



Growing Nut Trees — An Ecological Approach

Carl Albers

cwalbers@yahoo.com

Photosynthesis - Foundation of a Productive Orchard

- Harvesting sunlight is job one
- Enhancing CO₂ and atmospheric nitrogen capture follows
- Increasing water infiltration and use of key importance
- All fueled by the interplay between plant canopies, plant roots and a healthy soil biology





[Home](#) [About Soils](#) [Help](#) [Contact Us](#)

You are here: Web Soil Survey Home

Search

All NRCS Sites

Browse by Subject

- [Soils Home](#)
- [National Cooperative Soil Survey \(NCSS\)](#)
- [Archived Soil Surveys](#)
- [Status Maps](#)
- [Official Soil Series Descriptions \(OSD\)](#)
- [Series Extent Explorer](#)
- [Geospatial Data Gateway](#)
- [eFOTG](#)
- [National Soil Characterization Data](#)
- [Soil Health](#)
- [Soil Geography](#)

The simple yet powerful way to access and use soil data.

**START
WSS**

Welcome to Web Soil Survey (WSS)



Web Soil Survey (WSS) provides soil data and information produced by the National Cooperative Soil Survey. It is operated by the USDA Natural Resources Conservation Service (NRCS) and provides access to the largest natural resource information system in the world. NRCS has soil maps and data available online for more than 95 percent of the nation's counties and anticipates having 100 percent in the near future. The site is updated and maintained online as the single authoritative source of soil survey information.

Soil surveys can be used for general farm, local, and wider area planning. Onsite investigation is needed in some cases, such as soil quality assessments and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center at the following link: [USDA Service Center](#) or your NRCS State Soil Scientist at the following link: [NRCS State Soil Scientist](#).

Four Basic Steps

I Want To...

- [Start Web Soil Survey \(WSS\)](#)
- [Know Web Soil Survey Requirements](#)
- [Know Web Soil Survey operation hours](#)
- [Find what areas of the U.S. have soil data](#)
- [Find information by topic](#)
- [Know how to hyperlink from other documents to Web Soil Survey](#)
- [Know the SSURGO data structure](#)
- [Use Web Soil Survey on a mobile device](#)

