nutrient density. Agronomy plays a crucial role in improving the nutritional quality of food by influencing soil health, crop selection, farming systems, and input management. Nutrition-sensitive agronomic practices focus on producing nutrient-rich crops rather than maximizing yield alone. Strategies such as soil fertility management, crop diversification, biofortification, and sustainable farming practices enhance the availability and bioavailability of essential nutrients. Integrating agronomy with nutrition objectives offers a sustainable and cost-effective approach to addressing micronutrient deficiencies, improving dietary diversity, and strengthening food security. This chapter highlights the role of agronomy in producing healthier food and its potential contribution to improved human nutrition and sustainable food systems.

Keywords: Agronomy, Nutrition-sensitive agriculture, Soil health, Diversification, Biofortification, Food security, Micronutrients, Sustainable agriculture

Introduction

Malnutrition remains a serious challenge worldwide, particularly in developing countries such as India. It includes undernutrition, micronutrient deficiencies (hidden hunger), and the rising burden of diet-related diseases. While nutrition programs often focus on supplements and food distribution, improving the nutritional quality of food at the production stage is equally important. Agronomy the science of soil, crop, and farm management plays a key role in determining not only how much food is produced, but also how nutritious that food is. By applying nutrition-sensitive agronomic practices, agriculture can contribute directly to healthier diets, food security, and sustainable development.

Importance of Agronomy in Nutrition

Agronomy is important for nutrition because:

- It determines what crops are grown
- It influences nutrient content of food
- It affects food safety and quality
- It supports sustainable food systems
- It helps reduce hidden hunger (micronutrient deficiency)

Focusing only on yield can lead to calorie-rich but nutrient-poor diets. Agronomy helps shift agriculture toward nutrient-dense food production.

Process how Agronomy improves Nutrition

Step-by-Step Process-

1. Soil Management

- Improve organic matter
- Apply balanced fertilizers
- Correct micronutrient deficiencies

2. Crop Selection

- Choose nutrient-rich crops
- Promote pulses, millets, vegetables
- Use biofortified varieties

3. Cropping Systems

- Crop rotation
- Intercropping
- Integrated farming systems

4. Sustainable Practices

- Integrated nutrient management
- Integrated pest management
- Climate-smart agriculture

5. Nutrient-Rich Food Production

- Higher mineral and vitamin content
- Improved dietary diversity
- Better human nutrition

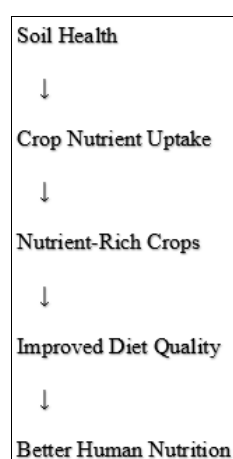


Fig 1: Pathway Linking Agronomy to Nutrition

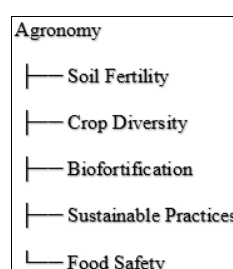


Fig 2: Nutrition-Sensitive Agronomic Components

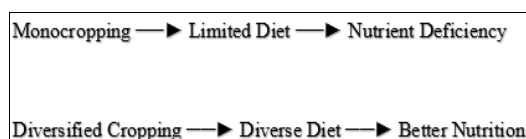


Fig 3: Crop Diversification and Dietary Diversity

• Soil Health and Nutritional Quality of Crops

Soil health strongly affects the nutrient content of crops. Poor soils lacking micronutrients such as zinc, iron, and selenium lead to nutrient-deficient food, which in turn affects human health.

Impact of Soil Health on Crop Nutrition:

- **Nutrient Density:** Crops grown in biologically active soil with high organic matter have better nutrient profiles,

containing more essential vitamins and minerals.

- **Micronutrient Availability:** Healthy soil ensures the availability of crucial micronutrients (e.g., iron, zinc, selenium) for plant uptake, which are then transferred to the human diet.
- **Root System Development:** Better soil structure allows roots to grow deeper, accessing a wider range of nutrients and improving the overall quality of produce.
- **Reduced Contaminants:** Healthy, living soils (with active microbiology) act as filters that can limit the uptake of heavy metals and contaminants by plants.

Key agronomic practices for soil-based nutrition:

- Use of organic manures and compost
- Balanced fertilization including micronutrients
- Crop rotation and inclusion of legumes

Benefits to Human and Environmental Health:

- **Nutritional Security:** Nutrient-dense, soil-grown foods reduce the prevalence of malnutrition.
- **Longer Shelf Life:** Nutrient-dense fruits and vegetables often have better post-harvest quality and longer shelf life.
- **Resilience:** Healthy soil is more resilient to environmental stressors like droughts and floods, ensuring a more stable, nutritious food supply.

