

# OPTIMIZING SOIL & PLANT HEALTH IN AGRI-FOOD PRODUCTION

Regenerative Agriculture - its  
benefits and innovations

Module 7



PRESENTATION BY :  
Eric & Ines Batterton  
Owner & Founder of My Nordic Garden



# 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 7:

# CROP ROTATION & PLANT PAIRING

- Crop Rotation & its Benefits
- Principles of Effective Crop Rotation
- Examples
- Companion Planting
- Deterrent Plants
- Attracting Plants



“While I am describing to you HOW NATURE works, you won’t understand WHY nature works that way. But you see, NOBODY understands that.”

Richard P. Feynman





# 1) CROP ROTATION

practice of growing different crops in a sequential manner on the same land to improve soil health

improved yields 10-25%

(Pavlis R., Soil Science for Gardeners)

scientifically not 100% clear why it works, factors include:



## DIFFERENT NUTRIENT DEMANDS

different plants require different amounts of nutrients; planting different kinds of crops in concession balances soil nutrients

## DIFFERENT PESTS & DISEASES

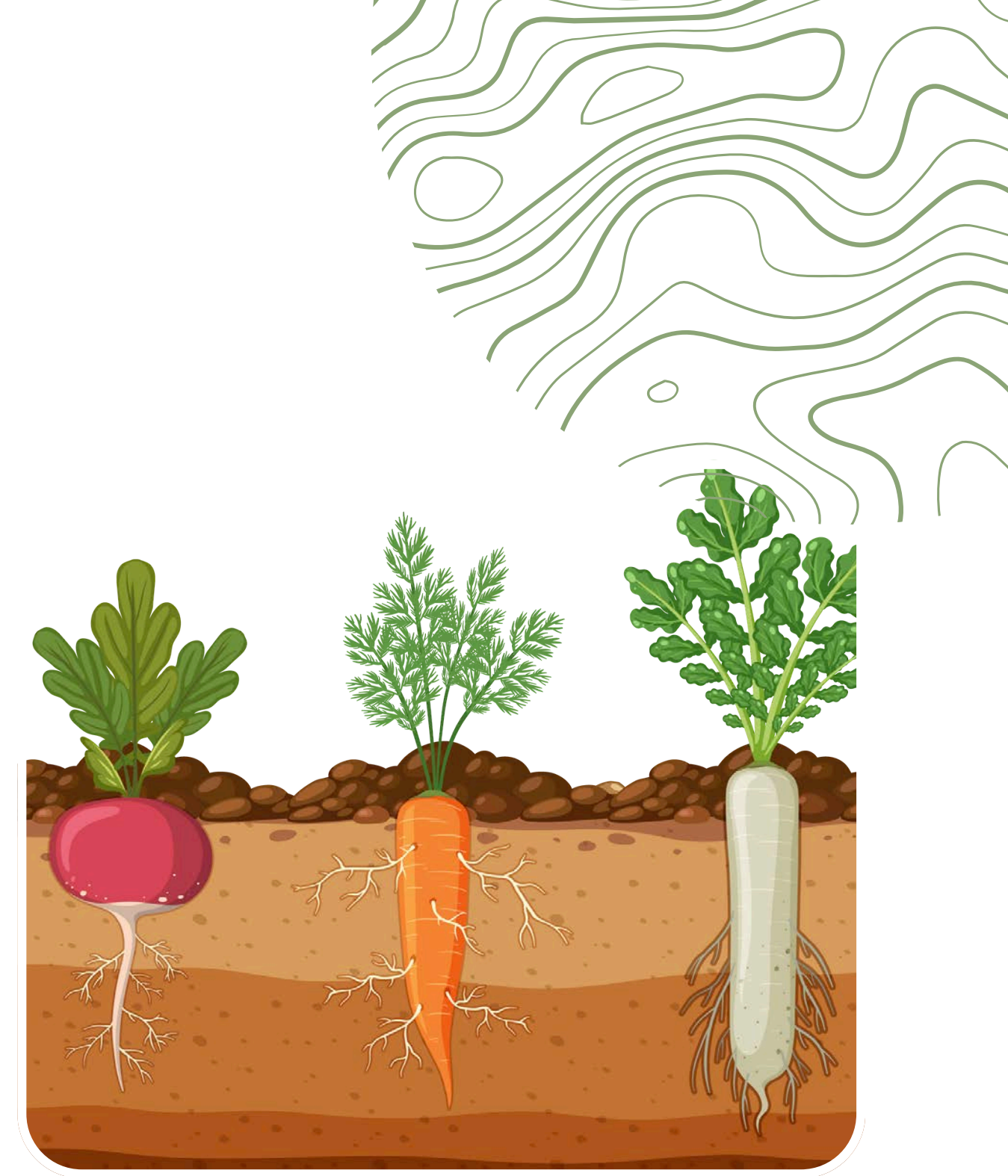
interrupting pest & pathogen life cycles;  
removing host plants

