

# Cover Crops and Green Manures

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# Cover Crops

## Provide Many Benefits for the Soil and Crop

- ✿ Least expensive nutrient and soil improvement method
- ✿ Increase organic matter and humus content
- ✿ Sequester carbon
- ✿ Increase beneficial microorganisms and earthworms
- ✿ Increase soil nitrogen content
- ✿ Increase availability of all nutrients
- ✿ Stabilize soil; prevents erosion
- ✿ Extracts nutrients from subsoil to topsoil for crop use
- ✿ Provides habitat, pollen and nectar for beneficial insects
- ✿ Improve water, root and air penetration

# Cover Crops

## More Benefits for the Soil and Crop

- ⊕ Increase water holding capacity and availability
- ⊕ Suppress and compete with weeds
- ⊕ Break up subsoils and hardpans
- ⊕ Reduce populations of pest organisms
- ⊕ Reduce populations of nematodes
- ⊕ Provide grazing and hay for animals
- ⊕ May be used for mulch or compost pile
- ⊕ Used in no till systems, annual and perennial
- ⊕ Marketable as greens, flowers and seed
- ⊕ Provide aesthetic value and color

# Organic Matter (Carbon) Increases

<b>Species</b>	<b>Dry Matter Per Acre</b>
Annual Ryegrass	2.7-4.8 tons
Barley	2.2-4 tons
Bell Beans	2.1-4.6 tons
Buckwheat	.5-1.2 tons
Cereal Rye	3.6-5.3 tons
Common Vetch	1.8-3.2 tons
Crimson Clover	2.8-4.5 tons
Field Peas	.9-1.7 tons
Lana Vetch	2.2-3.9 tons
Mustard	2.0-3.2 tons
Oats	2.4-5.2 tons
Oats/Peas/Vetch/Bell Beans	3.2-6.1 tons
Red Clover	1.7-3.3 tons
Subterranean Clovers	2.2-3.3 tons
Sudangrass	3.4-6.6 tons

# Nitrogen Fixation By Legumes

Legume Species	Nitrogen Fixed (Pounds Per Acre)
Alfalfa	70-225
Bell Beans	135-220
Berseem Clover	90-200
Birdsfoot Trefoil	44-105
Crown Vetch	98-145
Cowpeas	90-225
Crimson Clover	57-90
Fava Beans	58-225
Field Peas, Winter	85-190

# Nitrogen Fixation By Legumes

Legume Species	Nitrogen Fixed (Pounds Per Acre)
Red Clover	60-115
Soybean	20-275
Subterranean Clovers	52-165
Sweet Clover, Yellow	85-120
Vetch, Common	90-140
Vetch, Lana	125-270
Vetch, Purple	90-220
Vetch/Bell Bean/Field Pea/Oat Mix	160-295
White Clover, Perennial	115-180

# Cool Season Annual Cover Crops



Austrian Winter Peas

A photograph of a field of Magnus Pea plants. The plants have green, trifoliate leaves and are covered in small, light pink flowers. Some red flowers are also visible. The plants are growing in a dense, sprawling pattern across the frame.

Magnus Pea

A photograph of a agricultural field. The foreground is filled with dense, green, leafy plants, likely bell or fava beans, growing in rows. Behind them, a row of taller, thin, brown stalks stands, possibly dried plants or a different crop. The sky is overcast and hazy.

Bell and Fava (aka Faba)  
Beans

Bell Beans, Lana & Purple Vetch, Magness Peas, Cayuse Oats



# Bell Beans and Cayuse Oats





A photograph of a vast agricultural field covered in a dense, vibrant green crop. The field is organized into distinct, parallel rows that curve slightly from left to right. In the far distance, a range of low, rounded hills or mountains is visible under a clear, pale sky.