Crop Diversity and Farming Systems

Dietary diversity depends heavily on agricultural diversity. Monocropping systems dominated by cereals limit access to essential nutrients. Diversified cropping systems improve both farm resilience and nutrition.

Nutrition-enhancing agronomic strategies:

- **Diversified Cropping Systems:** Moving from monoculture to patterns like Maize-Aman-Napa Shak or Maize-Aman-Carrot can significantly increase zinc and iron.
- **Integrating Underutilized Crops:** Incorporating indigenous, nutritious, and traditional, nutrient-dense crops such as millets, pulses, and leafy vegetables helps combat specific micronutrient deficiencies, particularly in South Asia.
- **Crop-Livestock Integration:** Integrating livestock, especially cattle and poultry, into farming systems, provides high-value nutrients and improves food security.
- **Improving Soil Health:** Diverse cropping systems, such as crop rotation and intercropping, optimize nutrient cycling and boost soil organic matter, leading to healthier, more nutrient-rich food production.

In India, traditional crops such as millets, pulses, and leafy vegetables are rich in minerals, fiber, and protein, yet are often underutilized. Reviving these crops through supportive agronomy can significantly improve nutrition.

Biofortification and Crop Improvement

Biofortification increases the nutrient content of crops through plant breeding and agronomic practices. It is a cost-effective strategy to address micronutrient deficiencies, especially in rural

populations. Biofortification improves the nutritional value of staple crops (iron, zinc, Vitamin A) directly during plant growth, rather than through post-harvest processing, using conventional breeding, agronomic, or biotechnological techniques. This strategy complements, and sometimes replaces, industrial fortification to combat malnutrition in developing regions, with over 10 million farmers already growing biofortified varieties.

Key Aspects of Biofortification

- **Methods:** Includes conventional breeding (crossing high-nutrient varieties), agronomic practices (fertilizer application), and genetic modification (e.g., Golden Rice).
- **Target Nutrients:** Primarily iron, zinc, and Vitamin A (provitamin A carotenoids).
- **Key Crops:** Rice, wheat, maize, cassava, sweet potato, and beans.
- **Evidence of Impact:** Studies show biofortified staples (iron beans/pearl millet) improve nutritional status in children and women.

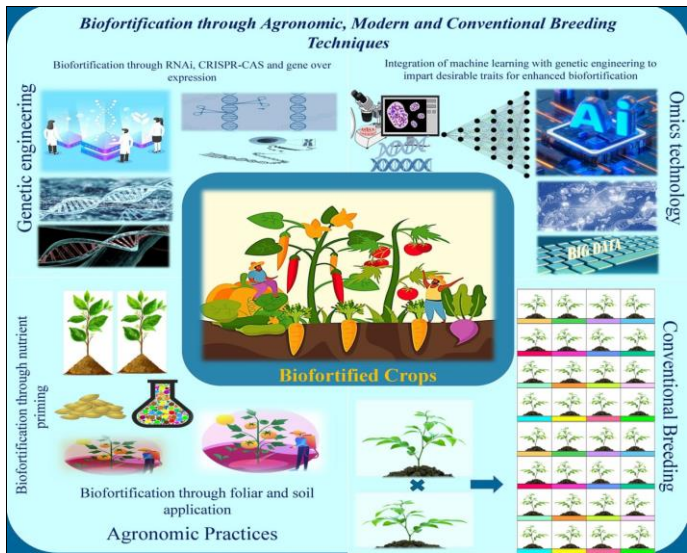


Fig: Biofortification - Agronomy Practices

Sustainable Agronomy and Food Safety

Sustainable agronomic practices protect ecosystems while improving food quality. Excessive use of chemical fertilizers and pesticides can reduce soil health and pose food safety risks. Sustainable agriculture ensures long-term food safety and security by focusing on ecological health, reducing chemical inputs, and improving soil, water, and biodiversity. It enhances food safety by minimizing contamination with hazardous chemicals, while techniques like IPM (Integrated Pest Management) and GAP (Good Agricultural Practices) create sustainable, high-quality, and resilient food production systems.

Key Aspects of Sustainable Agronomy and Food Safety

- **Environmental Health:** Sustainable methods protect ecosystems, conserve water, and improve soil quality, reducing the need for chemical fertilizers and pesticides.
- **Food Safety Measures:**
 - a. **Reduced Chemical Inputs:** Lowering pesticide use results in fewer residues on food, enhancing consumer safety.
 - b. **Good Agricultural Practices (GAP):** Implementing GAP helps manage food safety risks, reduce contamination, and improve quality.

