

OPTIMIZING SOIL & PLANT HEALTH IN AGRI-FOOD PRODUCTION

Regenerative Agriculture - its
benefits and innovations

Module 5



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MODULES

- 1 ➡ INTRODUCTION TO SOIL HEALTH
- 2 ➡ SOIL TESTING & ANALYSIS
- 3 ➡ BUILDING HEALTHY SOIL WITH COMPOSTING
- 4 ➡ PREVENTING MOLD & FUNGAL DISEASES
- 5 ➡ NUTRIENT MANAGEMENT & FERTILIZATION
- 6 ➡ ORGANIC SOIL AMENDMENTS & ALTERNATIVES
- 7 ➡ CROP ROTATION & PLANT PAIRING
- 8 ➡ WATER MANAGEMENT & IRRIGATION PRACTICES
- 9 ➡ INTEGRATED PEST MANAGEMENT (IPM)
- 10 ➡ SOIL CONSERVATION & SUSTAINABLE PRACTICES



MODULE 5: NUTRIENT MANAGEMENT & FERTILIZATION

- Definition
- Key Nutrients
- Micronutrients
- Nutrient Deficiency
- Fertilization Strategies
- Best Practices





1) NUTRIENT MANAGEMENT

“The strategic application of nutrients to optimize plant growth and soil health.”

SOIL HEALTH

Healthy soils are enriched with essential nutrients; ecosystem balance - microbial diversity

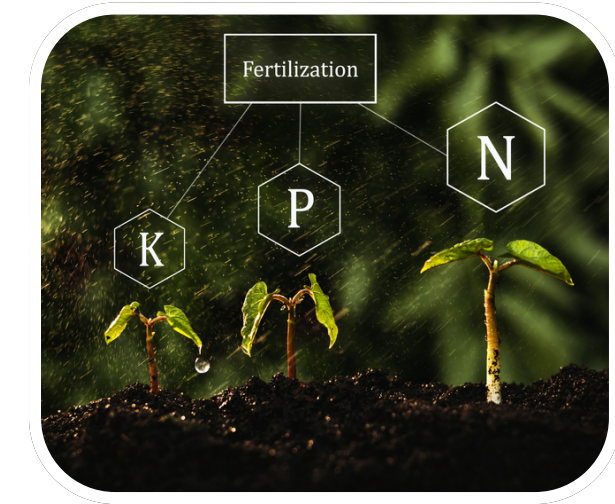
PLANT HEALTH

resistance to pests & diseases, vital for protein synthesis & chlorophyll formation

CROP YIELDS

ability to produce fruits, seeds & biomass

2) IMPORTANCE OF KEY NUTRIENTS

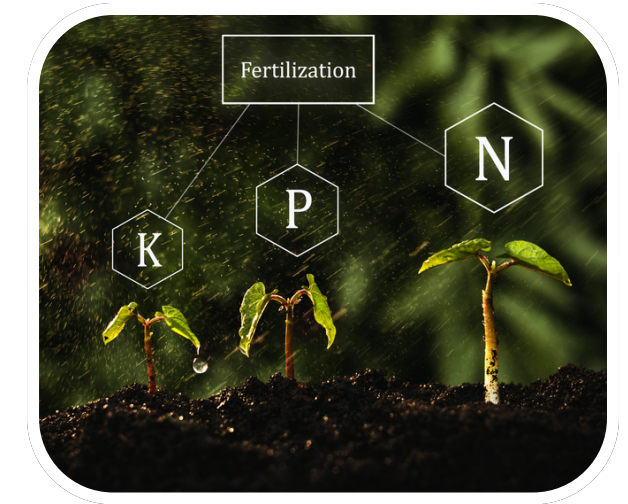


Nitrogen (N)