Purple Vetch



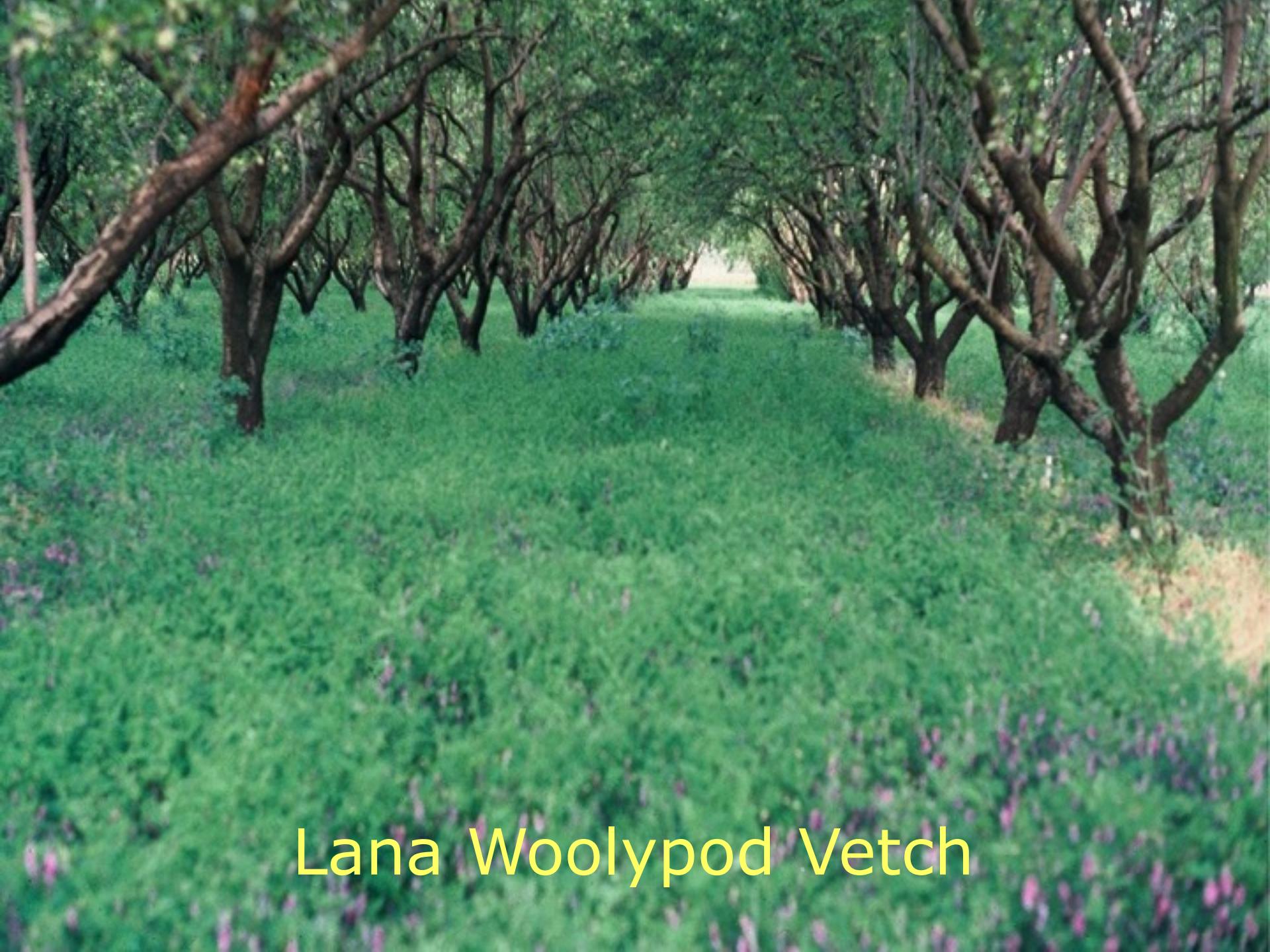
Purple Vetch and Cayuse Oats

A close-up photograph of a field of green rye grain plants. The plants are tall and slender, with long, narrow leaves and small, green, awl-shaped spikelets at the top. They are swaying slightly in the wind. The background is a clear, bright blue sky.

MERCED RYE GRAIN

A photograph of a fruit orchard. Rows of young fruit trees with bare branches are planted in a green grassy field. The trees are trained in a low-vine style. In the background, there is a small, dark building and a clear blue sky.