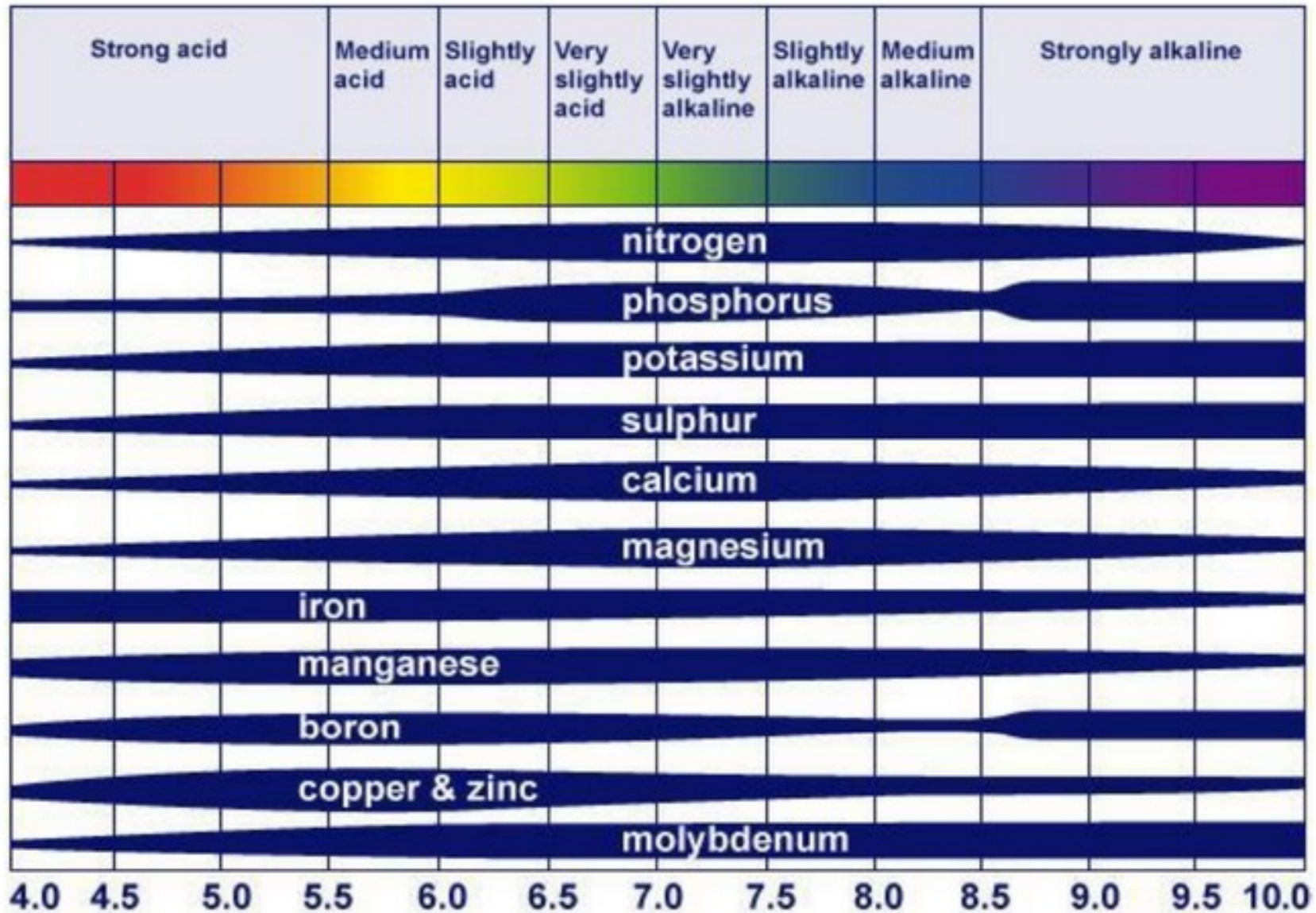
Announcements/Events

- [Web Soil Survey 3.4.0 has been released! View Web Soil Survey release history](#)
- [Sign up for e-mail](#)



Free to Farmers
Sunlight
Water
Nitrogen
CO2

Earth's atmosphere
78% Nitrogen
0.035% CO2



(Source: Roques et al., 2013)





Soil and Plant Nutrient Testing Laboratory
203 Paige Laboratory
161 Holdsworth Way
University of Massachusetts
Amherst, MA 01003
Phone: (413) 545-2311
e-mail: soiltest@umass.edu
website: soiltest.umass.edu

Soil Test Report

Prepared For:

Carl Albers
6305 Nash Rd
Bath, NY 14810

cwalbers@yahoo.com
607-346-5226

Sample Information:

Sample ID: Harp Nut Trees

Order Number: 48532
Lab Number: S191223-106
Area Sampled: 43560 sq ft
Received: 12/23/2019
Reported: 1/3/2020

Results

Analysis	Value Found	Optimum Range	Analysis	Value Found	Optimum Range
Soil pH (1:1, H ₂ O)	5.2		Cation Exch. Capacity, meq/100g	15.8	
Modified Morgan extractable, ppm			Exch. Acidity, meq/100g	11.0	
Macronutrients			Base Saturation, %		
Phosphorus (P)	1.9	4-14	Calcium Base Saturation	23	50-80
Potassium (K)	120	100-160	Magnesium Base Saturation	5	10-30
Calcium (Ca)	734	1000-1500	Potassium Base Saturation	2	2.0-7.0
Magnesium (Mg)	103	50-120	Scoop Density, g/cc	0.89	
Sulfur (S)	16.2	>10			
Micronutrients *					
Boron (B)	0.0	0.1-0.5			
Manganese (Mn)	36.4	1.1-6.3			
Zinc (Zn)	1.9	1.0-7.6			
Copper (Cu)	0.2	0.3-0.6			
Iron (Fe)	17.9	2.7-9.4			
Aluminum (Al)	141	<75			
Lead (Pb)	1.1	<22			

* Micronutrient deficiencies rarely occur in New England soils; therefore, an Optimum Range has never been defined. Values provided represent the normal range found in soils and are for reference only.