- Component of Amino acids > components of proteins
- Synthesis of Nucleic acids > component of nucleotides (make up DNA/RNA)
- Chlorophyll Production > green pigment essential for photosynthesis
- Growth & Development > cell division & expansion > new growth
- Enhance Crop Yield > N often limiting factor to growth
- Regulation of Metabolic Processes > regulates responses to environmental stresses
- Symbiotic Relationships > Legumes form symbiotic relationships with nitrogen-fixing bacteria, this bacteria converts atmospheric nitrogen into forms the plants can use



2) IMPORTANCE OF KEY NUTRIENTS

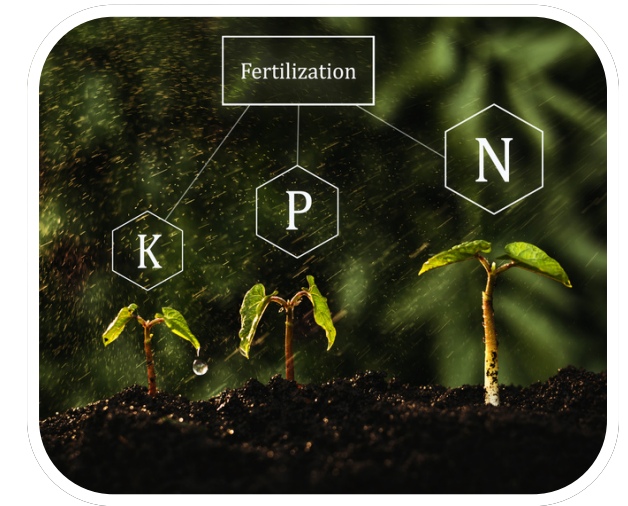


Phosphorus (P)

- vital component of ATP (energy currency of cells) > P important for energy transfer
- essential for photosynthesis (ATP)
- root development > extends root system > better water/nutrient uptake
- flowering & fruit development > reproductive process (pollination & seed formation)
- key component in DNA/RNA
- cell division & growth
- withstanding stress situations like drought
- contributes to nutrient uptake of N & K



2) IMPORTANCE OF KEY NUTRIENTS



Potassium (K - Kalium)

- water regulation > opening & closing of stomata
- nutrient transport > transportation sugar within the plant
- enzyme activation > crucial for metabolic processes (photosynthesis, respiration)
- key role in starch & protein synthesis
- fruit quality > influences e.g. size, color, taste
- disease resistance & stress tolerance
- root development > promotes root growth



3) IMPORTANCE OF MICRONUTRIENTS

Micronutrients are essential elements that plants need in small quantities for various physiological functions.



Chlorine (Cl)

- photosynthesis

Iron (Fe)

- chlorophyll synthesis, photosynthesis, rich green color

Copper (Cu)

- chlorophyll production, seed production/formation



Zink (Zn)

- growth & reproduction

Molybdenum (Mo)

- nitrogen utilization

Boron (B)

- metabolism & cell division

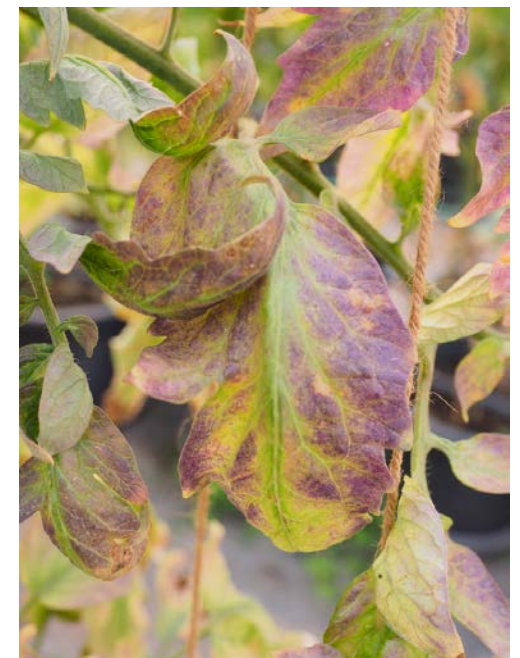
Manganese (Mn)

- enzyme formation in cells, CO₂ assimilation

4) IDENTIFYING NUTRIENT DEFICIENCIES

Many deficiencies show similar symptoms in the plant.