## MICROBIAL DIVERSITY

N-fixing bacteria on legume roots;  
mycorrhizal fungal network shares N with neighboring plants

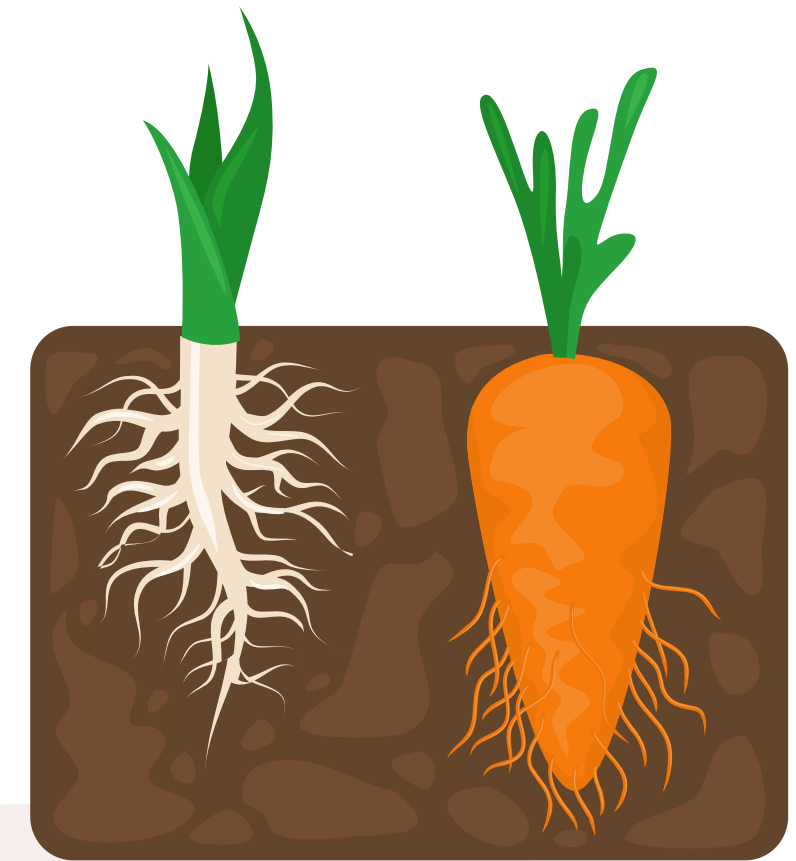
# OTHER BENEFITS OF CROP ROTATION

- **Weed management:** suppression on specific weeds
- **Soil structure improvement:** different root structures from different crops > improve aeration & water retention, different root compaction
- **Economic benefits:** diversified crops > reduced financial risk with crop failure
- **Sustainability:** support soil health, promoting ecological balance, less fertilizer/herbicide/pesticides needed