Purple & Lana Vetch, Austrian Winter Peas,  
Bell Beans, Cayuse Oats

A photograph of a field of green grass with small purple flowers, likely Lana Woolypod Vetch. In the background, there is a row of trees with dark brown trunks and green leaves.

Lana Woolypod Vetch



Cayuse Oats, Lana Vetch, Subterranean Clovers

# Common Yellow Mustard



# Nematicidal Mustards



# Daikon Radish aka Tillage Radish





Daikon Radish aka Tillage Radish

# Daikon Radish aka Tillage Radish



A close-up photograph of a dense ground cover of subterranean clover. The plants have trifoliate leaves with three leaflets each, some showing white variegation. Small, reddish-pink flowers are visible among the leaves. The overall texture is a lush, green carpet.

Subterranean Clovers



Medics

# Indian Sour Clover



A close-up photograph of a field of Crimson Clover. The plants have tall, green, hairy stems topped with dense, cylindrical flower spikes. The flowers are a vibrant, deep red color, with some showing a gradient from pink at the base to red at the top. The background is filled with more plants, creating a lush, textured appearance.

Crimson  
Clover

A dense field of Hykon Rose Clover plants. The plants have trifoliate leaves with three leaflets each. Small, clusters of pink flowers are visible throughout the foliage.

Hykon Rose Clover

A photograph of a vast field of Hykon Rose Clover. The plants form a dense, green carpet across the landscape. Small, clusters of pink flowers are scattered throughout the foliage, appearing as tiny dots against the green leaves. In the background, a line of trees marks the horizon under a clear, light blue sky.

Hykon Rose Clover

A close-up photograph of a vast field of red clover. The plants are densely packed, creating a textured carpet of vibrant red-pink flowers. Some green leaves and stems are visible at the base of the plants.

Red Clover



Berseem Clover  
aka Egyptian Alfalfa



Sub Clover Mix, Medics and New Zealand White Clover

A photograph of a agricultural landscape. In the foreground, a dense, vibrant green field of subterranean clover and medic cover crops stretches across the frame. Behind this field, there is a row of mature orange trees heavily laden with ripe, yellow-orange fruit. Further back, a line of purple-flowered shrubs or small trees marks the boundary of the orchard. Beyond the orchard, a range of mountains is visible under a clear, light blue sky.

**Subterranean Clovers and Medics**



**Sub Clover Mix**

A photograph of a field filled with Annual Lupin flowers. The flowers are light purple or lavender with distinct white or yellowish-tinted spots on the upper petals. They grow on tall, thin green stems. The background is a dense green grass. In the bottom right corner, the words "Annual Lupin" are written in a bold, yellow, sans-serif font.

Annual Lupin





White Grain Lupin



Grain Lupin aka Lupini

A close-up photograph of a large pile of green chickpea pods (garbanzos) on a tray. The pods are bright green and have a slightly curved, bean-like shape. They are attached to thin green stems with small, trifoliate leaves. Some of the leaves have turned brown, indicating ripeness. The tray is covered with a dense layer of these pods.

Garbanzos (aka Chickpeas)

A close-up photograph of a field of lentil plants. The plants have tall, green, branching stems and trifoliate leaves with small, light green leaflets. Small, delicate white flowers are visible along the stems. The plants are densely packed, creating a lush green texture.

Lentils

# Sweet Peas



A close-up photograph of a wheat field. The plants are tall and slender, with long, narrow green leaves. Small, green, spike-like structures grow at the top of each stem. The field is filled with these plants, creating a dense, textured pattern.

Wheat



Wheat



Wheat and Bean Relay Cropping

Red Clover Seeded Under Flax





Underseeding Clover in Winter Squash

# Warm Weather Annual Cover Crops



Field Beans

A close-up photograph of a dense field of garden bean plants. The plants have large, heart-shaped leaves with prominent veins. The sunlight creates bright highlights on the upper surfaces of the leaves, while the lower surfaces and the stems are in deep shadow, creating a strong contrast.