- *yellowing leaves*
- *irregular or stunted growth*
- *plant can suffer from several deficiencies at the same the time*
- *environmental factors that can have an impact too:
temperature fluctuation, irregular watering, compacted soil,
pest infestation*
- *soil testing to identify the specific deficiency (every 2-3 years)*



5) FERTILIZATION STRATEGIES



Types of Fertilizers



chemically manufactured products
specifically designed to supply
essential nutrients (NPK) to plants

natural substances derived from plant,
animal or mineral sources; used to
enrich soils & provide nutrients to plants



high concentration on NPK	Nutrient Composition	varied composition, often lower concentration, includes micronutrients & organic matter
quick-release, imidiate nutrient availability	Nutrient Release	slow release through decomposition of organic matter
potential soil degradation & nutrient imbalances	Soil Health	enhances soil structure, fertility & microbial activity
potential water pollution & soil acidification	Environmental Impact	environmentally friendly, promotes biodiversity
often frequent, rapid depletion	Application Frequency	less frequent, overtime build-up of organic matter
lower upfront	Cost	higher cost upfront, long-term benefits to soil health
can create dependency on chemical input	Dependency	sustainable & regenerative, long-term soil health

QUICK RELEASE

- quick plant feed
- often includes ammonium nitrate urea
- synthetic or organic fertilizers
- ideal for immediate nutrient needs (quick greening)
- effects on the plant: quick bursts of growth, high risk of nutrient burn, frequent application to keep nutrient level
- nutrient leaching (environmental concern)
- typically liquids
- foliar spray



SLOW RELEASE

- gradual release of nutrients
- often inchoated or encapsulated nutrients
- synthetic or organic fertilizer
- long-term feeding
- less frequent application
- effects on plants: sustain growth, lower risk of burn,
- less nutrient leaching
- less need for application
- dry fertilizer/pellets



'THE 4R'S OF NUTRIENT MANAGEMENT'



Right Amount

- following package instructions
- use right amount necessary

Right Placement

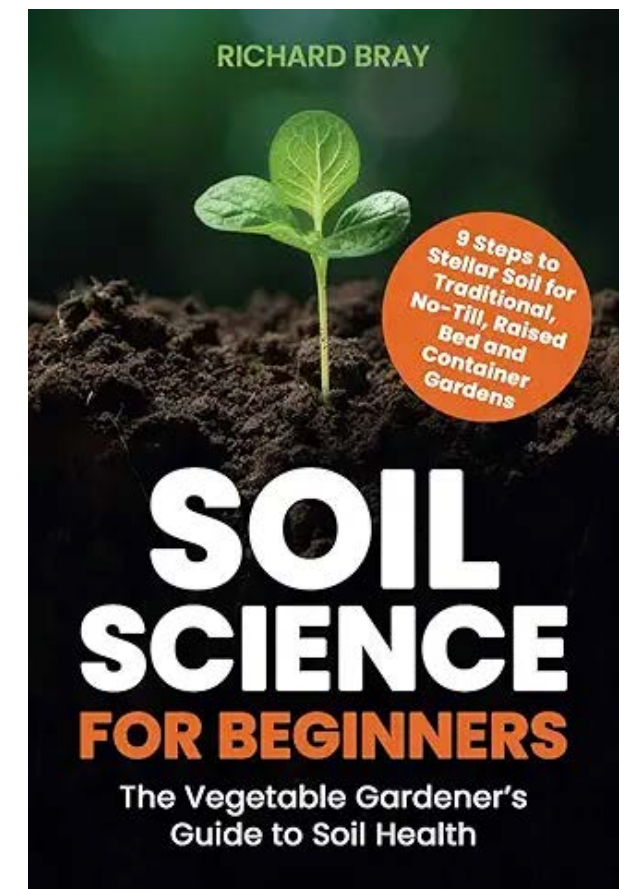
- application for best availability to plants
- e.g. dry fertilizer on or into soil, foliar spray on leaves