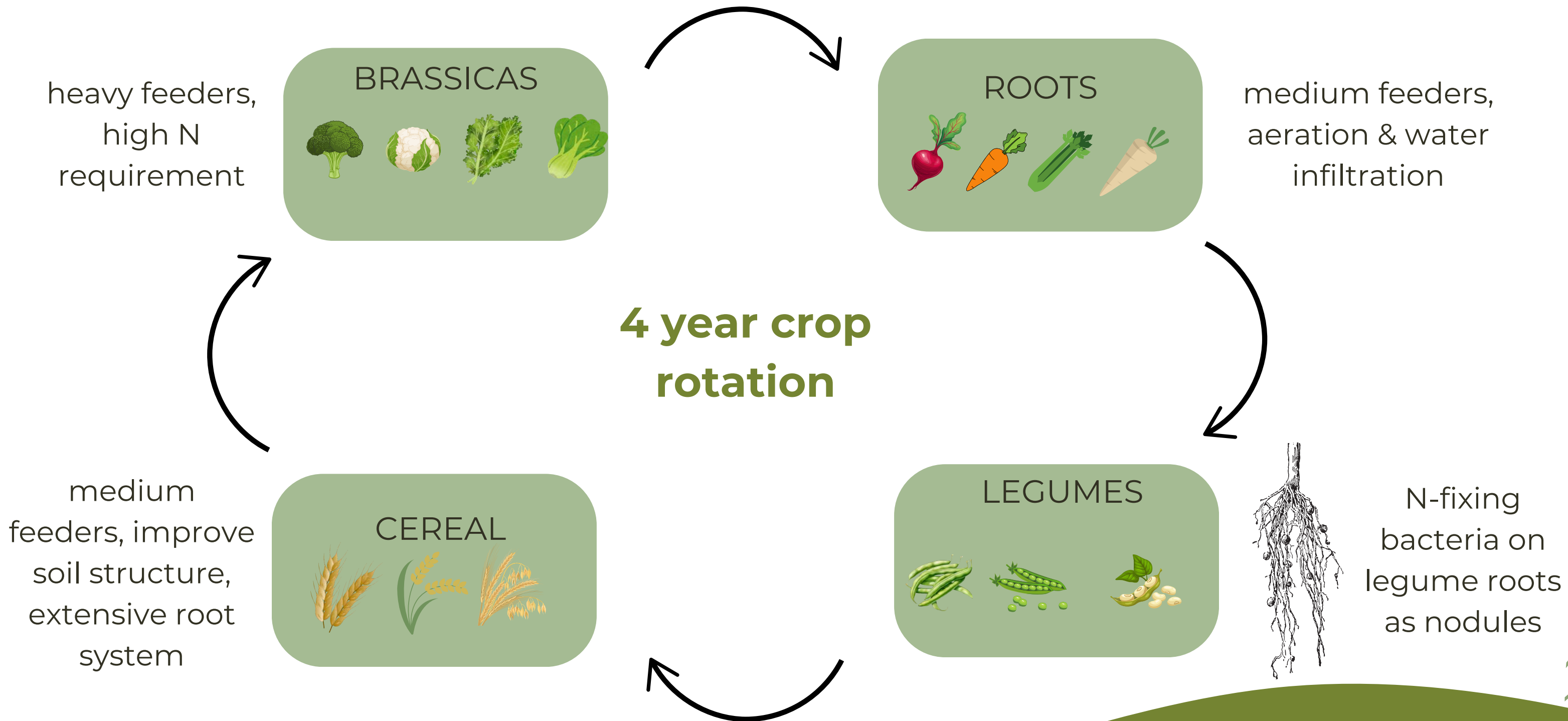


## 2) PRINCIPLES OF EFFECTIVE CROP ROTATION

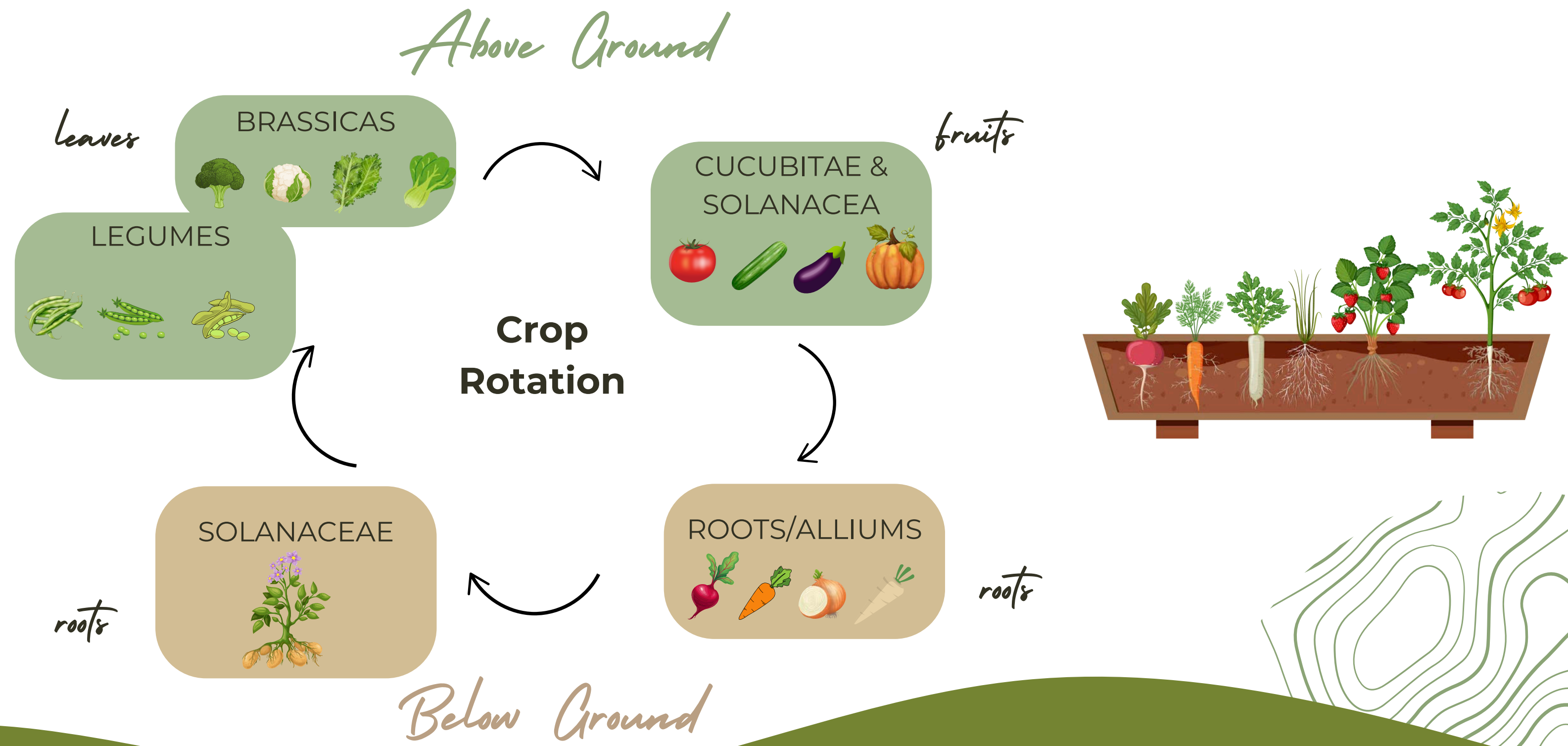
- **Crop families:** plants grouped in families with different characteristics & nutrient needs > avoid nutrient depletion & disease build - up
- **Timing & Sequence:** based on nutrient needs & local climatic conditions
- **Cover Crops:** armoring soil (cover), re-feeding soil




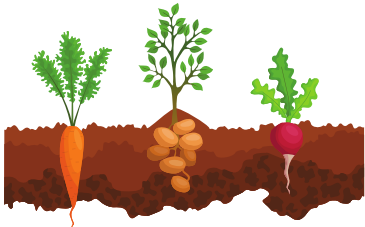








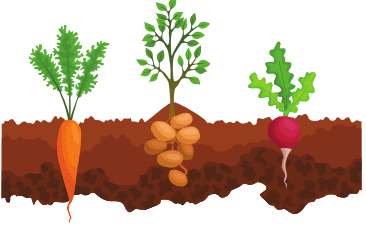









# EXAMPLE 1: PLANT FAMILIES -FARM



# EXAMPLE 2: PLANT FAMILIES - GARDEN



# EXAMPLES 3: TIMING & SEQUENCE - FARM

YEAR	Legume - Cereal	Root Veg. - Cereal - Legume	Cereal - Diverse crops	Cover Crop Integration
1	 legume, e.g. beans	 root veg	 cereal, e.g. corn	 cash crop, e.g. wheat  cover crop e.g. rye
2	 cereal, e.g. wheat/ corn	 cereal, e.g. barley	 broad leaf crop, e.g. sunflower, canola	 cash crop, e.g. wheat  cover crop e.g. vetch
3	 root veg	 legume, e.g. chickpeas	 legume, e.g. beans	 cash crop, e.g. wheat  cover crop e.g. rye
4	 cover crop e.g. vetch	 vegetables, e.g. brassicas	 cover crop e.g. vetch	 cash crop, e.g. wheat  cover crop e.g. vetch