Garden Beans



Cowpeas and Black Eye Beans

# Iron and Clay Cowpeas



# Red Ripper Cowpeas

A photograph of a vast field of cowpea plants. The plants have trifoliate leaves with three distinct leaflets each. Interspersed among the green foliage are numerous small, bright yellow flowers, likely the 'red rippers' mentioned in the title. The plants are densely packed, creating a textured pattern across the landscape.

The image shows a dense thicket of castor bean plants. The plants have large, deeply lobed leaves with prominent veins. The foliage is very thick and fills the frame.

Castor Beans

Crotalaria  
aka Sunn Hemp



A close-up photograph of a field of Crotalaria plants. The plants have long, narrow, lanceolate leaves and clusters of small, yellowish-green flowers at the leaf axils. The foliage is dense and somewhat tangled, creating a textured green carpet. The background shows more of the same plants under a clear sky.

Crotalaria



Sesbania

Velvet Beans

A close-up photograph of a dense field of tall green plants. The plants have long, narrow, lanceolate leaves with prominent veins. Some leaves show signs of wear or discoloration. The plants are growing in a lush, green environment, suggesting a well-maintained agricultural field.

Sudan Sorghum and Purple Vetch

A close-up photograph of a dense field of Sudan grass. The plants are tall and have long, narrow, green leaves with distinct serrated edges. The foliage is thick and overlapping, creating a textured appearance.

Sudangrass

# Artichoke and Sudangrass



A photograph of a vast field of buckwheat plants. The plants are densely packed, creating a textured green surface. Small, white, flower-like structures are visible along the stems. The perspective is from a low angle, looking across the field.

Buckwheat

Lab Lab



# Perennial And Biannual Cover Crops

New Zealand and Strawberry Salina Clovers





Ladino and Strawberry Perennial Clovers

A photograph of a lawn with a wooden fence and a tree in the background.

New Zealand White Clover

A photograph of a lush green alfalfa field. In the background, there is a white building with a red-tiled roof and several windows. The foreground is filled with the dense, green foliage of the alfalfa plants.

Alfalfa



Artichoke and Alfalfa Interplant

A photograph of a large, mature citrus tree, likely a lime or lemon tree, standing in a garden. The tree has a dense canopy of dark green leaves and a thick trunk. It is surrounded by a lush, low-growing groundcover plant called Lab Lab Living Mulch, which appears to be covering the soil around the base of the tree.

Lab Lab Living Mulch

Desmodium aka Prayer P





Arachis Perennial Peanut

A wide-angle photograph of a vast field covered in dense, low-growing plants. The plants have small, bright yellow flowers clustered along their stems, giving the field a golden-yellow hue. The perspective is from a low angle, looking across the expanse of the crop towards a distant, flat horizon under a clear blue sky.

Yellow Sweet Clover

# Pest Management with Cover Crops



Bell Bean  
Extra Floral Nectary

A wide-angle photograph of a vast agricultural field filled with mature onion plants. The plants have long, thin, green stems supporting spherical, light-brown flower heads. The field stretches to a dense line of dark green trees in the background under a clear, pale sky.

