

Answers

Module 1: Introduction to Soil Health

- 1) crumbly/fluffy structure, air and water pockets, microorganisms, earthworms, nematodes, fungi, pleasant smell (forest smell), organic matter (dark brown color)
- 2) Soil health significantly impacts crop yields, ecosystem stability & long-term success of farms. It is vital for promoting plant growth, plant resilience and adaptation to climate change. Healthy soil is rich in essential nutrients, retains water well and has a lively microbial community.
- 3) Compacting, Tilling, (Over-)Fertilization, Monocropping, Livestock Pressure
- 4) Sustainable agricultural practices support (not detract from) natural resources - keeping the as-is state, whereas regenerative agriculture aims to restore natural resources with the focus on soil health. Balances environmental priorities with agricultural output.

Module 2: Soil Testing and Analysis

- 1) It's important to understand the physical and chemical composition of soil. Farmers can make informed decisions based on results. Nutrient balance is essential for optimizing plant growth, ensuring economic efficiency & environmental stewardship.
- 2) pH, nutrients (NPK), mineral content, organic matter, texture, microbial activity
- 3) N: Nitrogen, essential to produce proteins, for photosynthesis & reproduction
P: Phosphorus, vital for photosynthesis & plant growth
K: Potassium, vital for plant metabolism & development
- 4) Microbes play a key role in nutrient cycling & disease suppression, they make nutrients available to plants. Microbes loosen soil which increases air & water pockets within the soil.

Module 3: Building Healthy Soil with Composting

- 1) partly decayed organic matter that feeds plants, feeds soil biology, and improves soil
- 2) improves soil structure, retains water, provides nutrients, as a mulch it keeps soil & roots cool, reduces erosion, buffers pH, supports microbial activity
- 3) brown material: carbon rich, dry, e.g. dry leaves, sticks, straw, wood chips
green material: nitrogen rich, fresh & moist, e.g. lawn clippings, kitchen scraps, coffee grounds, manure
- 4) aerobic composting: 'hot' composting, involves the decomposition of organic material in oxygen rich environment and heat
anaerobic composting: 'cold' composting, involves the decomposition of organic material in low oxygen environments

Module 4: Preventing Mould and Fungal Diseases

- 1) Fungi are a diverse group of eukaryotic organisms., they include yeasts, moulds & mushrooms. Moulds are a specific type of fungus.
- 2) temperature and moisture
- 3) leaf sampling, soil sampling, laboratory tests, regular observation, record keeping, home testing kits
- 4) In-field: crop rotation, resistant varieties, proper spacing (air flow), sanitation (clean tools), water management, mulching, timely harvest
post-harvest: good hygiene, reduced storage time, avoid contamination at processing/packaging, careful handling of produce, monitoring temperature & humidity in storage

Module 5: Nutrient Management & Fertilization

- 1) Nutrient management is the strategic application of nutrients to optimize plant growth and soil health.
- 2) Micronutrients are essential elements that plants need in small quantities for various physiological functions. For example: copper, iron, manganese
- 3) yellowing leaves, irregular or stunted growth
- 4) True or false? Mark the true statements!

-  • Synthetic fertilizers are better for soil health than organic fertilizers.
-  • Synthetic fertilizers release nutrients quickly.
-  • Organic fertilizers are cheaper upfront.
-  • Organic fertilizers enhance soil structure, fertility & microbial activity.

Module 6: Organic Soil Amendments & Alternatives

- 1) Mulch, Compost, Manure, Green Manure, Cover Crop, Organic Fertilizer
- 2) Effects of tilling: strong degradation of soil; top 6-10" turned over, exposed to air; disrupts life of soil organisms; kills earthworms; damages soil structure & mycelium connections; exposes soil > erosion; kills living roots in the soil; reduces water retention capability > drought, floods; nutrient loss, loss of organic matter; chemical fertilizers used to supplement nutrient loss
- 3) ridge-tilling, mulch-tilling, strip-tilling
- 4) Research task to find your own answer

Module 7: Crop Rotation & Plant Pairing

- 1) It's not 100% scientifically proven, why crop rotation increases yields, but influencing factors include: different nutrient demands of plants, interrupting pest & disease life cycle, increased microbial activity.
- 2) crop families, timing & sequence, cover crops
- 3) Companion planting is growing two or more plants next to each other for mutual benefits.
- 4) Examples on slides 13 & 14 of Module 7 include: Marigold, Calendula, Rue, Borage, Lavender

Module 8: Water Management & Irrigation Practices

- 1) Surface water (lakes, rivers..), groundwater, rain water/snow melt, recycled water, desalination
- 2) mulching, cover crops, drought resistant crops, drip irrigation, smart irrigation system
- 3) Examples are:
 - emptying aquifers > irrigation needs outgrow refill/precipitation
 - drainage of fresh water lakes > over-use of water for irrigation
 - run-off contamination from fertilizer > eutrophication of rivers & lakes
 - run-off from nearby livestock > contamination of crops with E.coli
 - non-sanitary equipment in crop processing > listeria contamination
- 4) Research task to find your own answer

Module 9: Integrated Pest Management

- 1) Integrated pest management (IPM) involves evaluating all plant protection methods and integrating measures to prevent harmful organism populations.
- 2)
 - Usage of Agriculture Methods with least negative impacts on environment
 - Monitoring & Identification of harmful organisms , e.g. by observation, forecasting, diagnosis
 - Economic Threshold (ET) for pest action: pest population level at which the cost of managing the pest = crops loss cost
 - Usage of Multiple Control Methods
 - Always biological, physical & non-chemical methods over pesticide usage
 - If Pesticide necessary: reduced dosage, application frequency, partial application > always keep detailed records
- 3) Crop Rotation; Intercropping; Soil Health Management & Adequate Cultivation Techniques; Usage of Resistant/Tolerant Cultivars & Certified Seeds/Plants; Balanced Fertilization, Liming, Irrigation, Drainage; Hygiene Measures to prevent spreading of harmful organisms; Protection & Enhancement of beneficial organisms
- 4) see table next page

	Pros	Cons
organic	+ Biodiversity Enhancement + Environmental Protection + Economical Benefits + Natural Resilience + Health Benefits + Sustainable Practices + Long-Term Solution	labor intensive & time consuming
physical	+ Biodiversity Enhancement + Environmental Protection + Economical Benefits + Natural Resilience + Health Benefits + Sustainable Practices + Long-Term Solution	labor intensive & time consuming
chemical	+ quick fix	-Biodiversity Loss: contaminating soil, water & non-target organisms -Toxicity to Humans: health risks to farmworkers, consumers, community -Pest Resistance: increased dosages, increased environmental risks -Disruption of Ecological Balance: unintentionally effecting beneficial insects & animal higher up in the food chain, soil degradation & effects on microbial communities -Short-Term Solution -Pest Resurgence: populations may rebound if underlying issues not addressed -Liability Issues: harm caused by chemicals can lead to legal consequences

Module 10: Soil Conservation & Sustainable Practices

1) Individual Answers

2) Individual Answers and Documentation