# 3) COMPANION PLANTING

*Growing two or more plants next to each other for mutual benefits*

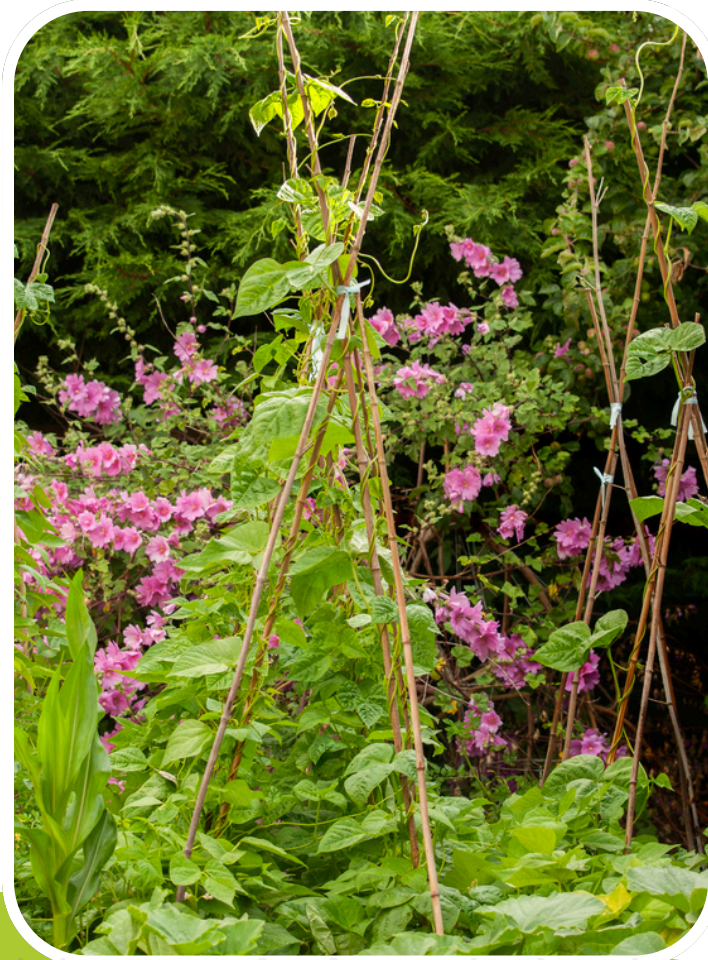
- **Choosing the right varieties of companions is crucial**
- **Nutrient Sharing:** N from legumes to neighboring plant
- **Growth Support:** tall plants support vining plants
- **Deter Pests:** natural pest repellent properties
- **Disruption of pest life cycles:** strong smelling plants can confuse pests, disrupt life cycle, pest can't find all their preferred host plants
- **Attract Beneficial Insects:** predatory insect habitat, pollinators
- **Optimizing Space:** vertical gardening, succession planting



# EXAMPLES OF EFFECTIVE PLANT PAIRING

## THREE SISTERS

corn as support for beans, beans fix N for neighboring plants, squash suppresses weeds



## TOMATOES & BASIL

basil enhances flavor of tomatoes, basil repels aphids, different root systems feed on different soil levels



## CARROTS & ONIONS

onions deter carrot flies, carrots & onions don't compete heavily for nutrients



# 4) DETERRENT PLANTS

MARIGOLD repels nematodes, aphids, white flies

CALENDULA deters aphids, nematodes, beetles

PEPPERMINT deters ants, cabbage moths

BASIL deters aphids, spider mites, flies

RUE repels Japanese beetles, aphids

LEMON BALM deters mosquitos, flies

BORAGE deters tomato hornworm

LAVENDER deters moths, fleas, mosquitos

FENNEL deters aphids, caterpillars



# 5) ATTRACTING PLANTS

MARIGOLD attracts predatory insects

CALENDULA attracts ladybugs, lacewings, pollinators

NASTURTIUMS attracts aphids (trap crop) > ladybugs

DILL attracts lace wings & parasitic wasps > hunt pests like aphids, caterpillars

SWEET ALYSSUM attracts hoverflies > feed on aphids

COSMOS & ZINNIAS attracts pollinators, predatory insects

YARROW attracts predatory insects, pollinators

BUCKWHEAT attracts predatory insects, pollinators (+cover crop)