Right Source

- chose fertilizer type that benefits your garden/field most

Right Timing

- take plant life cycle into account
- weather/ environmental factors



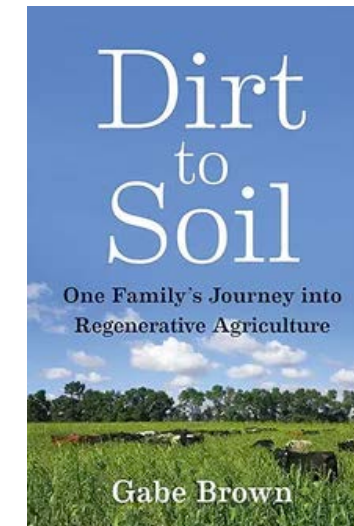
6. BEST PRACTICES

6.1 REGENERATIVE AGRICULTURE

The 5 Principals of Soil Health

- Limit Disturbance 'no-till' > improve soil structure, protects beneficial microorganisms, weed suppression, stress reduction, nutrient availability
- Armor the Soil Surface > Keep soil covered with plant residues
- Build Diversity > Crop Rotation, Cover crops, Soil organisms
- Keep Living Roots in the Soil > Cover crops, C-transfer into soil, soil structure improvement, erosion control, disease suppression
- Integrate animals > Attract predatory birds/animals help pest control, apply organic fertilizer, weed management

>wild meadows/forests as the model



6.2 INTEGRATED NUTRIENT MANAGEMENT

- holistic approach
- includes organic & synthetic fertilizers
- soil amendments & other nutrient sources
- enhances soil fertility & health
- sustainable practice



7. CONCLUSION

*Nutrient Management is essential to promote
soil & plant health.*

Environmental balance is key.