- c. **Integrated Pest Management (IPM):** This approach uses natural enemies of pests to minimize chemical pesticide application.
- **Resilient Food Systems:** Sustainable practices like crop rotation and diversification help crops adapt to climate change, ensuring food availability.
- **Water Management:** Utilizing drip irrigation and reusing safe, treated wastewater helps conserve resources.
- **Waste Utilization:** Composting farm waste recycles nutrients back into the soil, promoting healthier crop growth.

Benefits and Impact

- **Improved Human Health:** Reduced reliance on agrochemicals and lower levels of pollutants in the environment lead to safer, healthier food.
- **Economic Viability:** Sustainable farming can reduce production costs, open new market opportunities, and increase yields.
- **Long-Term Food Security:** By protecting natural resources, sustainable agriculture ensures that future generations can access sufficient and nutritious food.
- **Circular Economy:** Using organic waste to enhance soil health creates a sustainable cycle that benefits both farmers and consumers.
- **Natural Systems:** Sustainable practices often lead to healthier ecosystems, reducing risks from pollution.

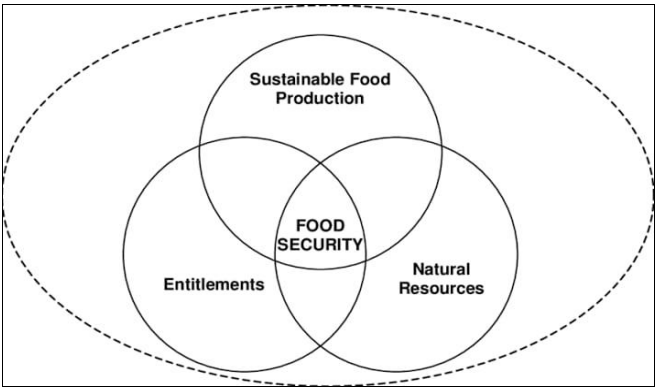


Fig: Sustainability in Human Food

Table 1: Agronomic practices and their nutritional impact

Agronomic Practice	Nutritional Impact
Organic manures	Improves micronutrient availability
Balanced fertilization	Enhances mineral content of crops
Crop rotation	Improves protein and mineral availability
Intercropping	Increases dietary diversity
Biofortified crops	Reduces micronutrient deficiencies

Table 2: Nutrition-sensitive crops and key nutrients

Crop	Key Nutrients
Rice (biofortified)	Iron, Zinc
Wheat	Protein, Zinc
Millets	Iron, Calcium, Dietary fiber
Pulses	Protein, Iron
Leafy vegetables	Vitamin A, Vitamin C, Iron

Table 3: Soil micronutrients and their role in human health

Soil Nutrient	Role in Crop	Human Health Impact
Zinc	Grain quality improvement	Enhances immunity
Iron	Chlorophyll synthesis	Prevents anemia
Selenium	Antioxidant activity	Supports thyroid function

Challenges and Future Opportunities

Despite its potential, nutrition-sensitive agronomy faces challenges:

- Limited integration of agriculture and nutrition policies
- Lack of farmer awareness
- Research focus on yield rather than nutrient outcomes

Future efforts should strengthen collaboration between agronomists, nutritionists, policymakers, and extension services to promote nutrition-oriented farming systems.

References

1. FAO. The State of Food and Agriculture. Rome: Food and Agriculture Organization; 2013.
2. FAO, WHO. Nutrition-sensitive agriculture. Rome: FAO; 2014.
3. Welch RM, Graham RD. Breeding for micronutrients in staple food crops. *Journal of Trace Elements in Medicine and Biology*. 2004;18(4):299-307.
4. Bouis HE, Saltzman A. Improving nutrition through biofortification. *Global Food Security*. 2017;12:49-58.
5. Lal R. Restoring soil quality to mitigate soil degradation. *Sustainability*. 2015;7:5875-5895.
6. ICAR. Nutrient management for food security. New Delhi: Indian Council of Agricultural Research; 2019.

Chapter Summary

Agronomy plays a critical role in improving the nutritional quality of food by influencing soil health, crop choice, and farming practices.

Nutrition-sensitive agronomy focuses on nutrient-rich food production rather than yield alone.

Soil health management enhances the availability of essential micronutrients such as iron and zinc.

Crop diversification, including millets, pulses, and vegetables, improves dietary diversity.

Biofortification is an effective and sustainable strategy to address micronutrient deficiencies.

Sustainable agronomic practices improve food quality, safety, and long-term productivity.

Integrating agronomy and nutrition is essential for achieving food and nutrition security.

Key Points

- Agronomy influences both food quantity and quality.
- Healthy soils lead to nutrient-dense crops.
- Crop diversity supports balanced human diets.
- Biofortified crops reduce hidden hunger.
- Sustainable agriculture ensures long-term nutrition security