Onion



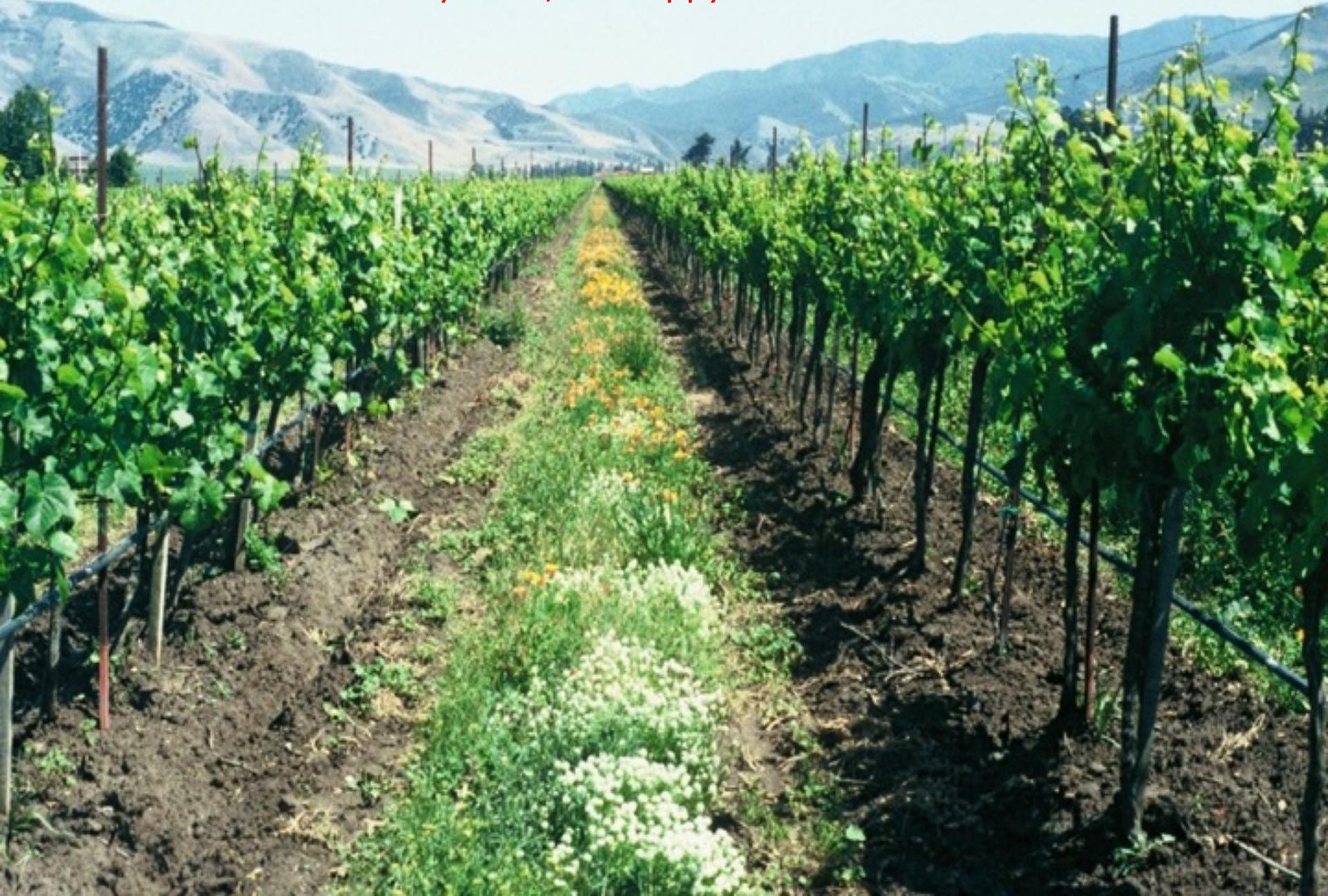
Alfalfa



Cover as Border Insectary

Winter Cover Incorporated  
2 weeks earlier

Alyssum, CA Poppy & Sub Clovers





Artichoke and Alfalfa Interplant



Oats and Vetch

Buckwheat

A wide-angle photograph of a agricultural field filled with dense, green mustard plants. The plants are low-growing with many leaves. In the far distance, a range of hills or mountains is visible under a clear, light blue sky.

Caliente Nematicidal Mustard



A photograph of a vineyard on a hillside. The foreground shows a steep slope covered in dry, golden-brown straw mulch. In the background, rows of grapevines are trained in a fan or canopy style and supported by vertical wooden stakes. The vines are lush and green. The sky is clear and blue.