# 6) CONCLUSION



CHART BY ANNABELL LANGBEIN, A FREE RANGE LIFE, [WWW.LANGBEIN.COM](http://WWW.LANGBEIN.COM)

## PLANNING & RESEARCH

plan crop rotation and plant pairing for your needs; research solutions that fit your needs

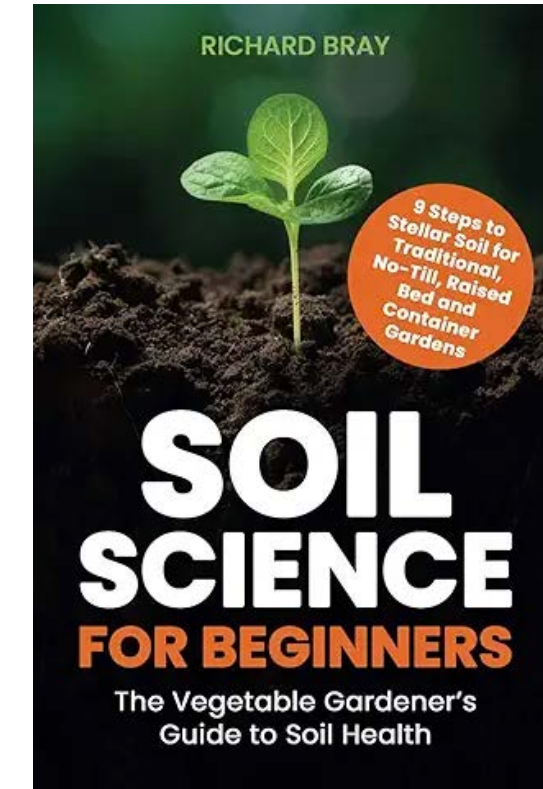
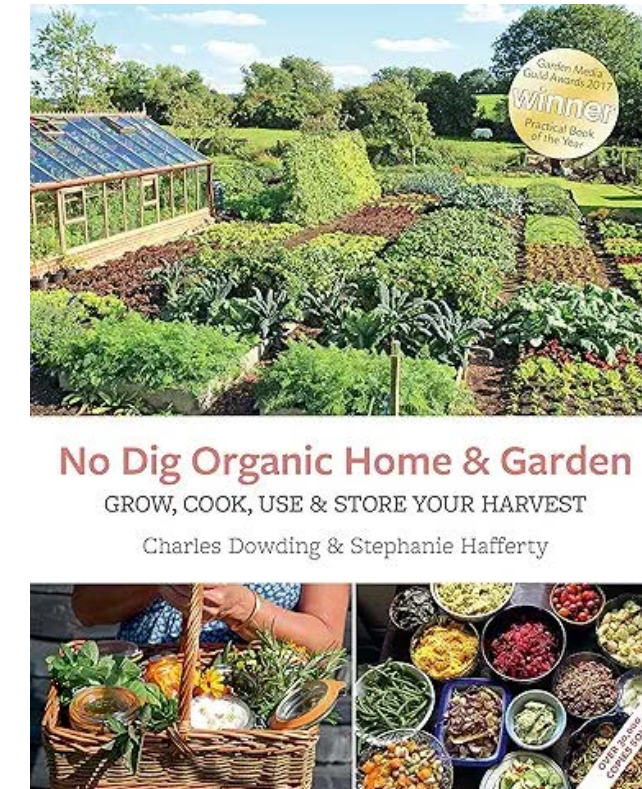
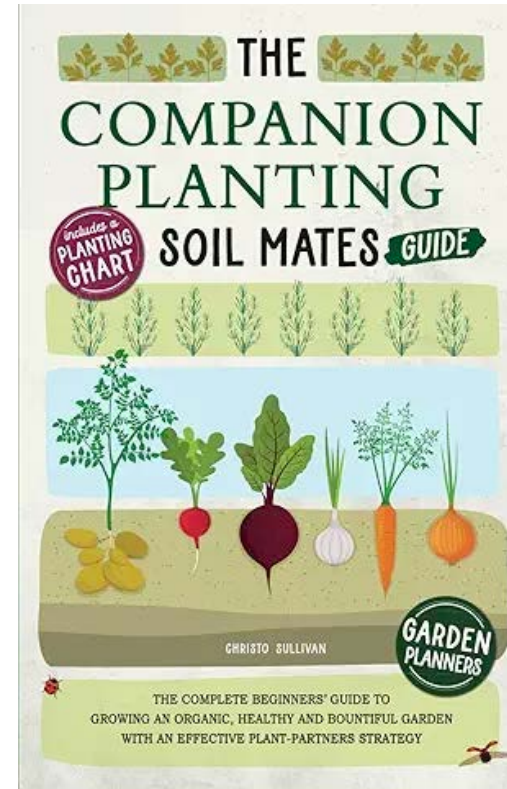
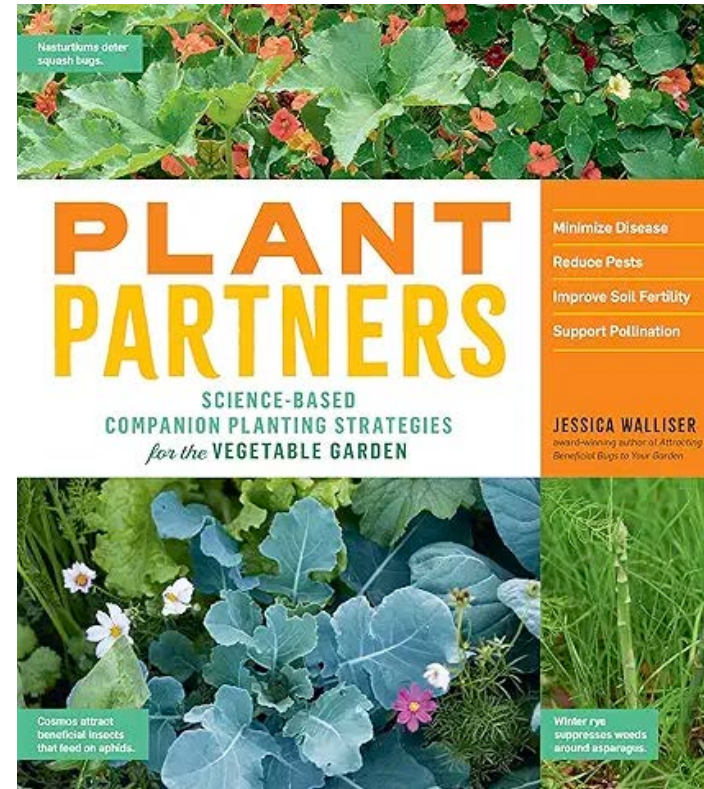