IMPROVED
SOIL FERTILITY



ENHANCED
YIELD
STABILITY

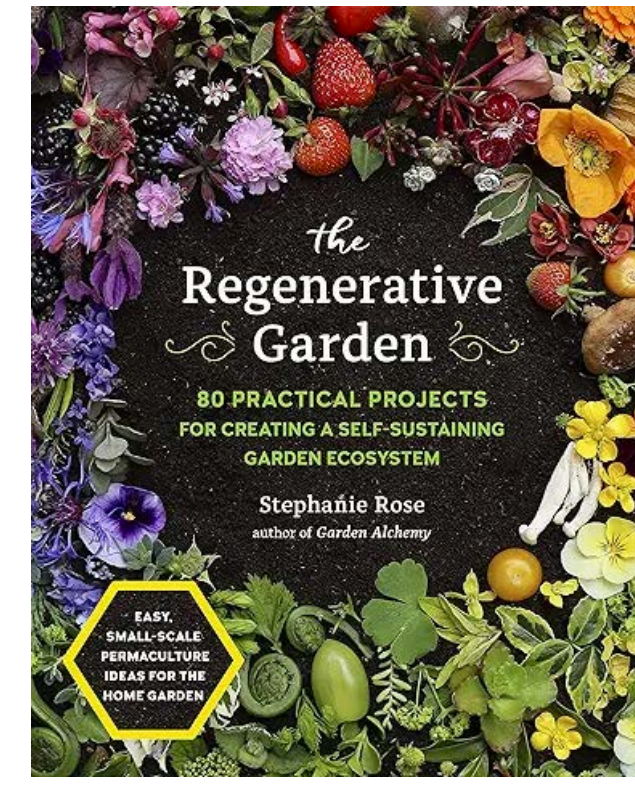
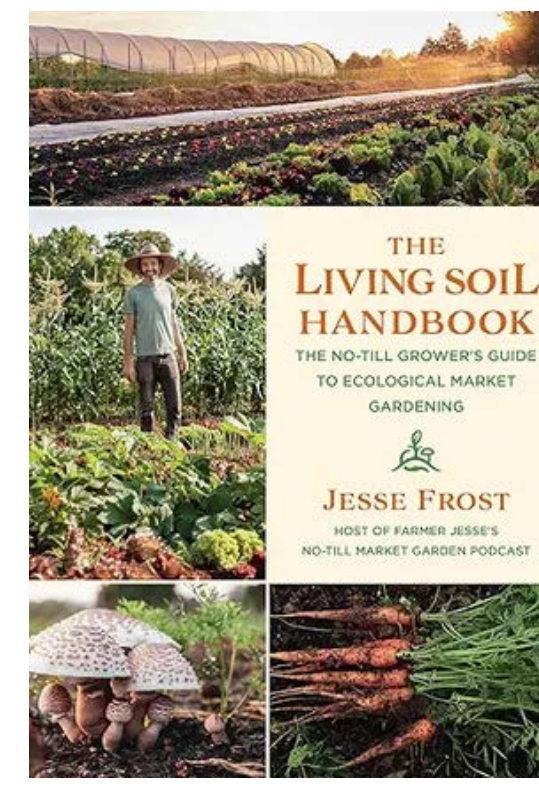
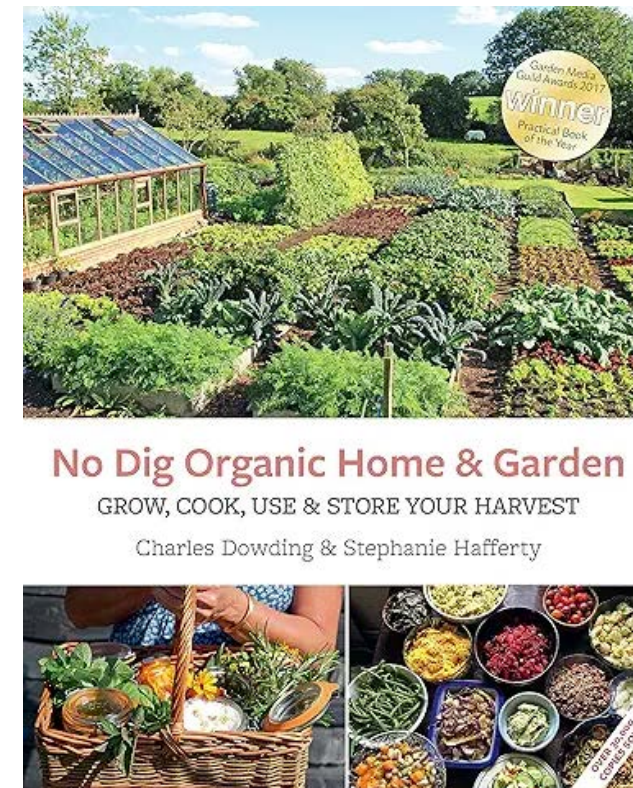
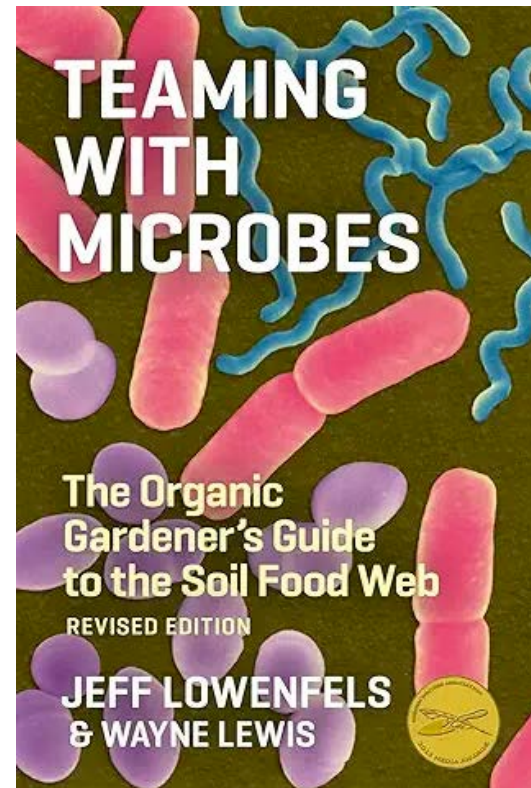
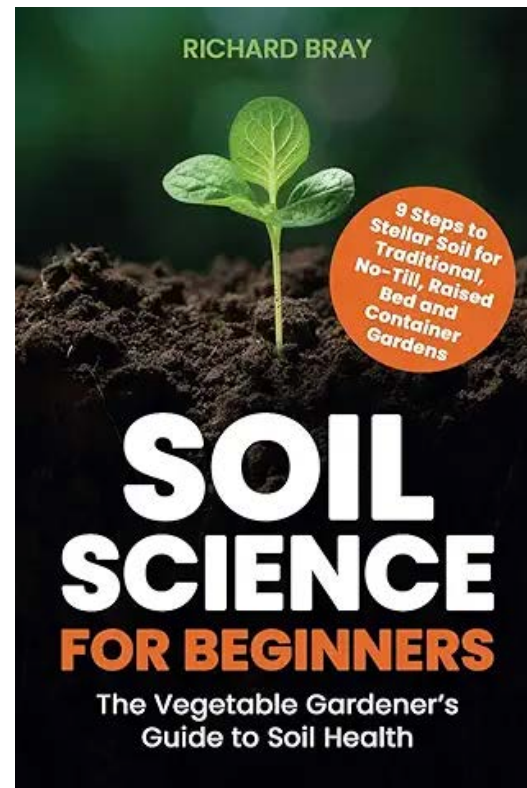
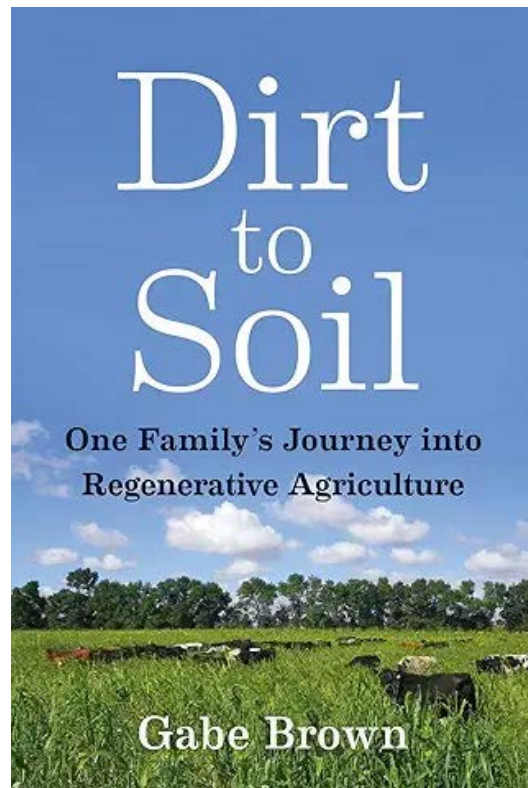


PEST AND
DISEASE
CONTROL



INCREASED
BIODIVERSITY

RESOURCES



Nutrient Management Plan Template (Penn State University)

<https://extension.psu.edu/programs/nutrient-management/tools/plan>

Nutrient Management & Planning Tool (Livestock & Poultry Environ. Learning Community, YouTube video)

www.youtube.com/watch?v=MA6lZ5t6MjU

Center for Sustaining Agriculture and Natural Resources, Washington State University

csanr.wsu.edu/how-does-regenerative-agriculture-reduce-nutrient-inputs/

Regenerative Farmers of America

www.regenerativefarmersofamerica.com

THANK
YOU