Soil Test Interpretation

Nutrient	Very Low	Low	Optimum	Above Optimum
Phosphorus (P):	██████████			
Potassium (K):	██████████	██████████		
Calcium (Ca):	██████████	██████████		
Magnesium (Mg):	██████████	██████████	██████████	



Soil and Plant Nutrient Testing Laboratory
203 Paige Laboratory
161 Holdsworth Way
University of Massachusetts
Amherst, MA 01003
Phone: (413) 545-2311
e-mail: soiltest@umass.edu
website: soiltest.umass.edu

Soil Test Report

Prepared For:

Carl Albers
6305 Nash Rd
Bath, NY 14810

cwalbers@yahoo.com
607-346-5226

Sample Information:

Sample ID: Harp Orchard

Order Number: 63840
Lab Number: S230119-210
Area Sampled: 2 sq ft
Received: 1/19/2023
Reported: 1/31/2023

Results

Analysis	Value Found	Optimum Range	Analysis	Value Found	Optimum Range
Soil pH (1:1, H ₂ O)	5.6		Cation Exch. Capacity, meq/100g	13.7	
Modified Morgan extractable, ppm			Exch. Acidity, meq/100g	8.3	
Macronutrients			Base Saturation, %		
Phosphorus (P)	2.5	4-14	Calcium Base Saturation	30	50-80
Potassium (K)	110	100-160	Magnesium Base Saturation	7	10-30
Calcium (Ca)	830	1000-1500	Potassium Base Saturation	2	2.0-7.0
Magnesium (Mg)	118	50-120	Scoop Density, g/cc	0.86	
Sulfur (S)	14.6	>10	Optional tests		
Micronutrients *			Soil Organic Matter (LOI), %	5.9	
Boron (B)	0.1	0.1-0.5			
Manganese (Mn)	16.6	1.1-6.3			
Zinc (Zn)	1.3	1.0-7.6			
Copper (Cu)	0.1	0.3-0.6			
Iron (Fe)	15.4	2.7-9.4			
Aluminum (Al)	108	<75			
Lead (Pb)	0.9	<22			

* Micronutrient deficiencies rarely occur in New England soils; therefore, an Optimum Range has never been defined. Values provided represent the normal range found in soils and are for reference only.

Soil Test Interpretation

Nutrient	Very Low	Low	Optimum	Above Optimum
Phosphorus (P):	██████████			
Potassium (K):	██████████	██████████		
Calcium (Ca):	██████████	██████████		
Magnesium (Mg):	██████████	██████████	██████████	

Nutrient availability best at a
soil pH of 6.5

Limestone used to raise soil pH is either
calcitic (high calcium content) or dolomitic
(high magnesium content)

Which to use is based on soil test levels of
calcium and magnesium

For surface applications don't exceed 3 tons
per acre at one time regardless of lime
requirement

The higher the Effective Neutralizing Value
(ENV) of any given limestone the faster it will
begin to neutralize soil acidity