Oats and Peas as Mulch



New Zealand and Sub Clovers

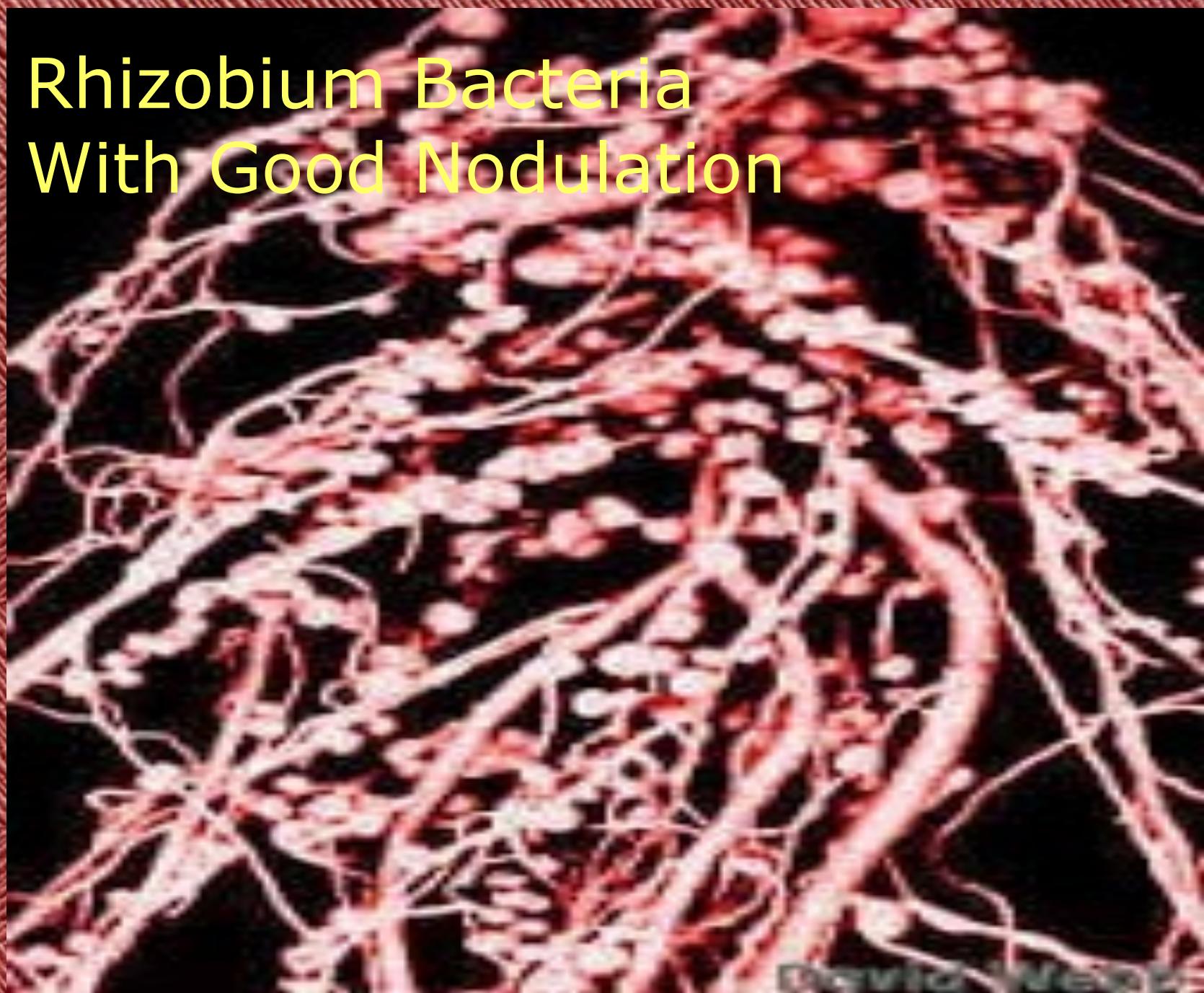
# Tips for Growing A Great Cover Crop

-  Select best species and varieties
-  Mixes usually outperform single species
-  Proper seeding rate
-  Use a drill; or increase seed rate
-  Prepare seedbed to meet seed needs
-  Correct seeding depth; common mistake
-  Plant at the right time; irrigate if necessary
-  Inoculate legumes just before planting
-  Provide adequate fertility
-  Mow or graze competition as needed

# Requirements for Maximum Legume Growth

-  Proper planting date
-  High levels of phosphorus, calcium and sulfur
-  Properly inoculated with correct Rhizobium species
-  Adequate moisture during germination and growth
-  Incorporate quickly at early pod forming stage
-  Adequate light; manage competition

# Rhizobium Bacteria With Good Nodulation



Poor Nodulation



A close-up photograph showing several reddish-pink, spherical nodules attached to a plant's root system. These nodules are characteristic of active nitrogen-fixing bacteria like Rhizobium. The background is blurred, focusing attention on the nodules.

