NEW ERA AGRICULTURE MAGAZINE

Soil Health Management Techniques for Sustainable Yields

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Abstract: -

Healthy soil is the foundation of sustainable agriculture and food security. Continuous use of chemical fertilizers and poor soil management practices has led to declining soil fertility and imbalanced nutrient availability. This article discusses practical soil health management techniques such as green manuring, vermicomposting, crop rotation, residue incorporation, and balanced fertilization. Special emphasis is placed on biofertilizers and organic amendments as cost-effective solutions for farmers. The use of soil health cards for precise nutrient application and sustainable tillage practices for preserving soil structure are also covered. These field-level techniques enhance soil productivity, improve crop yields, and support long-term agricultural sustainability.

Introduction:

Soil is the lifeline of agriculture. A healthy soil supports high crop yields, sustains soil biodiversity, retains water efficiently, and resists pests and diseases naturally. However, continuous cropping, excessive use of chemical fertilizers, imbalanced nutrient application, and declining organic matter have severely affected soil health in many parts of India. This has led to reduced soil fertility, poor crop productivity, and increased production costs for farmers.

Farmers often overlook soil health and focus only on crops — but restoring and maintaining soil fertility is the most economical, sustainable, and risk-proof method to ensure long-term farm profitability. This article presents practical, farmer-friendly, and low-cost soil health management practices that can be adopted at the field level for sustainable, profitable agriculture.

What is Soil Health?

Soil health refers to the capacity of soil to function as a living ecosystem that sustains

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plants, animals, and humans. A healthy soil is rich in organic matter, has balanced nutrients, good structure, proper aeration, adequate water-holding capacity, and beneficial microorganisms.

Common Problems in Farmer Fields

- Continuous cropping without crop rotation
- Imbalanced use of chemical fertilizers (overuse of urea)
- Declining organic matter due to crop residue burning
- Soil compaction due to excessive tillage
- Waterlogging in poorly drained fields
- Nutrient mining without replenishment
- Soil acidity, salinity, or alkalinity

Proven Soil Health Management Techniques for Farmers

1. **Soil Testing and Use of Soil Health Cards**
   - Get your soil tested before every season at a nearby **Krishi Vigyan Kendra (KVK)** or soil testing lab.
   - Use a soil health card to understand your soil's nutrient status and pH.
   - Apply only those fertilizers and in the required quantity, saving money and improving crop yields.
   - Use **mobile-based services like mKisan or IFFCO Kisan App** for soil test recommendations.
2. **Incorporation of Organic Manures**
   - Apply **5–10 tonnes of well-decomposed farmyard manure (FYM) per acre** before sowing.
   - If FYM is insufficient, prepare **vermicompost pits** on-farm using crop residues and animal dung.
   - Use **green manuring crops like Dhaincha (Sesbania), Sunhemp, or Cowpea** in the kharif season.
   - Improves soil structure, water-holding capacity, microbial activity, and adds organic carbon.
3. **Use of Biofertilizers**
   - For cereals: Apply **Azotobacter or Azospirillum** (nitrogen-fixing bacteria)
   - For legumes: Use **Rhizobium culture** on seeds.
   - For all crops: Use **Phosphate Solubilizing Bacteria (PSB)**
   - Apply **Trichoderma mixed with compost/FYM** for disease control.
   - 500 g per acre mixed with 25 kg compost during field preparation.
   - Enhances nutrient availability naturally, improves plant health, and reduces dependence on chemical fertilizers.
4. **Mulching for Soil Moisture and Organic Matter**

- Apply **crop residues, dried leaves, or straw mulch** around plants in vegetables and orchards.
- Use plastic mulch in commercial farming for tomato, chilli, and cucurbits.
- Conserves moisture, suppresses weeds, adds organic matter after decomposition, and reduces soil erosion.

5. **Crop Rotation and Intercropping**
   - Avoid continuous monocropping of paddy-wheat or maize-wheat.
   - Include pulses (lentil, gram, mung) or oilseeds (mustard) in rotation.

Example:

- Wheat → Moong → Rice
  or
  Maize + Cowpea Intercropping
- ✓ Breaks pest and disease cycles, improves soil nitrogen, and enhances farm income diversity.

6. **Deep Ploughing and Tillage Management**
   - Perform **deep ploughing during peak summer (May–June)** to expose soil pests and pathogens to heat.
   - Avoid over-tillage to maintain soil structure.
   - Reduces soil-borne diseases and improves aeration and water percolation.

7. **Application of Organic Bio-Pesticides in Soil**
   - Mix **neem cake (50 kg/acre)** in soil for controlling termites and nematodes.
   - Apply **Trichoderma-enriched compost** to suppress soil pathogens.
   - Eco-friendly control of pests and diseases, reducing pesticide cost.

Advantages of Adopting Soil Health Practices

- Improves soil fertility and structure
- Enhances soil microbial biodiversity
- Reduces dependency on chemical fertilizers
- Increases yield stability and crop quality
- Reduces input cost over time
- Builds resilience against drought and climate stress
- Improves **water-use efficiency**

Challenges in Adoption

- Lack of awareness about soil management
- Shortage of organic manures and biofertilizers in villages
- Preference for quick-yielding chemical fertilizers
- Unavailability of timely soil testing services

Farmer Success Story

Farmer Sunil Kumar from Barabanki (U.P.) practiced crop rotation

(Wheat–Moong–Rice) and applied 5 tonnes of FYM and biofertilizers. He reported a 30% yield increase in wheat and reduced urea use by 40 kg per acre. His soil organic carbon improved from 0.38% to 0.62% in 3 years. His water requirement for irrigation also reduced due to better soil moisture retention.

Conclusion

Improving soil health is the key to doubling farmer income, increasing yield stability, and ensuring sustainable farming. Indian farmers can easily adopt practical, low-cost soil management techniques like soil testing, biofertilizer use, organic manures, deep ploughing, mulching, and crop rotation. These practices not only increase crop productivity but also reduce input costs and protect soil for future generations.

Government schemes like **Soil Health Card Yojana** and **Paramparagat Krishi Vikas Yojana (PKVY)** are available to support farmers in adopting these techniques. Every farmer should consider soil health as his most valuable asset for long-term prosperity.