Monitor desired changes in soil pH by
retesting at least once every 3 years

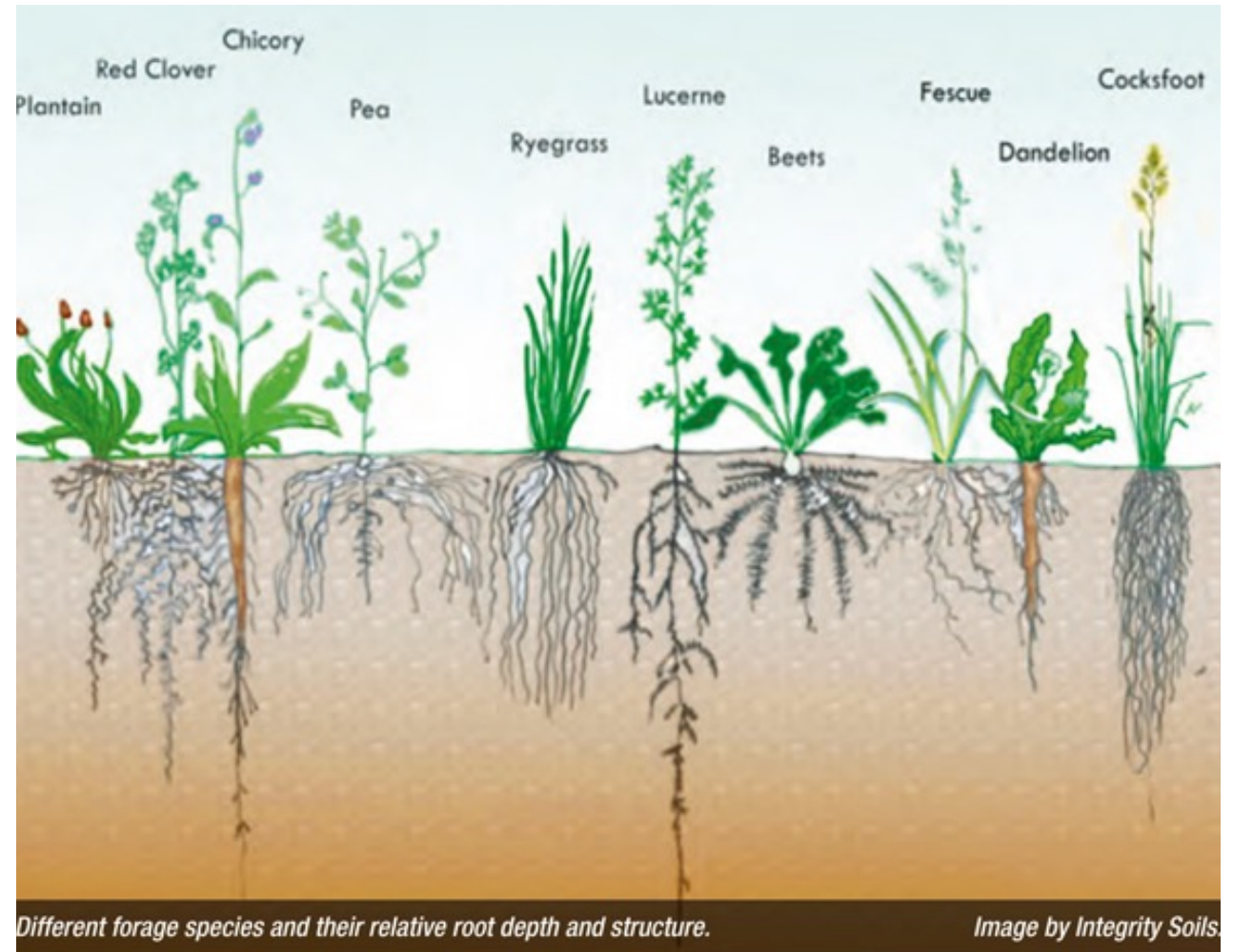
PULVERIZED CALCITIC LIMESTONE	
Minimum Guaranteed Chemical Analysis	
Calcium (Ca)	37.2%
Magnesium (Mg)	1.1%
Calcium Oxide (CaO)	52.1%
Magnesium Oxide (MgO)	1.9%
Calcium Carbonate (CaCO ₃)	93.0%
Magnesium Carbonate (MgCO ₃)	4.0%
Maximum Moisture Content	1.0%
Calcium Carbonate Equivalent (CCE)	97.7%
Effective Neutralizing Power (ENP)	1,861 lbs. per ton
Effective Neutralizing Value (ENV)	89.1%
Total Neutralizing Power (TNP)	97.8%
Relative Neutralizing Value (RNV)	95.9%
Effective Calcium Carbonate Equivalent (ECCE)	91.8%
Fineness Factor	95.2%
Index Zone	90-99
<i>Derived from Calcitic Limestone.</i>	