Look For Pink Nodules

White and Yellow Nodules  
are NOT Fixing Nitrogen

# Inoculation Tips to Maximize Nitrogen

-  Use correct species of Rhizobium
-  Use fresh product; protect from heat
-  Use 2 times the recommended rate
-  Use milk for sticking agent
-  Pellet with soft rock phosphate
-  Inoculate, then plant immediately
-  Get the seed covered with soil ASAP
-  Inoculate for at least 2 years
-  Select most vigorous plants, with lots of pink or red nodules for home brewed inoculant; site adapted microbes



- Get Correct Species of Bacteria
- Make Sure It's Fresh, Check Date
- Keep Refrigerated Until Use



Freshly Inoculated Raw Clover Seed





Pelleted Seed Farm Made  
With Soft Rock Phosphate

Commercial Pelleted Seed

# Maximizing Nitrogen Availability from Cover Crops

-  Incorporate at early to full bloom stage
-  Shred completely before tilling
-  Apply LAB, compost tea, compost or cellulose digester microbes at shredding or tilling
-  Incorporate immediately into moist soil, avoid rapid N loss
-  Use a spader
-  Cultivate 1-2x to increase oxygen
-  Irrigate if necessary



Optimum Stage For Maximum Nitrogen

# Percent Nitrogen in Legume Tops and Roots

	%N Tops	%N Roots
Vetch	89	11
Cowpeas	84	16
Alfalfa	58	42
Red Clover	68	32
Soybeans	93	7

Fully Incorporate When Fresh and  
Green  
For Maximum Nitrogen Availability





Cultivate to Add Oxygen and Speed  
Decomposition

# Cover Cropping Mishaps



Poor Weed Management

A photograph of a field of dense, green, leafy plants, likely a crop like peanut or soybean. The plants are growing in rows. In the background, there is a line of bare, dead trees, suggesting environmental degradation or a failed plantation.

Wrong Plant Choice



Austrian Pea & Oat Mix Planted early  
October



Same Farm, Same Mix, Planted 3 Weeks

**Seed Company Provided Wrong Oat Variety**



A close-up photograph of a field of ryegrass. The grass is predominantly green, with many blades reaching upwards. Interspersed among the green grass are several tall, thin, brownish-purple seed spikes (panicles) that have developed at the top of the stems. These seed spikes are characteristic of ryegrass as it begins to mature.

Ryegrass Going To Seed

Topos





Poor Weed Management

A close-up photograph of a large, dense patch of tall, bladey fescue grass. The grass is a vibrant green color and grows in a tight, rounded clump. It is set against a background of dry, brown, cracked earth, which appears to be a mix of dirt and sand. The lighting suggests a bright, sunny day, casting soft shadows that emphasize the texture of the grass blades.

Fescue Is Hard on Your Back!



Letting Cover Grow Too Long

# Tools and Equipment for Cover Cropping

# Broadfork



Walk Behind Rototiller











Seed Drill



No Till Seed Drill



Broadcast Seeders

# Sheep Grazing Sudangrass



# Cows Grazing Forage Turnips



# Scything Buckwheat



# String Trimming Cover Crop



Add To Compost Pile Fresh and Green



# High Wheel Walk Behind Mower





Flail Mower



# ATV with Flail Mower





Mowing and Disking Mustard Cover



Spader

# Resources for Detailed Info on Cover Crops



Amigo Bob Cantisano  
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Organic Ag Advisors  
530-292-3619



“Green Manuring, Principles and Practices”  
Adrian Pieters



“Using Cover Crops In Oregon”  
Oregon State University



UC SAREP Cover Crop Database

# Cover Crops Create Happy Soils and Happy Farmers