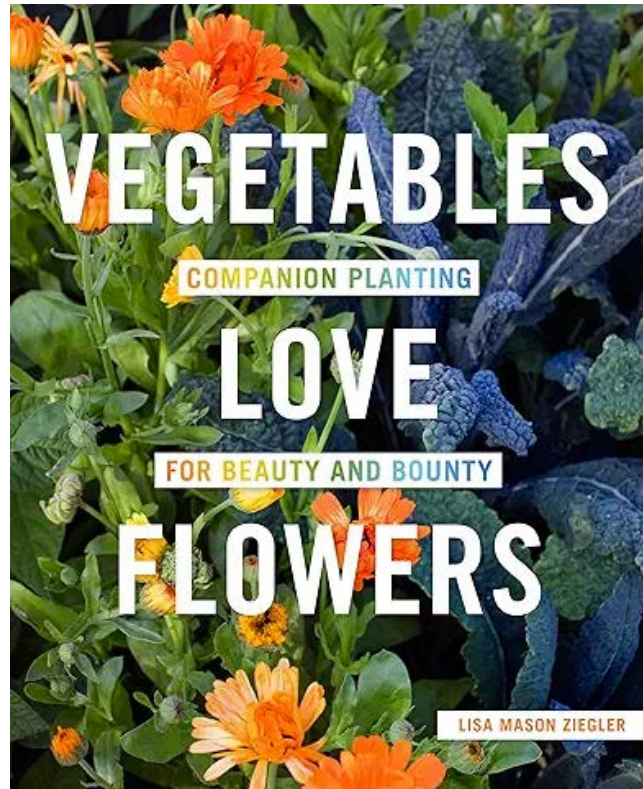
## RECORD KEEPING

document what worked for you; review regularly to understand changes, successes, failure and to plan accordingly

## TRUST & GIVE NATURE TIME

your patience is worth the outcome; it takes time to rebuild soil and create a naturally balanced garden/field

# RESOURCES



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THANK  
YOU