Even
Application of
Limestone is a
Challenge



Biological Soil Builders

- Plant diversity = variety of root architecture and better soil exploration
- Differences in the plant canopy (height and leaf architecture) = increased capture of sunlight, enhancing overall photosynthesis and the feeding of soil microbiology
- Allow to grow tall during the growing season but mow close in preparation for harvest

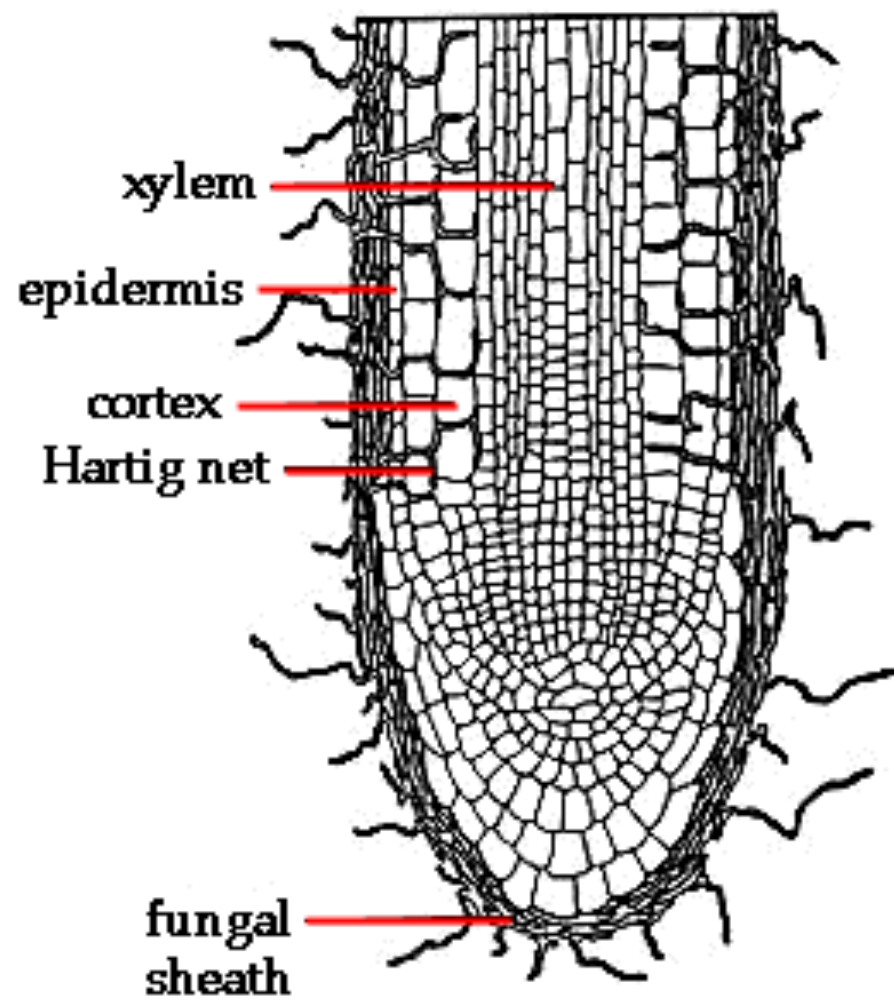


Chicory

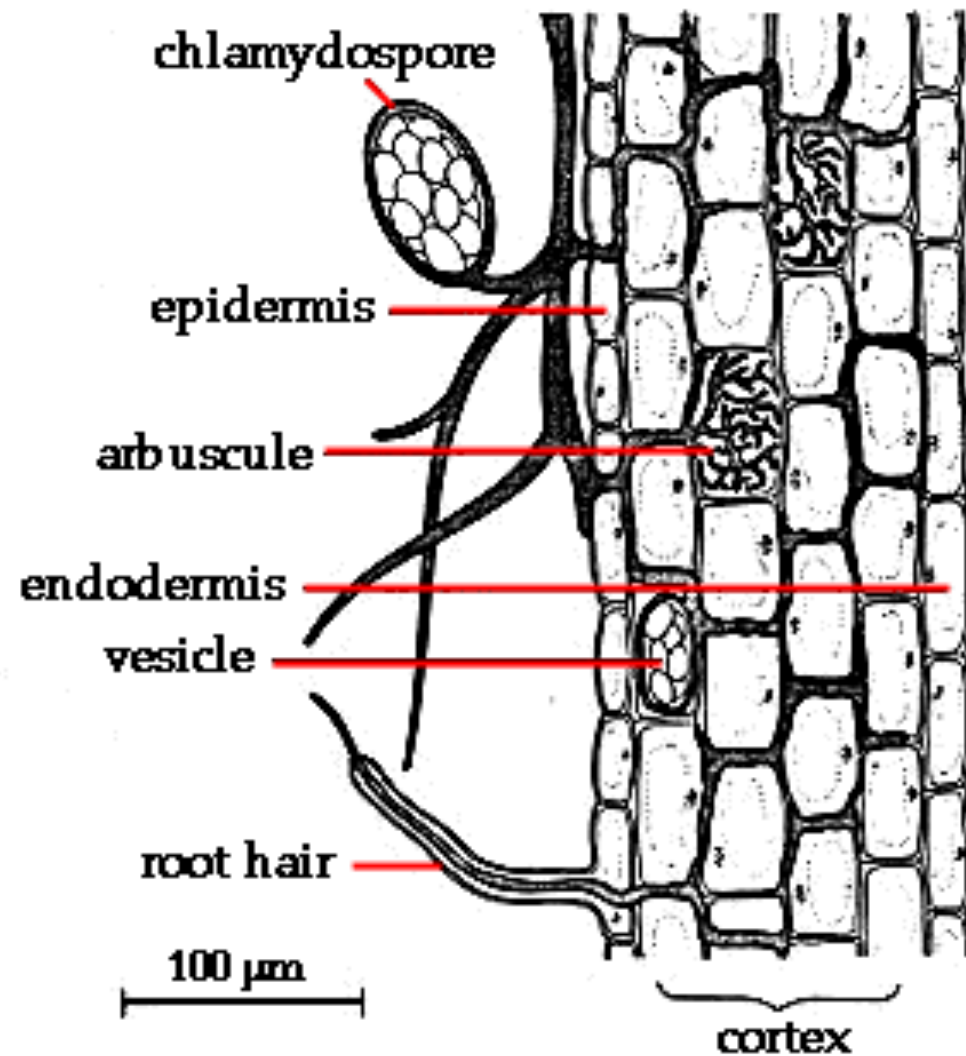
(*Cichorium intybus*)
Asteraceae family



Ectomycorrhizae



Endomycorrhizae



Mycorrhizal Fungi by Nut Tree Species

- Endomycorrhizae (Arbuscular mycorrhizae)
 - Apple
 - Cherry
 - Hazelnut
 - Pear
 - Walnut
- Ectomycorrhizae
 - Chestnut
 - Hazelnut
 - Hickory
 - Oak
 - Walnut???

Mycorrhizal Fungi and Plant Growth Promoting Bacteria

Best Applied On Seed Or Directly On Roots When Transplanting



MAXIMIZE CONTINUOUS LIVING ROOTS

- Crop Rotation
- Relay Crops
- Forage and Biomass Planting
- Perennial Crops
- Cover Crops

MINIMIZE DISTURBANCE

- No-till
- Reduced Tillage
- Controlled Traffic
- Avoid Tillage When Wet
- IPM

MAXIMIZE BIODIVERSITY

- Crop Rotation
- Rotational Grazing
- IPM
- Pollinator Plantings
- Organic Fertilizers
- Legumes in Mix
- Agroforestry
- Cover Crops
- Crop/ Livestock Integration

MAXIMIZE SOIL COVER

- Mulching
- Reduced Tillage
- Forage and Biomass Planting
- Residue Retention
- Cover Crops
- Green Manures

4

SOIL HEALTH PRINCIPLES

Nutrient/
H₂O Mgt

